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

Investigation Report 231/09

Serious Marine Casualty

Collision involving the AURORA and the TRANSANUND during an overtaking manoeuvre on the Elbe on 29 June 2009

1 February 2011

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

This 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 this Investigation Report.

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Table of Contents

1 SUMMARY OF THE MARINE CASUALTY 5

2 SHIP PARTICULARS 6

2.1 Aurora 6
2.1.1 Photo 6
2.1.2 Vessel particulars 6
2.1.3 Voyage particulars 7
2.2 TRANSANUND 8
2.2.1 Photo 8
2.2.2 Vessel particulars 8
2.2.3 Voyage particulars 9
2.3 Marine casualty or incident information 10
2.4 Shore authority involvement and emergency response 11

3 COURSE OF THE ACCIDENT AND INVESTIGATION 12

3.1 Course of the accident 12
3.1.1 Course of the voyage – AURORA 12
3.1.2 Course of the voyage – TRANSANUND 12
3.1.3 Subsequent events 14
3.2 Investigation 17
3.2.1 Weather 17
3.2.2 Current 17
3.2.3 Traffic situation 17
3.2.4 AURORA 18
3.2.5 TRANSANUND 20
3.2.6 Overtaking manoeuvre 20

4 ANALYSIS 36

4.1 AURORA 36
4.1.1 Bridge manning and communications 36
4.1.2 Cooperation between the pilot and officer on watch 39
4.1.3 Overtaking manoeuvre 40
4.2 TRANSANUND 41

5 CONCLUSIONS 42

5.1 Bridge manning 42
5.2 Ship's command 42
5.3 Overtaking manoeuvre 42

6 SAFETY RECOMMENDATIONS 43

6.1 Ship’s command and operator of the AURORA 43
6.2 Pilots Association Elbe 43

7 SOURCES 44

Table of Figures

Figure 1: Photo of the AURORA 6
Figure 2: Photo of the TRANSANUND 8
Figure 3: The Elbe, Bützfleth to Lühesand with scene of accident 10
Figure 4: AURORA, damage at the stern 15
Figure 5: AURORA, damage to the stern and the free-fall lifeboat's launching apparatus 15
Figure 6: TRANSANUND, damage to the forecastle 16
Figure 7: TRANSANUND, damage to the forecastle 16
Figure 8: Excerpt of Nautical Chart 3267 UKHO from the AURORA with course line marked (photo) 19
Figure 9: Traffic situation at 040750 with the AURORA, TRANSANUND and KAGU 20
Figure 10: Traffic situation at 041301 with the oncoming BELUGA MEDITATION ... 21
Figure 11: Radar picture from the TRANSANUND at 041341 22
Figure 12: Traffic situation at 041516 23
Figure 13: Radar picture from the TRANSANUND at 041525 23
Figure 14: Radar picture from the TRANSANUND at 041610 24
Figure 15: Situation at 041731 25
Figure 16: Radar picture from the TRANSANUND at 041710 26
Figure 17: Situation at 041825 26
Figure 18: Radar picture from the TRANSANUND at 041810 27
Figure 19: Radar picture from the TRANSANUND at 041925, ... 28
Figure 20: Radar picture from the TRANSANUND at 041940, ... 29
Figure 21: Situation at 042016 29
Figure 22: Situation at 042039 30
Figure 23: Track of the AURORA and TRANSANUND at about 0412 31
Figure 24: AURORA, electronic nautical chart with track (photo) 31
Figure 25 AURORA, log-file with compass course and speed 32
Figure 26: TRANSANUND, compass course and course over ground 33
Figure 27: Radar plot of Hetlingen Radar from VTS Brunsbüttel 35

1 Summary of the marine casualty

At about 0419[1] on 29 June 2009, two container vessels, the AURORA and the TRANSANUND, which were sailing upstream on the Elbe, collided during an overtaking manoeuvre.
The ship's command of the AURORA was advised by a pilot on board. The master of the TRANSANUND was in possession of a pilotage exemption certificate. Reduced visibility prevailed at the time of the accident. Therefore, both vessels were receiving additional shore-based radar pilotage.
Two oncoming vessels passed during the overtaking manoeuvre. One was the BELUGA MEDITATION and the other was the CSCL EUROPE, which was classified as an exceptionally large vessel (AGF). The space available for manoeuvring narrowed because of the oncoming CSCL EUROPE. The AURORA closed in while overtaking the TRANSANUND and passed at a distance of about 30 m. This resulted in the TRANSANUND being sucked in and her bow collided with the other vessel's stern. Following the collision, the AURORA ran aground on the southern side of the fairway. The TRANSANUND was able to avoid running aground and continued her voyage to Hamburg shortly afterwards. After ballast operations and the onset of flood, the AURORA was able to free herself under her own steam and also continued her voyage.

There were no fatalities or injuries due to the collision. The BSU was not made aware of any environmental pollution.

[1] All times shown in this report are CEST = UTC + 2

2 SHIP PARTICULARS

2.1 Aurora

2.1.1 Photo

Figure 1: Photo of the AURORA

2.1.2 Vessel particulars

Name of vessel:	AURORA
Type of vessel:	Container vessel
Flag:	Cyprus
Port of registry:	Limassol
IMO number:	9234989
Call sign:	P3QH9
Owner:	Reederei Rudolf Schepers KG MS "Aurora"
Operator:	Reederei Rudolf Schepers
Year built:	2001
Shipyard/yard number:	J.J. Sietas KG Schiffswerft GmbH Co./ 1128
Classification society:	Germanischer Lloyd
Length overall:	134.42 m
Breadth overall:	22.74 m
Gross tonnage:	9,981
Deadweight:	11,384 t
Draught (max.):	8.70 m
Engine rating:	8,400 kW
Main engine:	Caterpillar 9 M 43
(Service) Speed:	18 kts
Hull material:	Steel

2.1.3 Voyage particulars

Port of departure:	Klaipeda, Lithuania
Port of call:	Hamburg
Type of voyage:	Merchant shipping, international
Cargo information:	Container
Manning:	13
Draught at time of accident:	D_f= 8.3 m; D_a= 8.7 m
Pilot on board:	Yes
Canal helmsman:	No
Number of passengers:	None

2.2 TRANSANUND

2.2.1 Photo

Figure 2: Photo of the TRANSANUND

2.2.2 Vessel particulars

Name of vessel:	TRANSANUND
Type of vessel:	Container vessel
Flag:	Cyprus
Port of registry:	Limassol
IMO number:	9349215
Call sign:	C4RJ2
Owner:	MS "Astrosprinter" GmbH & Co. KG
Operator:	Astromare Bereederungs GmbH & Co. KG
Year built:	2005
Shipyard/yard number:	IHDA Shipbuilding Service B.V. / 223
Classification society:	Germanischer Lloyd
Length overall:	141.60 m
Breadth overall:	20.60 m
Gross tonnage:	7,720
Deadweight:	9,526 t
Draught (max.):	9.50 m
Engine rating:	7,999 kW
Main engine:	Caterpillar 8 M 43 C
(Service) Speed:	18 kts
Hull material:	Steel

2.2.3 Voyage particulars

Port of departure:	Oskarshamn, Sweden
Port of call:	Hamburg
Type of voyage:	Merchant shipping, international
Cargo information:	Container
Manning:	12
Draught at time of accident:	D_f= 7.0 m; D_a= 7.4 m
Pilot on board:	No
Canal helmsman:	No
Number of passengers:	One

2.3 Marine casualty or incident information

Type of marine casualty:	Serious marine casualty Collision and subsequent grounding
Date/Time:	29 June 2009/0419
Location:	Elbe, km 652
Latitude/Longitude:	φ 53° 36.5'N λ 009° 33.9'E
Ship operation and voyage segment:	Harbour mode
Consequences:	Damage to the hull of both vessels, damage to the launching apparatus of the AURORA's free-fall lifeboat, grounding of the AURORA

Excerpt from Nautical Chart 47, Federal Maritime and Hydrographic Agency (BSH)

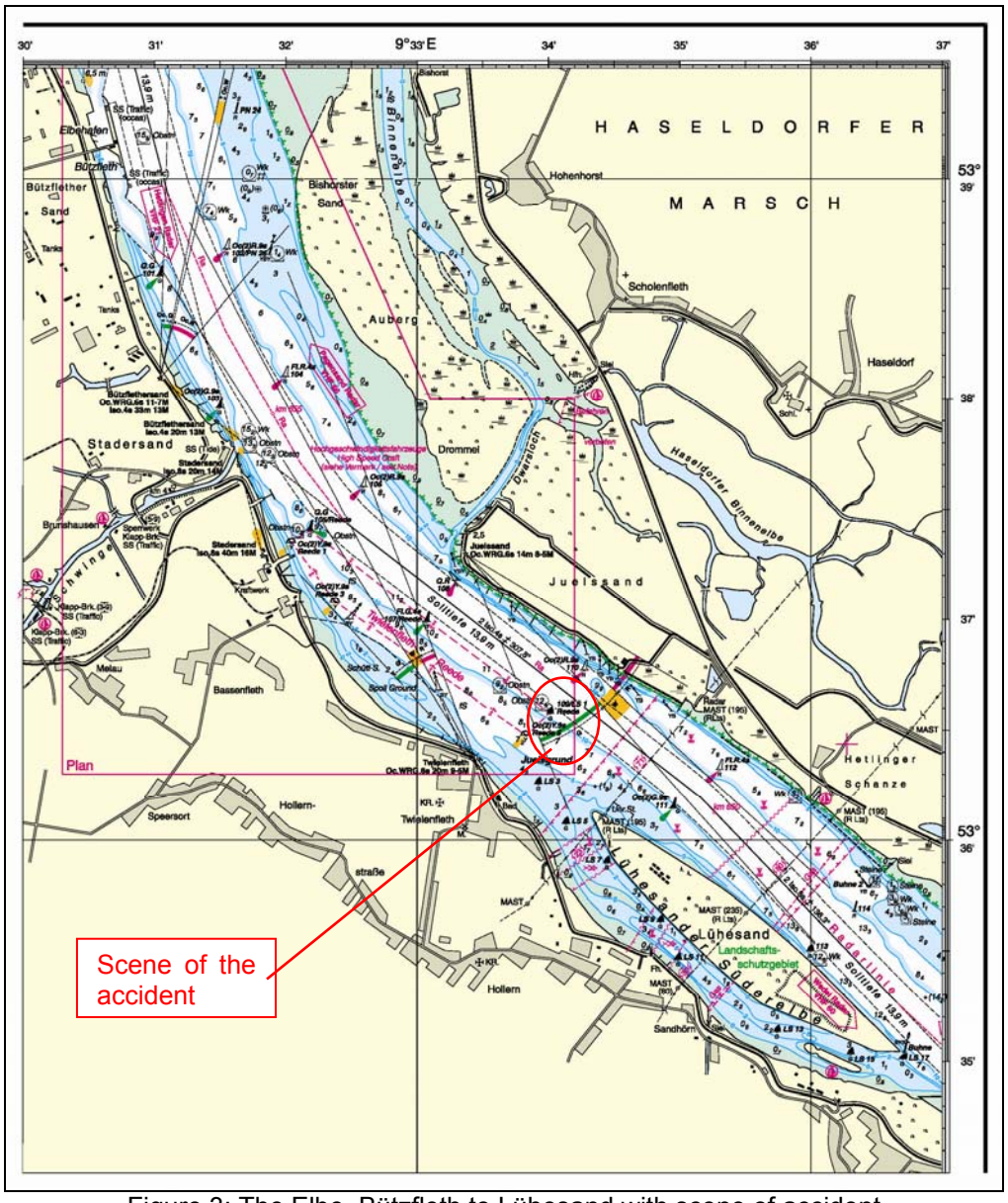

Figure 3: The Elbe, Bützfleth to Lühesand with scene of accident

2.4 Shore authority involvement and emergency response

Agencies involved:	a) Vessel Traffic Service (VTS) Brunsbüttel b) WSPK 1 Hamburg[2]
Resources used:	WSP boat
Actions taken:	Prohibition to leave
Results achieved:	Unknown

[2] WSPK 1 Hamburg – Waterway Police Station 1, Hamburg

3 COURSE OF THE ACCIDENT AND INVESTIGATION

3.1 Course of the accident

3.1.1 Course of the voyage – AURORA

The course of the voyage described for the AURORA is based on entries in the bridge logbook and an interview with one of the navigating officers.
The AURORA's port of departure was Klaipeda. The vessel entered the lock at Kiel-Holtenau at about 1600 on 28 June 2009 and began her passage through the Kiel Canal (NOK). The vessel left the lock at Brunsbüttel at about 0230 on 29 June 2009. An Elbe pilot boarded the vessel for the Brunsbüttel-Hamburg stretch.
One of the officers was in charge of the navigational watch at the time of the accident. He took over the watch from his forerunner at 0400. The bridge was manned by the officer on watch and the pilot. A seaman was on standby in the superstructure.
According to the officer, the pilot was using the autopilot to steer the vessel, i.e. the officer had no input on the course and speed. Since communication between the pilot, vessel traffic service and all other remote sites was only conducted in German, the officer on watch had no knowledge of the situation.
Shortly before reaching the fogbank, the officer on watch asked the pilot about visibility up to Hamburg. He was told that there were occasional fog patches, but that the visibility off Hamburg was reportedly good[3]. As the officer on watch sighted the TRANSANUND ahead, he asked the pilot whether their vessel would overtake the vessel in front. This was confirmed by the pilot. The officer on watch then switched the helm to manual control. However, the helm was still operated by the pilot, that is, the officer on watch stated that he did not receive any helm commands from the pilot. The officer on watch then went to the starboard wing to monitor the approach from there. After the accident, he immediately informed the master.

3.1.2 Course of the voyage – TRANSANUND

The course of the voyage described is based on the master's report.
At the time of the accident, the TRANSANUND was on a time charter and operated on a regular feeder service between Hamburg, Bremerhaven, Oulu and Tornio. She departed from the unscheduled port of Oskarshamn on 27 June 2009. She left the lock at Kiel-Holtenau at about 1600 on 28 June 2009. During the passage through the NOK, the ship's command was advised by a canal pilot and assisted by a canal helmsman. The master rested between 1700 and 2300. The master assumed command of the vessel from the chief officer at about 2330 for the entry into Brunsbüttel Lock. The vessel left the lock for Hamburg at 0005 on 29 June 2009. Visibility was good. The wind blew at 2 to 3 Bft from the east. Since the arrival time at the container terminal was scheduled for 0630, the TRANSANUND proceeded upstream on the Elbe at a speed over ground (SOG) of approx. 4 to 4.5 kts. In addition to other feeder vessels sailing at reduced speed, one vessel was sailing up stream on the Elbe under radar advise.

[3] According to a statement regarding the draft report the pilot gave this information already in the Brunsbüttel lock. Possibly this was not communicated during the changes of the watch.

This vessel overtook the TRANSANUND between Rhinplatte and Schwarztonnensand.
At 0300, the scheduled shift change for the look-out took place on the bridge of the TRANSANUND. At about the same time, the master discussed the exact arrival time with the harbour pilots in Hamburg. Since the TRANSANUND was to stay ahead of two other up coming deep-going vessels, her speed was raised to approx. 7.5 kts over ground off Pagensand-Nord. At this point the controllable pitch propeller was set at about 45%. Good visibility and an ebb stream continued to prevail. Both radar units were in operation on the TRANSANUND. The starboard radar (X-band) was operated head up and set to a range of 1.5 nm off-centre, the port radar (S-band) was operated north up and set to a range of 0.75 nm off-centre. The vessel was navigated with the aid of the autopilot.
At 0355, the riverside quay at Bützfleth was passed. Visibility deteriorated shortly afterwards. While the light was easily recognisable on the Stade side, the northern bank and line of buoys quickly disappeared in the haze. Following that, the measures for sailing in fog were taken and the second officer woken, who began his task at 0400. He then monitored the starboard radar. The master worked with the port radar. The look-out was situated in the starboard wing. The master registered the TRANSANUND for radar advice with Hetlingen Radar on VHF Channel 21.
Shortly after entering the fog, the vessel sailed into a fogbank which stretched across the entire river. At this point, visibility was between 200 and 500 m. At about the same time, the AURORA made contact on VHF Channel 68 and requested to overtake the TRANSANUND. The master confirmed and agreed that he would keep his vessel on the southern buoy line.
According to the master, the AURORA was about 0.6 nm astern in the middle of the fairway and moving at approx. 14.5 kts over ground at the time.
The TRANSANUND reached the southern buoy line when she was level with buoy number 107 and headed for buoy number 109 such that it would be close to starboard. The look-out was instructed to watch carefully for the buoy. The AURORA was fast approaching and initially positioned on the radar reference line. The master expected her to pass at a wide passing distance.
In the given situation, the radar pilot advised that an upcoming deep-going vessel was reportedly approaching from the opposite direction and would need the middle of the fairway.
Shortly afterwards, the master saw the AURORA, which was still not within sighting distance, move into the southern half of the fairway on the radar.
The radar pilot advised the TRANSANUND that her starboard side was on the southern buoy line. A short time later, he advised the AURORA that she should move further to port. It was apparent from the radar that the AURORA was approaching very closely. The second officer, who was looking out for the AURORA from the port wing, was astonished at the close proximity of the vessel and the master identified the AURORA at a bearing of 45° abaft the beam. The speed of the AURORA was considerably higher and her course line was not parallel to that of the TRANSANUND. The distance was less than one vessel length. The master realised that there was a significant risk of suction. He therefore switched the helm to manual and turned on the second steering pump and second servo pump for the controllable pitch propeller.

He then concentrated on the tight passage of buoy number 109. Shortly after, the foremast of the AURORA passed the wing of the TRANSANUND. The passing distance between the two vessels was about 20 m. The master initially succeeded in counteracting the effects of suction and wake. When the vessels were fully abreast of one another, the master of the TRANSANUND increased the speed to 70% pitch because he noticed that the rudder angle alone could no longer prevent the vessel from being drawn in. Nevertheless, the bow was sucked to port as the stern of the AURORA had nearly passed the fore ship of the TRANSANUND. As a result, the fore ship collided with the stern of the AURORA at about 0420. This caused the AURORA to turn to starboard. The controllable pitch propeller of the TRANSANUND was reversed to 'full astern' and the helm to 'hard starboard'. Both vessels continued in this manner towards the southern edge of the fairway at different speeds and almost parallel. The AURORA grounded above buoy number 109. The TRANSANUND did not run aground.

After the collision, the master of the TRANSANUND informed VTS Brunsbüttel about the incident.
The TRANSANUND, in consultation with the VTS, continued her voyage to Hamburg after the two deep-going vessels had passed the scene of the accident. She made fast in Waltershofer Hafen at 0700.

3.1.3 Subsequent events

Both vessels sustained material damage above the water line due to the collision. The damage on the AURORA was located on the starboard side of the stern and on the free-fall lifeboat's launching device (Figure 4 and 5). The TRANSANUND was damaged on the port side in the area of the bow (Figure 6 and 7).
There were no injuries on either vessel. No fuels or lubricants escaped.
Two tugs sent to the AURORA were not made use of because the vessel was able to free herself under her own steam after ballast operations and the onset of flood.

The waterway police was on the scene with a boat from 0450 onwards. The officers embarked the AURORA at 0525 and began their initial enquiries there. After mooring in Hamburg, the TRANSANUND was inspected by another investigation team from the waterway police.

Figure 4: AURORA, damage at the stern

Figure 5: AURORA, damage to the stern and the free-fall lifeboat's launching apparatus

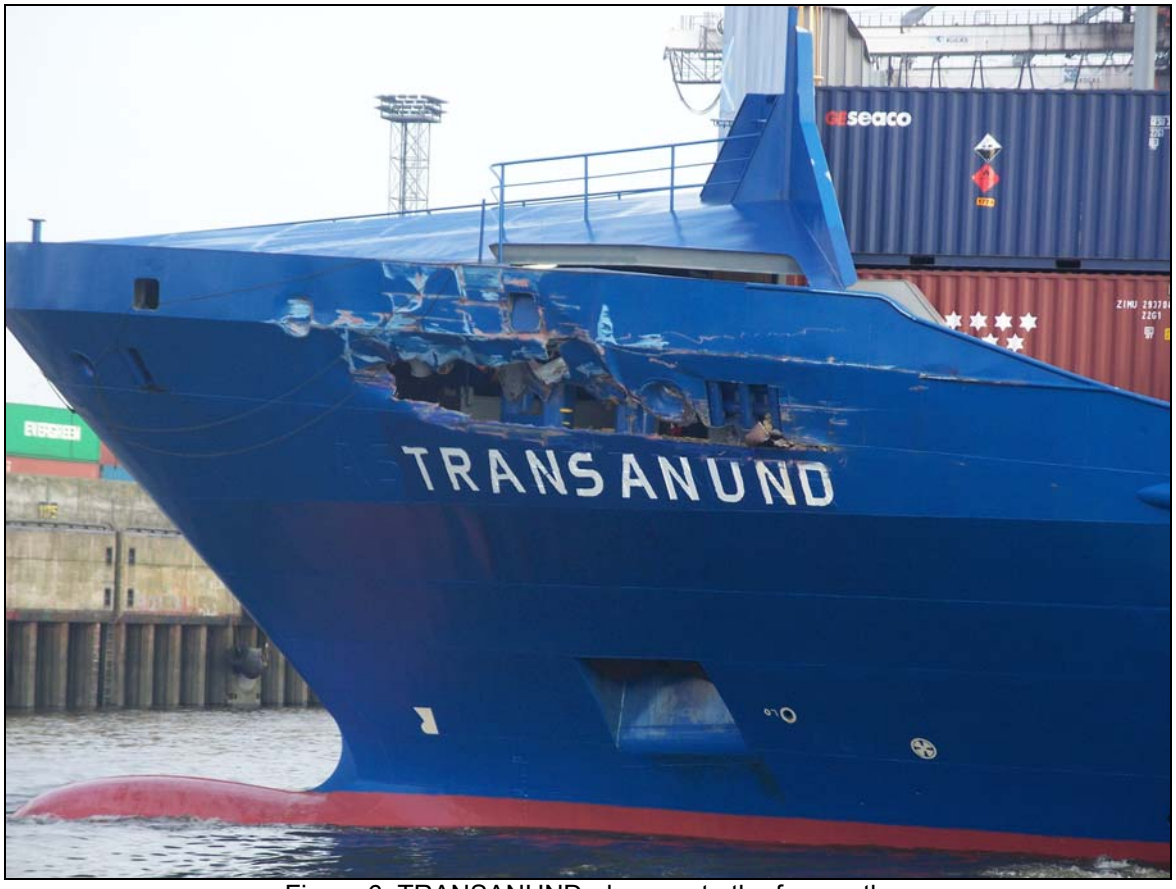

Figure 6: TRANSANUND, damage to the forecastle

Figure 7: TRANSANUND, damage to the forecastle

3.2 Investigation

On 29 June 2009, both vessels were visited by a team from the Federal Bureau of Maritime Casualty Investigation (BSU) and the crews interviewed. The data from the TRANSANUND's voyage data recorder were backed up with the help of a service technician. Beyond that, the master of the TRANSANUND provided ECDIS data[4] resp. screenshots. A voyage data recorder was not installed on the AURORA. The waterway police was able to back up a data file which as a log file, inter alia, comprised position, course and speed information. The recording interval was irregular and was between 3 seconds and 1 minute.

VTS Brunsbüttel prepared the radar plots of the vessels involved in the accident for the period relevant to the accident and submitted them to the BSU. The WSP provided the BSU with access to the recording of the VHF channel of VTS Brunsbüttel (call sign: Brunsbüttel Elbe Traffic/Channel 68) and the VHF channel of the radar pilotage service for the Hetlingen area (call sign: Hetlingen Radar/Channel 21).

3.2.1 Weather

Germany's National Meteorological Service prepared a weather report for this accident at the request of the waterway police Hamburg. The weather conditions set out in the report are as follows: *Based on the available reports and measurements from weather stations in the area (Hamburg Fuhlsbüttel, Mittelnkirchen im Alten Land and Neuwiedenthal), visibility was very poor at the (...) time (04 to 05 CEST).*
There was fog and visibility was between 200 and 600 metres. The temperature and humidity measurements of the Mittelnkirchen automatic station indicate that visibility may have been less than 200 m.
The wind came from east to north-east with a mean strength of 2 Bft and gusts of 3 Bft.
There was no measurable precipitation. Air temperature was 12 to 14 degrees C.

The crew of each vessel involved in the collision confirmed the visibility stated above; however, the BSU assumes that visibility is more likely to have been in the lower range, i.e. about 200 m.

3.2.2 Current

The Waterways and Shipping Office Hamburg determined that low tide prevailed at the time of the accident in the relevant area. However, there was a falling tide with about 1 kts.

3.2.3 Traffic situation

During the period under consideration, the TRANSANUND sailed at 5.6 kts on average from 0340. The AURORA approached rapidly from astern with up to 15 kts. The situation report of the VTS revealed that two oncoming vessels, sailing downstream on the Elbe, were approaching the two vessels sailing upstream. One was the BELUGA MEDITATION (length: 155 m, breadth: 21.5 m, GT: 8,971), the other was the CSCL EUROPE (length: 334 m, breadth: 43 m, draught: 12 m, GT:

[4] ECDIS – electronic chart display and information system which uses approved chart data on an approved display unit.

90,645), which was classified as an extraordinarily large vessel (AGF) and dependent on the dredged channel in the fairway. According to the nautical chart, the breadth of the channel in the area of the collision is about 320 m. The radar reference line is located between buoy pairs 105/106 and 111/112 at about the middle of the channel.
The BELUGA MEDITATION had overtaken the CSCL EUROPE and was now proceeding at 15 to 16 kts SOG. The CSCL EUROPE followed at about 12 kts SOG. Both vessels were advised by a pilot on board.
While the vessels mentioned above were approaching the later scene of the accident, the KAGU (length: 63 m, breadth: 13 m, GT: 1,589) left Twielenfleth roadstead and was headed for Hamburg. This vessel did not have an Elbe pilot on board because of her size.

Since visibility was less than 2,000 m[5] because of the fog, all the vessels mentioned were assisted by shore-based radar pilotage. Here vessels are advised in a type of loop, inter alia, of their position in relation to the radar reference line[6] and the distance to course change points and buoys. Traffic information is also transmitted. The Elbe is divided into sectors for that purpose, in which a pilot, acting as a radar pilot, advises the vessels located in his sector. There are 7 such radar sectors between Brunsbüttel and the Hamburg boundary.
As the KAGU was not manoeuvring in the usual manner, she required additional assistance from the radar pilot. The ship's command had to be explicitly made aware of certain buoys and evasion manoeuvres were recommended with respect to buoys.

3.2.4 AURORA

At the time of the accident, the AURORA was sailing under the flag of Cyprus. The ship's command responsible for navigational operations consisted of Russian and Ukrainian officers.
The officer on watch stated that he reportedly possessed 23 years of experience as a seaman. He had operated in the appointed position for 1.5 years. The officer had been on board for 1.5 months under the current contract. Analysis of the submitted time sheet revealed no evidence of the influence of fatigue.
The master stated that he had 5 years of experience in this position. His time sheet also revealed no evidence to suggest fatigue.
The pilot of the AURORA did not give a statement.

The usual appliances and equipment to assist the ship's command were on the bridge of the AURORA. There was no evidence of malfunctions or defects on the bridge or in the engine room.
According to the ship's command, both radar units were in use on the Elbe and set to the 3 and 1.5 nm range. The pilot was working with the unit on the starboard side of the bridge console.

[5] Art 13 para. 1 (1) Elbe Pilot Regulation (Elb-LV)
[6] Radar reference line – theoretical line that usually marks the middle of the fairway or the deeper navigation channel, also entered on the nautical chart. Often made optically visible by leading light lines. Used to determine the vessel's position in the fairway.

An ECDIS made by the company Raytheon was used for navigation. The chart material used with it consisted of ARCS charts[7]. The latest version on board was requested and submitted. It was dated 14 May 2009. There was also a set of paper nautical charts on board for the area in which the vessel was operating. The current and amended Chart 3267 of the United Kingdom Hydrographic Office (UKHO) was available for the area relevant to the accident.
The general courses for entering and leaving were marked on the charts for the Elbe. The courses entered were usually on the radar reference line. However, in some cases they cut the bends in the fairway (see Figure 8). There were no entries on the chart relating to position fixing or passage times. Furthermore, the logbook and the bridge bell book contained no entries for the time between leaving the lock at Brunsbüttel and the collision resp. grounding.
On the AURORA, there were no special instructions for the watch for the period in which the master was not on the bridge.

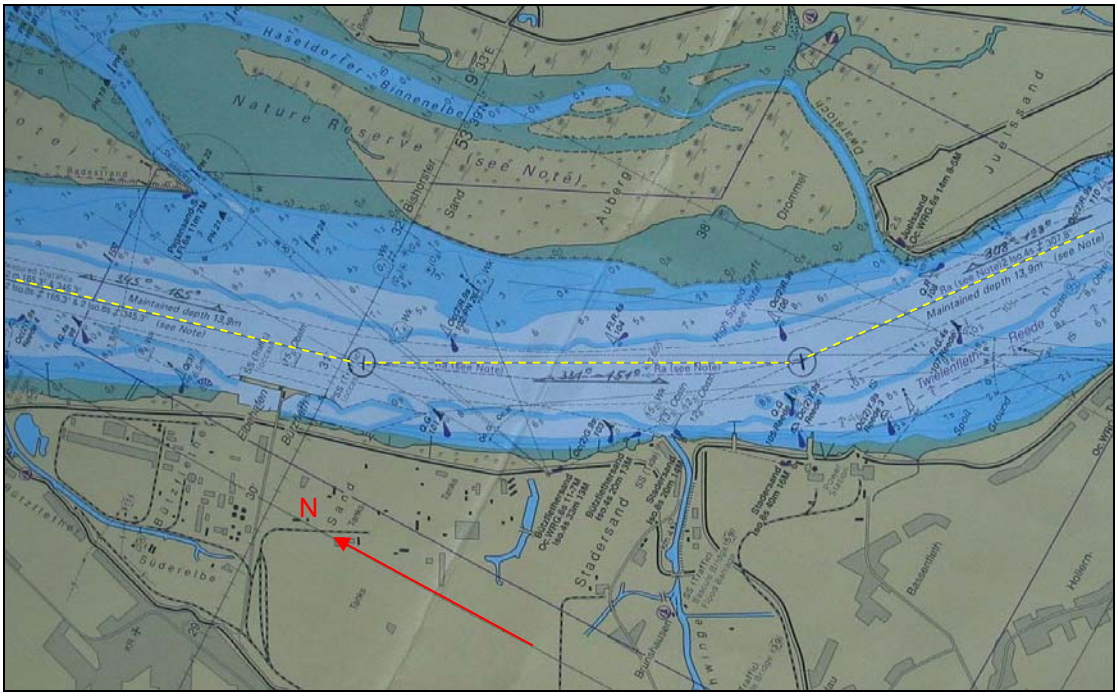

Figure 8: Excerpt of Nautical Chart 3267 UKHO from the AURORA with course line marked (photo)

The AURORA proceeded from 0244 with 14 to 15 kts SOG upstream the Elbe. From 04:01 the speed was reduced to 12 kts (04:13). After the pilot of the AURORA had discussed the overtaking manoeuvre with the master of the TRANSANUND at 0413, the vessel's speed was increased. According to the radar plot, the speed of the AURORA was 15.5 kts at the time of the collision (041937). According to the log-file the speed was 14.3 kts (041921).

[7] ARCS – Admiralty Raster Chart Service; scanned, digitised version of the official British paper nautical charts, which does not have the functionality of a vector chart and is only approved for use in ECDIS equipment when electronic navigational charts (ENC) do not exist for the area.

3.2.5 TRANSANUND

The master of the TRANSANUND was German and the other two members of the bridge crew were Philippine nationals.
The master possessed a pilotage exemption certificate of the Waterways and Shipping Office (WSA) Hamburg. According to this pilotage exemption certificate resp. on the basis of art. 13 para. 1 Elb-LV, the master was obliged to accept shore-based radar pilotage when visibility is below 2,000 m. That was the case off the Schwinge estuary during this voyage and the master requested pilotage from Hetlingen Radar at 0401, after which the vessel was included in the pilotage service. Due to the fog just setting in, the VTS was not yet manned by a sufficient number of radar pilots.
Therefore, the TRANSANUND was initially advised on VHF Channel 66. The pilotage service then moved back to the proper VHF channel (21) at 041020. At the same time, the speed of the vessel was increased from approx. 5.8 kts to approx. 7.7 kts.
Shortly after the VHF channel was changed, the radar pilot drew attention to the vessel ahead, the KAGU.

3.2.6 Overtaking manoeuvre

The description of the overtaking manoeuvre starts with the picture of the traffic situation at 040750 (figure 9). The KAGU was just leaving the Twielenfleth roadstead. The TRANSANUND was abeam of buoy 105 in the proximity of the radar reference line.

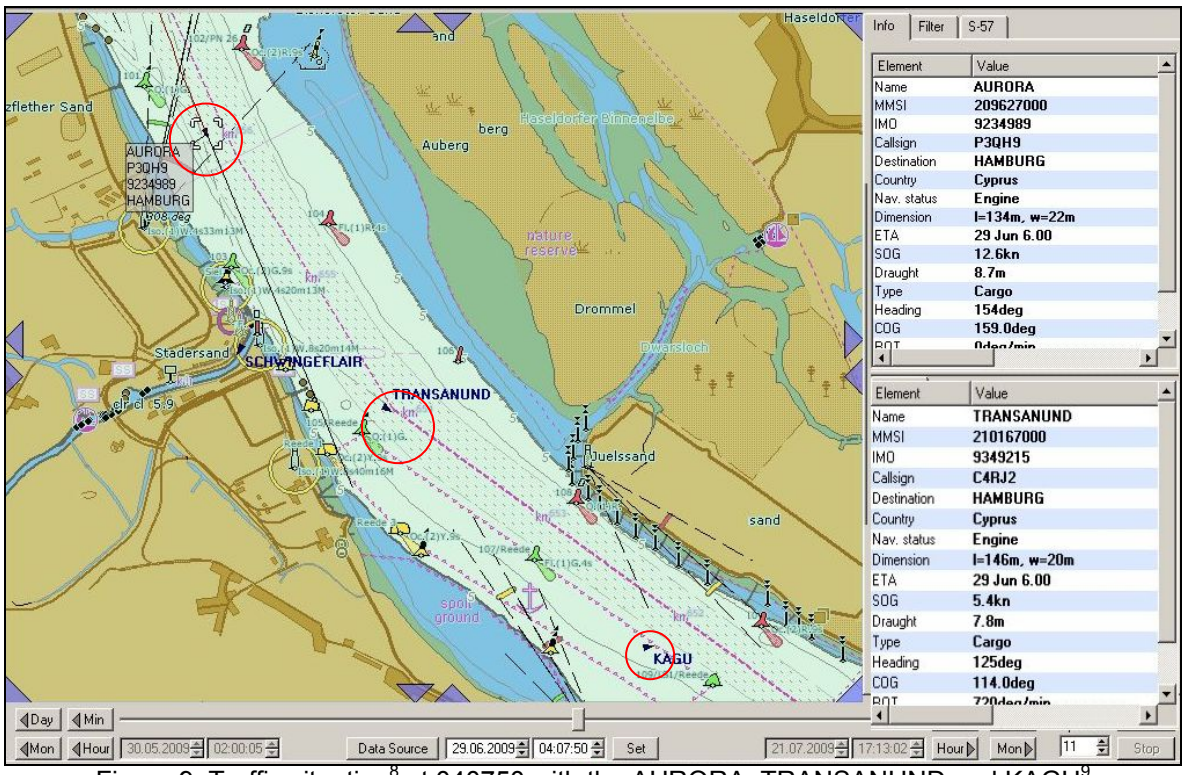

Figure 9: Traffic situation[8] at 040750 with the AURORA, TRANSANUND and KAGU[9]

[8] The displayed data of the two vessels are based on the AIS data (automatic identification system), as well as in figures 10, 12, 15, 17, 21, 22.
[9] The highlighting (red circles) in this and subsequent figures was added by the BSU.

At 0412, the radar pilot informed the TRANSANUND about a vessel approaching from astern. This information concerned the AURORA.

At 0413 (see Fig. 10), the pilot of the AURORA called the TRANSANUND over VHF. The pilot of the AURORA expressed his intention to overtake the TRANSANUND. Following that, the master of the TRANSANUND agreed to move right across to the green side, i.e. that he intended to sail directly along the green buoys.
Furthermore, the look-out on the starboard side of the TRANSANUND was instructed to keep watch for the green buoys. At that point, buoy number 109 was about 7.5 cbl or 1,400 m away and the distance to the BELUGA MEDITATION was about 1.8 nm. The AURORA was about 0.6 nm away from the TRANSANUND.

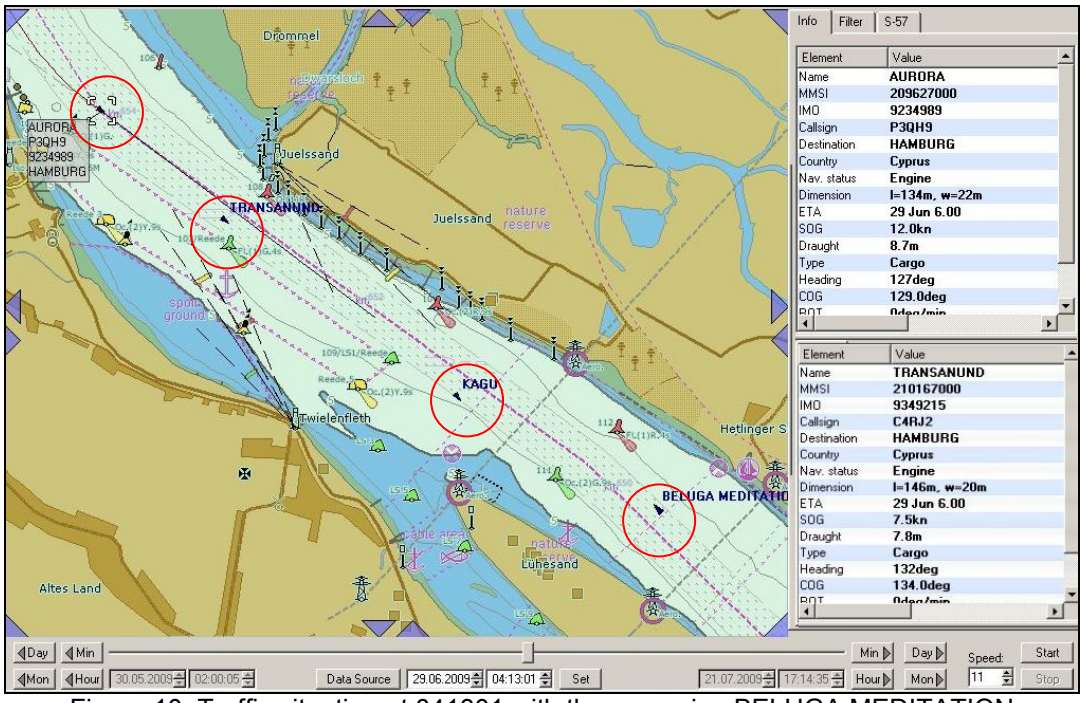

Figure 10: Traffic situation at 041301 with the oncoming BELUGA MEDITATION

The VDR radar recording reveals that the buoy 109 was taken ahead by TRANSANUND at least since 0410. The head line and the vector for the course over ground then showed in the direction of the buoy 109 up to 0416 that means the TRANSANUND steered a compass course of 132°. The course over ground was on average 133°. The true track in this section of the Elbe is 128°.

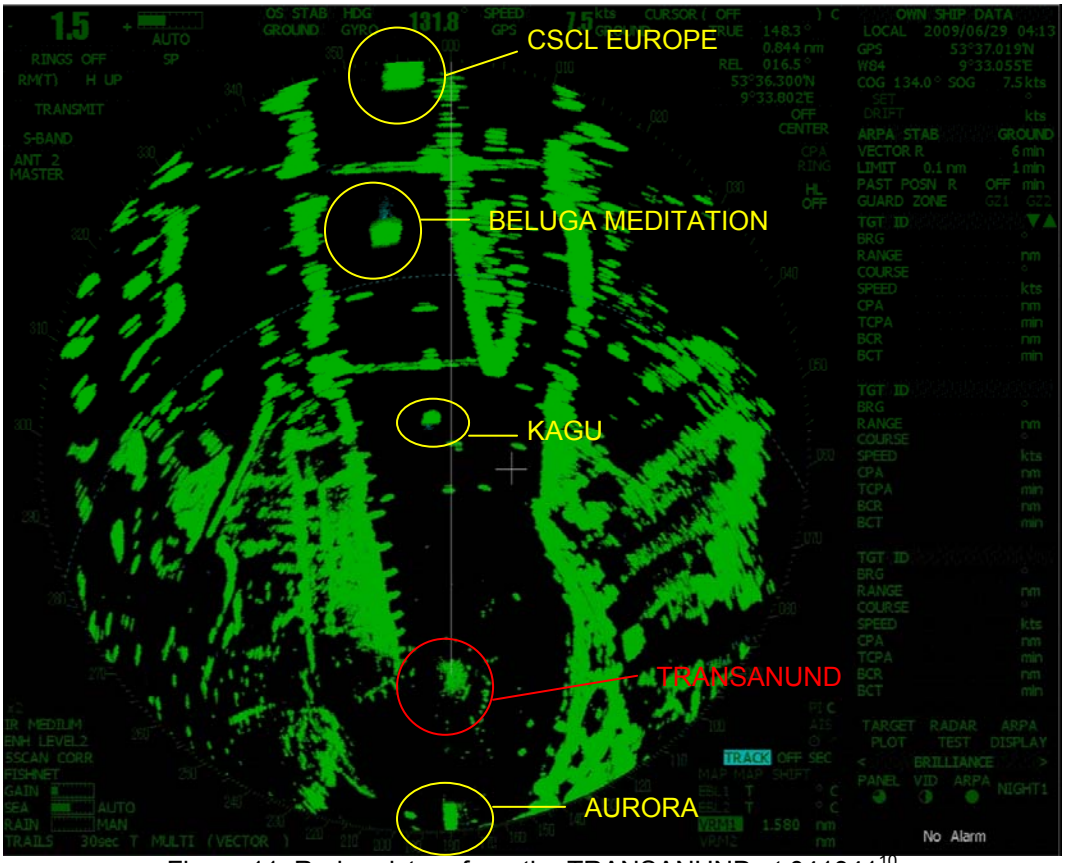

Figure 11: Radar picture from the TRANSANUND at 041341[10]

The following information was provided by the radar pilot during the loop at 0414: "Downstream Elbe, BELUGA MEDITATION 100 m north of the line[11], 200 m until buoy number 112 is passed. Further downstream Elbe, CSCL EUROPE with 12 m draught, port side on the line, 114 was passed. Upstream Elbe, KAGU, located 200 m south of the line and still has 700 m until 111 is passed. TRANSANUND 200 m south of the line and 107 was passed and on the radar reference line the AURORA, 105 astern and another 600 m until 107 is passed."

At 041459, the pilot of the AURORA was addressed directly by the radar pilot: "(First name) you have two vessels proceeding in the same direction and the large AGF, which has now passed 114 (...)." The pilot of the AURORA answered: "Yes, I have coordinated with the TRANSANUND. She will keep right to the south. I will pass her. Should be okay." Radar pilot: "Yes, okay."
At that point, the distance between the AURORA and the CSCL EUROPE was about 2.9 nm.

The radar pilot, who had previously contacted the KAGU with regard to the correct passage of buoy number 111 ahead, had to intervene once again because the KAGU was now situated outside the fairway.

[10] Radar picture from the VDR of the TRANSANUND. 4 radar pictures were stored in memory of the VDR per minute.
[11] Radar reference line

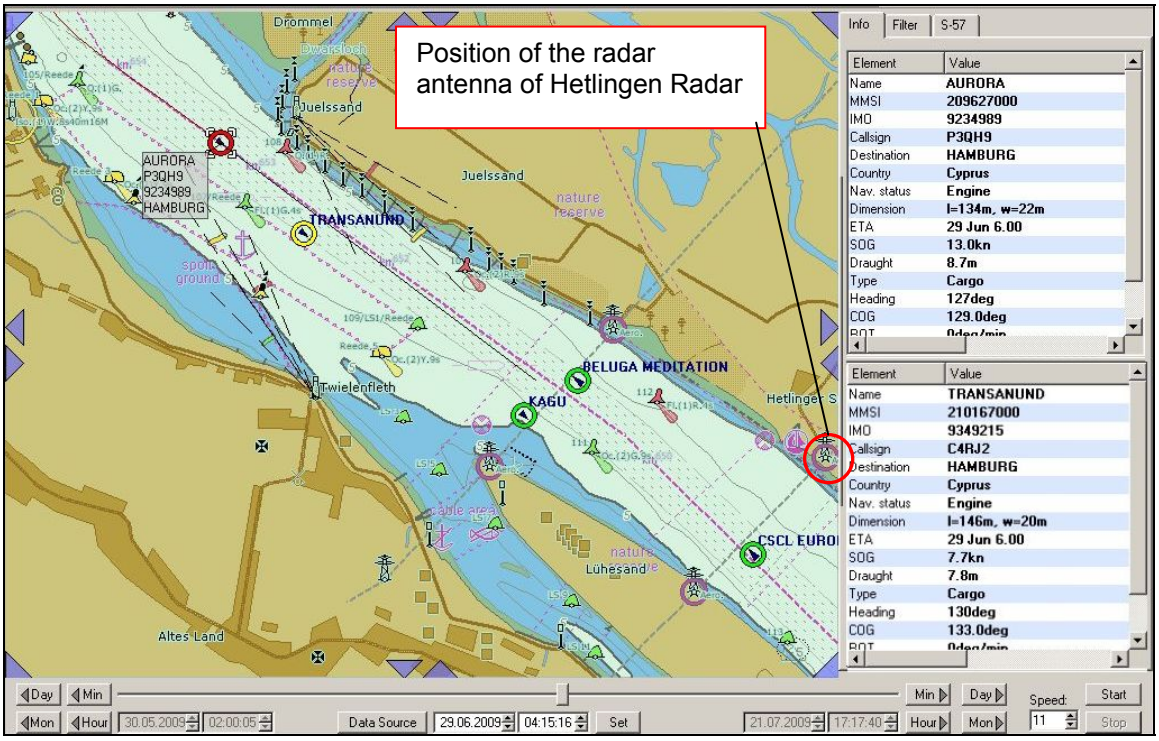

Figure 12: Traffic situation at 041516 CSCL EUROPE has reached the area shown

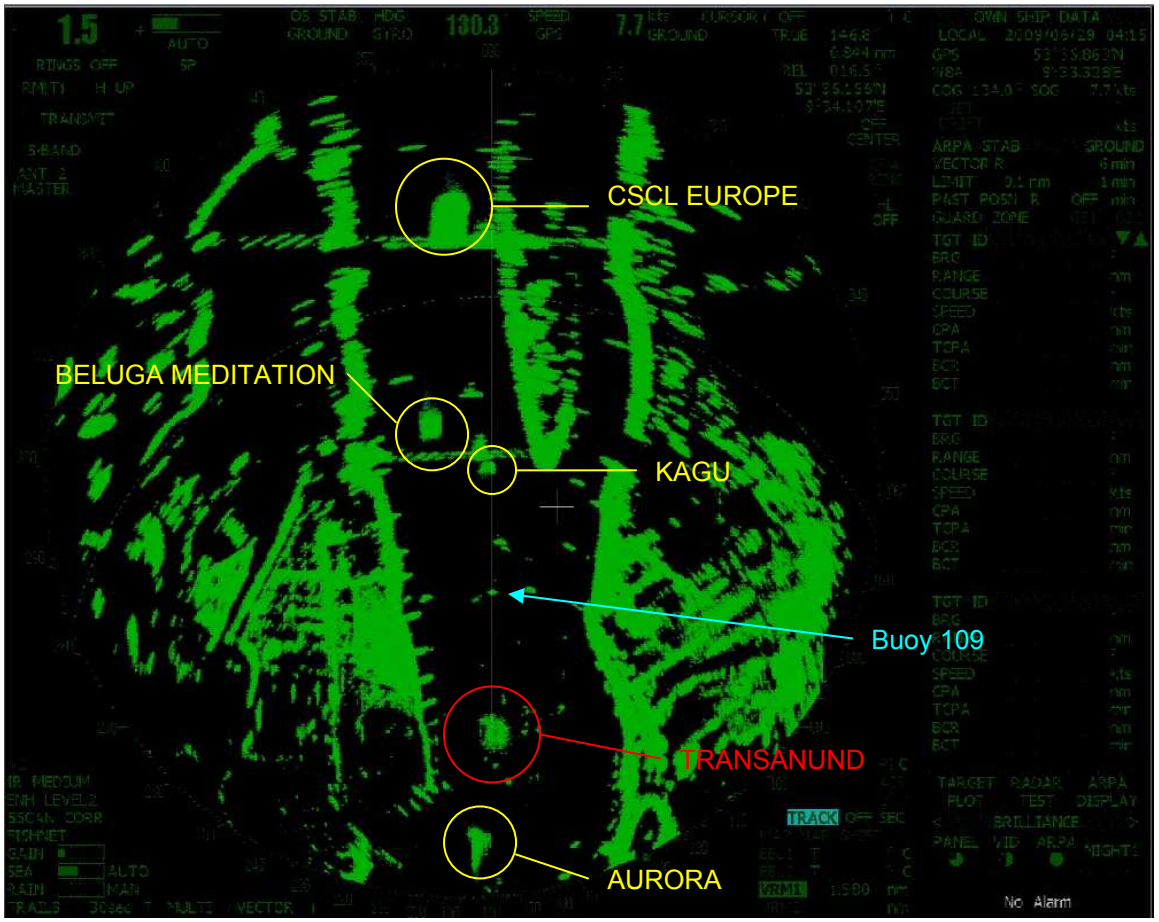

Figure 13: Radar picture from the TRANSANUND at 041525

At 0416, the radar pilot gave the following advice: "Downstream Elbe, BELUGA MEDITATION, 80 m north of the line and 600 m until 110 is passed. Followed by CSCL EUROPE, port side on the line, 600 m to the intersection with 112. Upstream Elbe, KAGU, now south of the buoy line, only 300 m until 111 is passed." The distance between the AURORA and the CSCL EUROPE was about 2.4 nm.
The TRANSANUND had reached the southern buoy line and now altered the course to port in order to follow the course of the fairway. At 041616 the compass course was 128°, at 041636 the COG was 128".
The AURORA passed buoy 107 at about 0416.

Figure 14: Radar picture from the TRANSANUND at 041610

At 0417, the radar pilot gave the following information: "So, CSCL EUROPE, stem with port side on the intersection at 112. Further upstream Elbe, the TRANSANUND, port side on the line, err port side on, starboard side on the buoy line and will pass buoy number 109 in 100 m. The AURORA on overtaking course, she is positioned 100 m south of the radar reference line and now close to the TRANSANUND. AURORA move a little to port." That was followed by two unanswered calls to the AURORA by the radar pilot. The distance between the AURORA and the CSCL EUROPE was about 1.8 nm at the time.
From 0417 the TRANSAND steered a course deviating from the course of the fairway (128°). The compass course was 121° to 122°. The course over ground was approx. 123°. Possibly this course was steered in order to avoid an approach to close to buoy 109. The actual rudder positions could not be determined for lack of VDR recording.

It is to be noted, that the buoy was not yet visually recognisable under the prevailing visibilities.
The speed of TRANSANUND was 7, 6 kts and 7, 8 kts between 0414 and 0418.

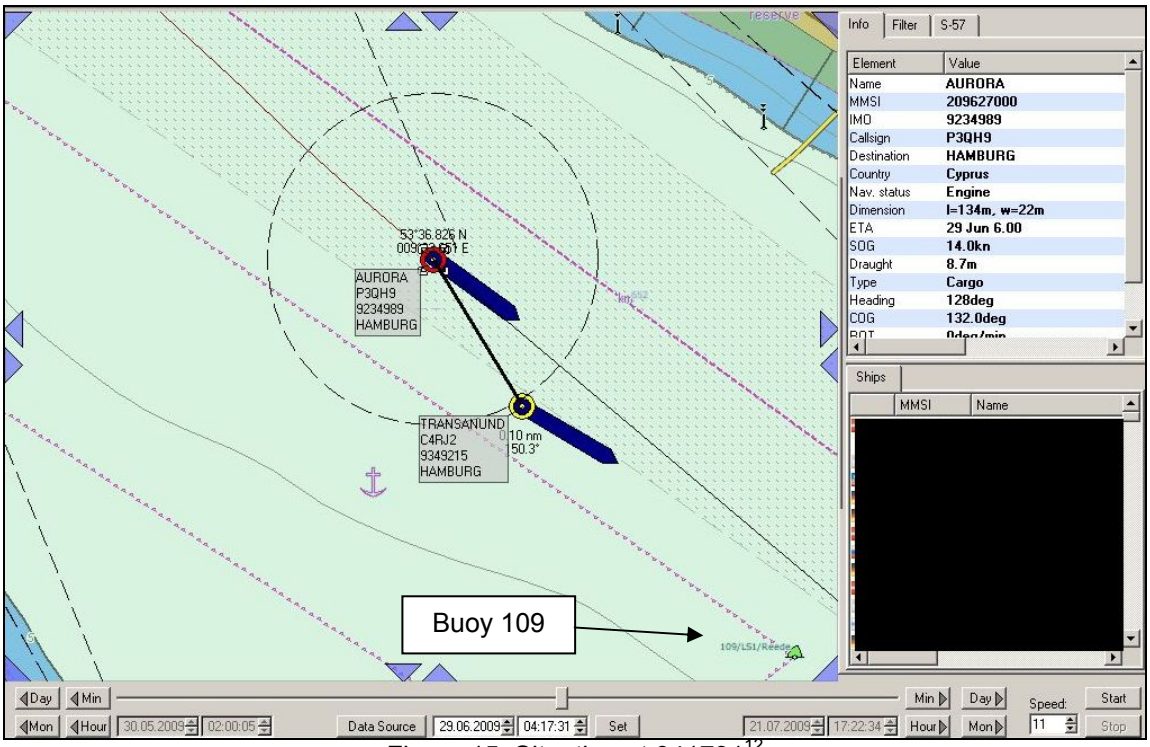

Figure 15: Situation at 041731[12]

[12] Enlarged view of the vessel particulars transmitted via AIS.

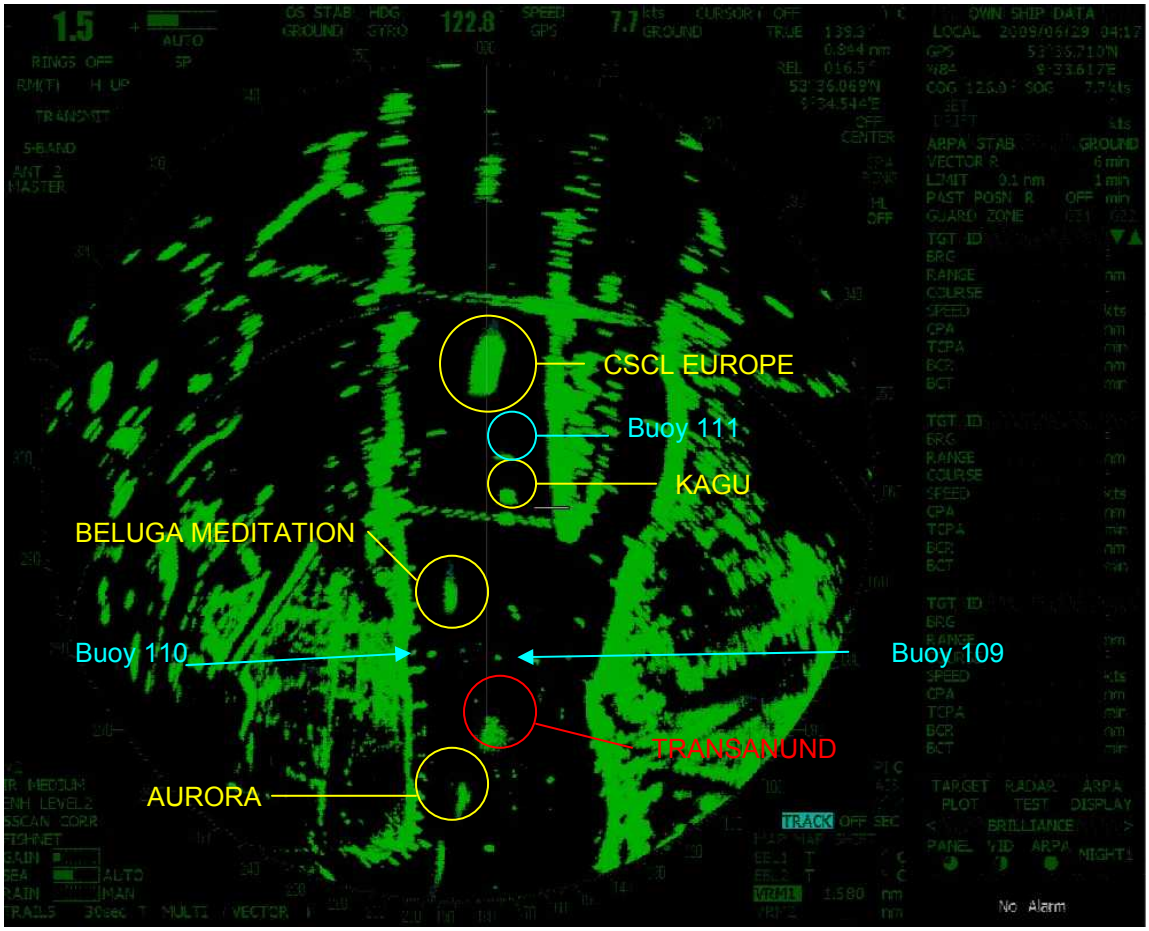

Figure 16: Radar picture from the TRANSANUND at 041710

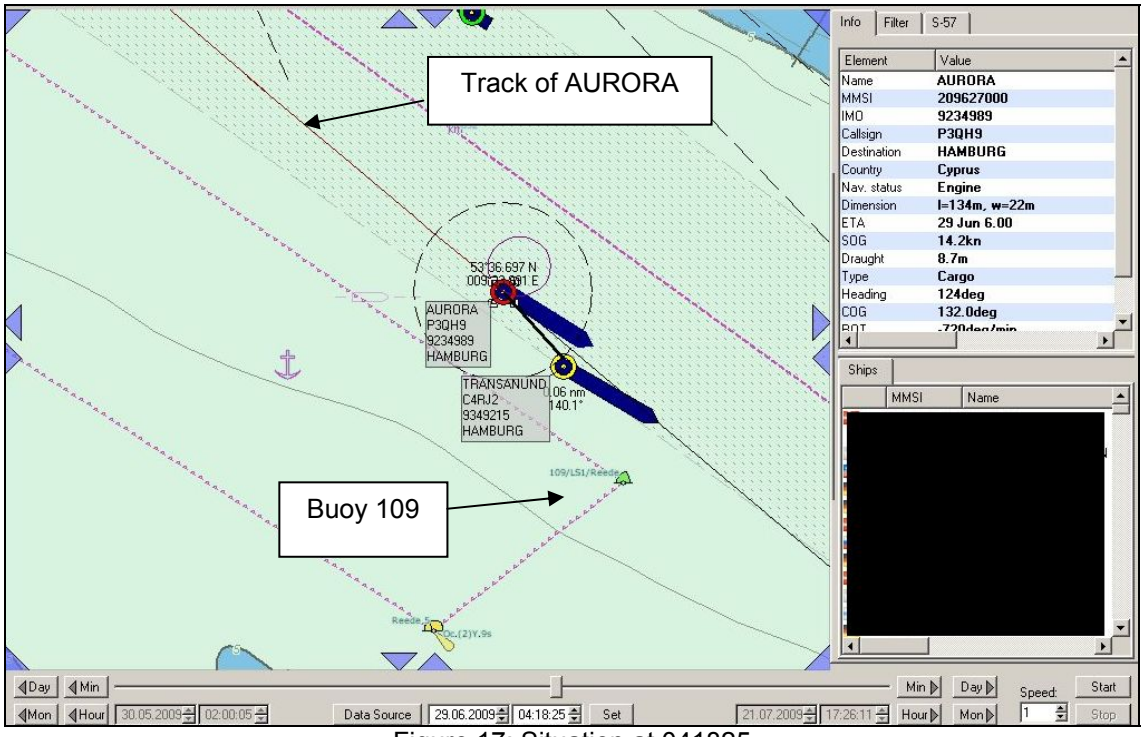

Figure 17: Situation at 041825

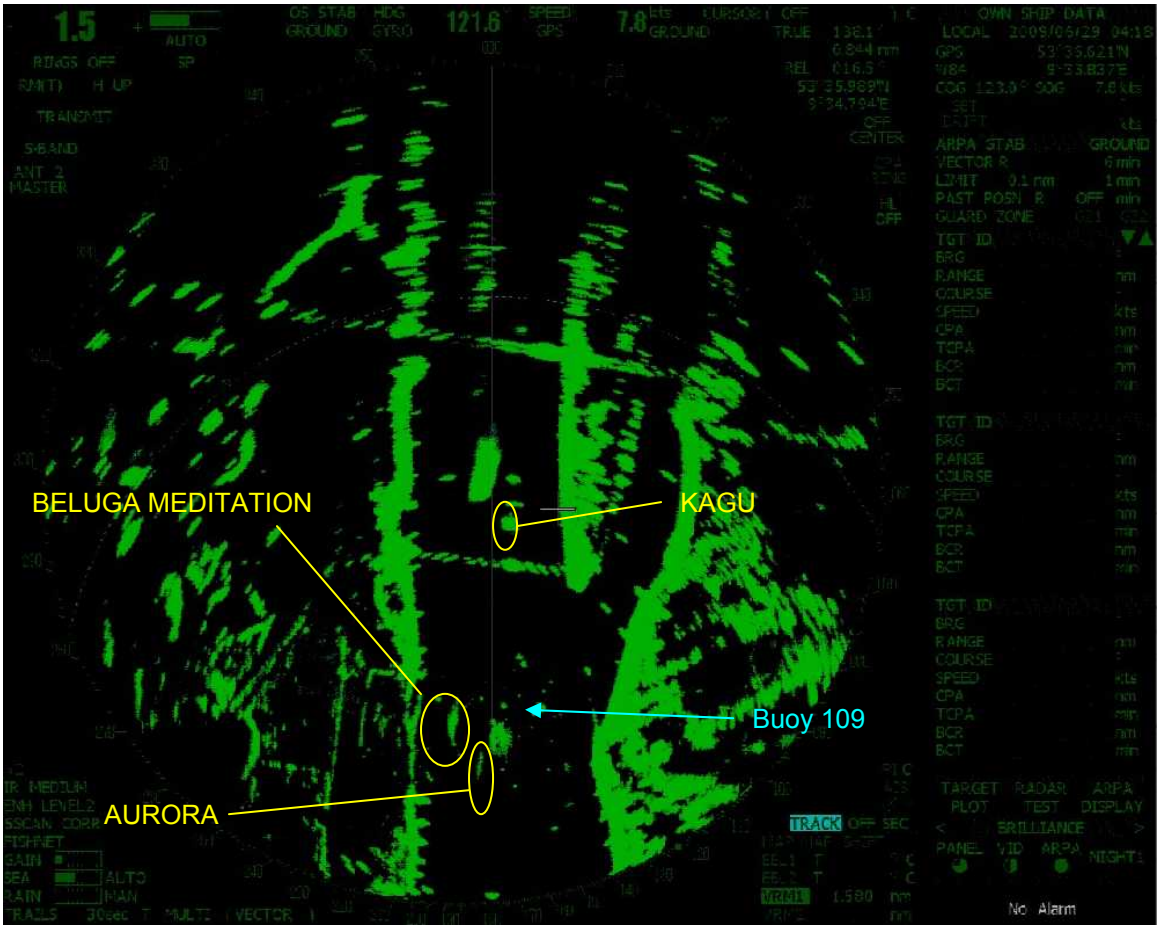

Figure 18: Radar picture from the TRANSANUND at 041810

At 0418 (s. figure 17) the AURORA still had a southerly moving tendency. The TRANSANUND in contrast got slightly to the north.

In the period between 0418 and 0419, the BALUGA MEDITATION passed the AURORA and the TRANSANUND, which were level with one another.

At 041930, the information of the radar pilot was: "The TRANSANUND is passing 109 nearly and close to her port side the AURORA is overtaking the TRANSANUND. The stem of the AURORA is 50 m south of the radar reference line. Downstream Elbe, the CSCL EUROPE, AGF 1, port side 50 m north of the line. Upstream Elbe, the TRANSANUND, port side 100 m south and the AURORA on an overtaking course, port side 50 m south of the line."

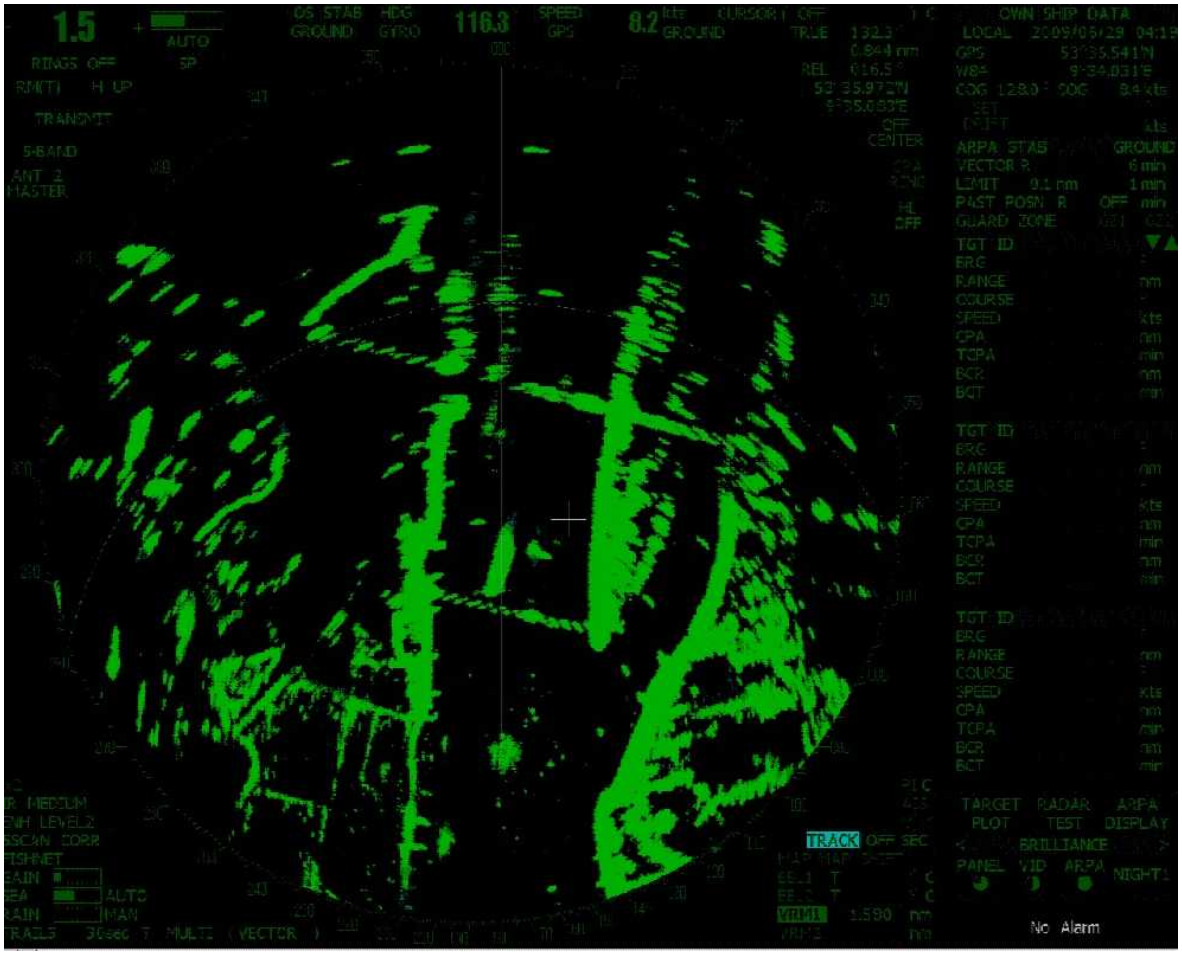

Figure 19: Radar picture from the TRANSANUND at 041925,
AURORA abeam of the TRANSANUND, TRANSANUND beginning to turn to port

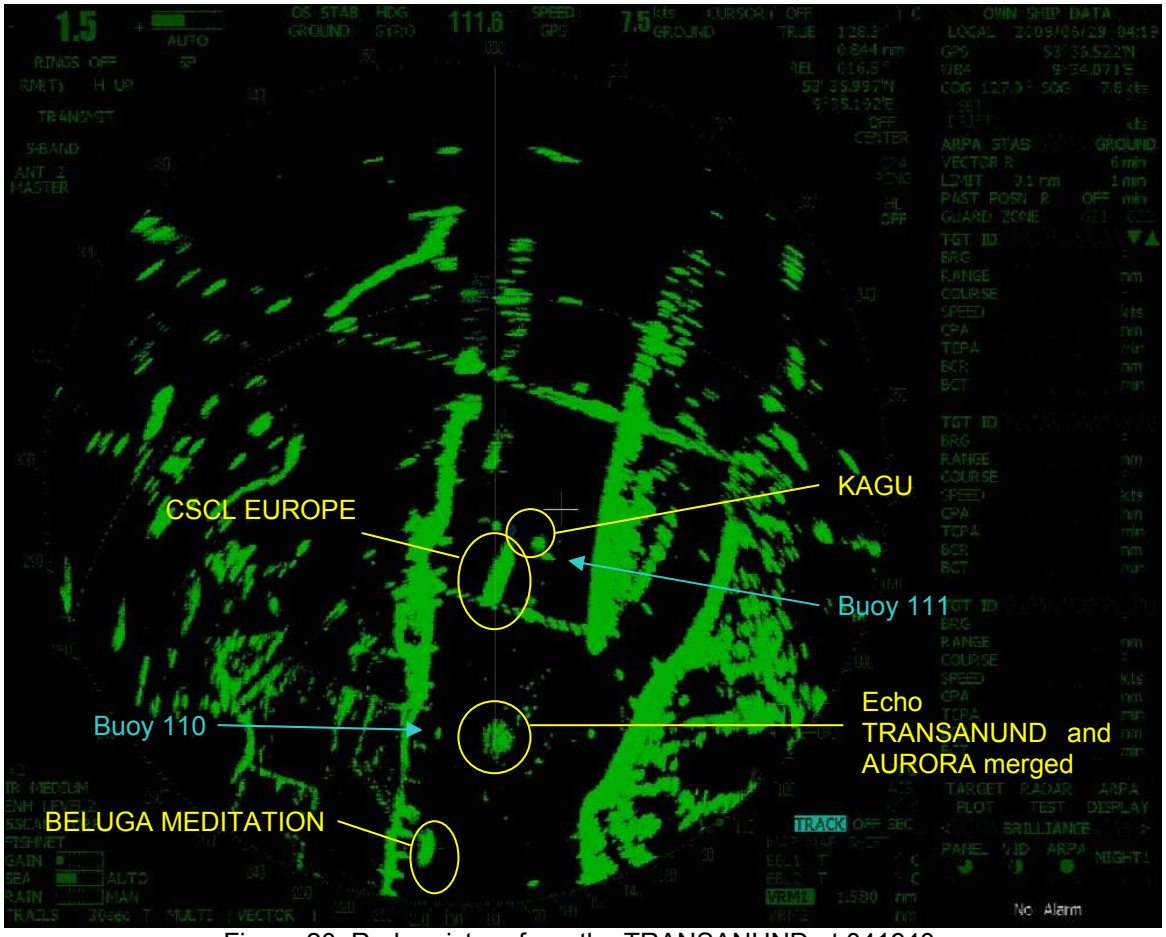

Figure 20: Radar picture from the TRANSANUND at 041940,
further turn to port by the TRANSANUND

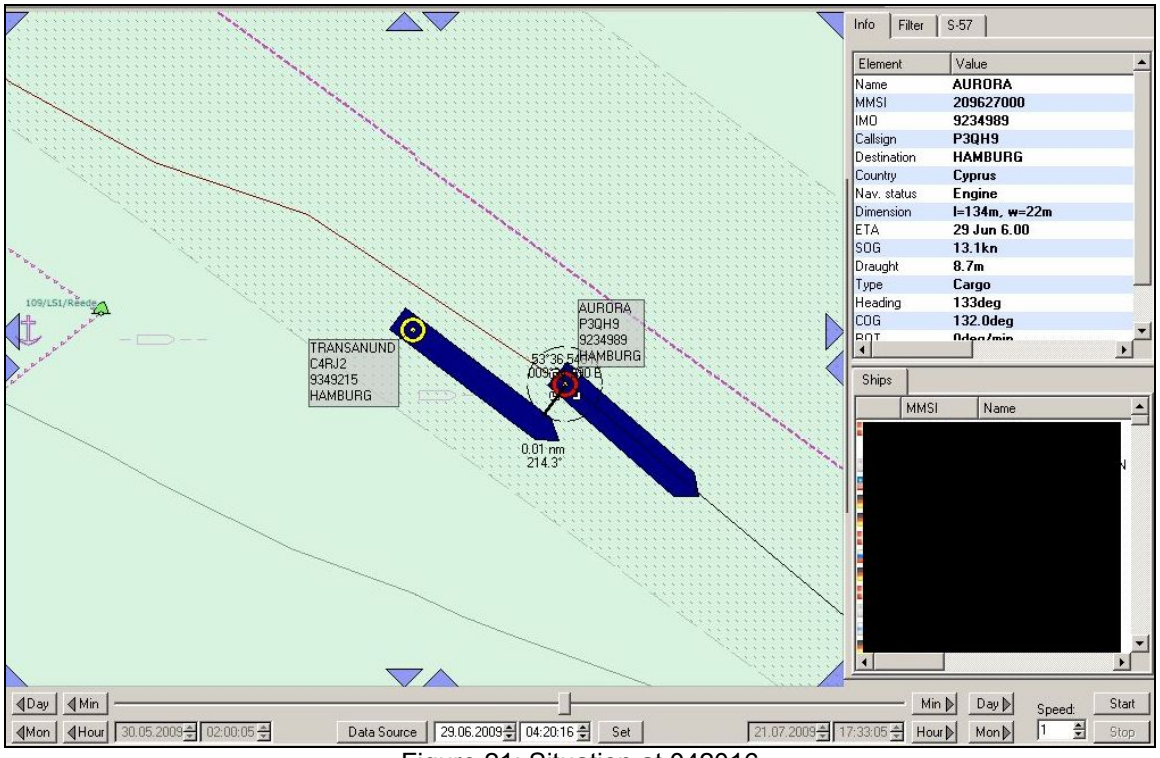

Figure 21: Situation at 042016

At 042024, the radar pilot gave the following assistance: "Downstream Elbe, BELUGA MEDITATION, 100 m north of the line, 118 passed. CSCL EUROPE, AGF 1, port side 50 m north of the line, distance to buoy number 110 600 m. Upstream Elbe, KAGU, 100 m south of the line, 111 has been passed. TRANS yes ... the AURORA is now ahead, is 50 m south in my picture with TRANSANUND following closely, also 50 m south of the line, both vessels currently passing the CSCL EUROPE."

According to the AIS data, the CSCL EUROPE was avoided further north. After that, she was positioned with her starboard side close to the northern edge of the navigation channel. This means that the distance from the port side of the vessel to the radar reference line was about 100 m. The discrepancy may be due to the position of the radar antenna used for the radar pilotage. This is situated on the northern mast of the westerly high voltage line (see Figure 12). The port side of the CSCL EUROPE was therefore in the radar shadow, meaning the true size of the vessel was not shown.

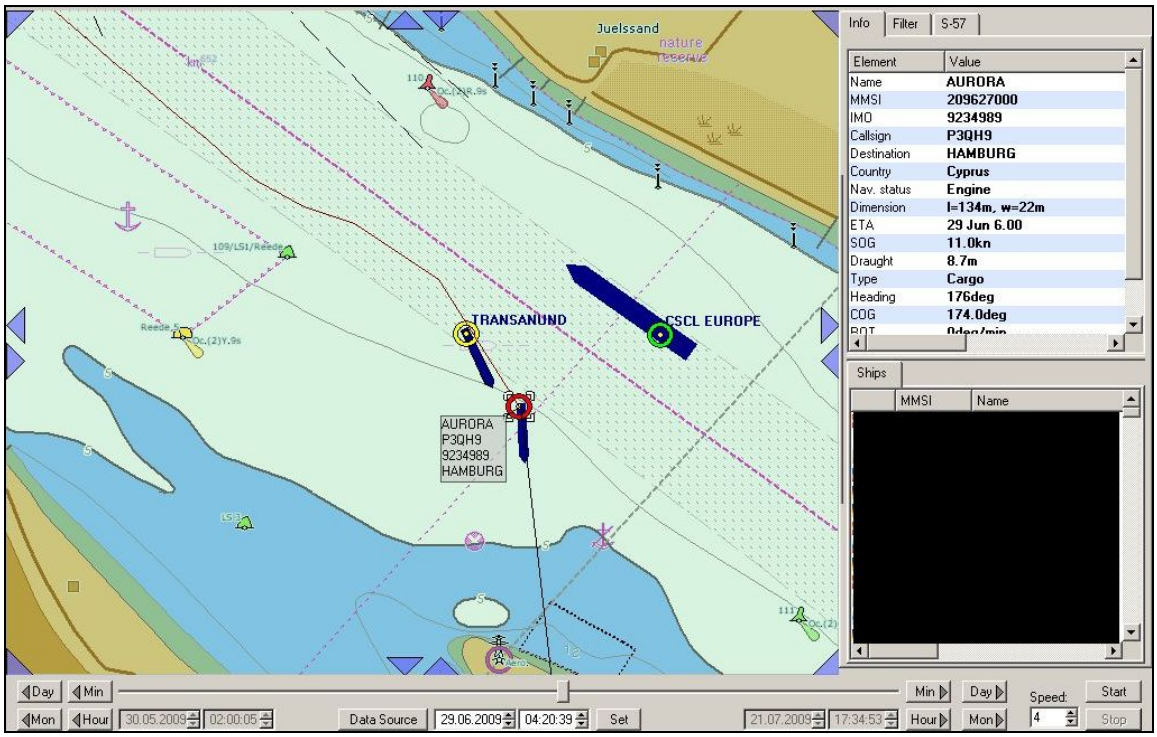

Figure 22: Situation at 042039

After a call by Hetlingen Radar, the master of the TRANSANUND informed the radar pilot at 0422 that a collision had occurred.

The course of the TRANSANUND and the AURORA according to the recording of the ECDIS of the TRANSANUND is shown in Figure 23. This shows that after passing buoy number 105, the TRANSANUND continuously steered for the right edge and after reaching it kept almost there. However, the AURORA continuously steered a course that took the vessel closer and closer to the TRANSANUND.
On the AURORA, there was no way of graphically presenting the log files (s. figure 25) later on stored in the nautical chart system, i.e. the data for the course of the voyage. Therefore, the screen was photographed (Figure 24).

The track shown is identical to that of the TRANSANUND.

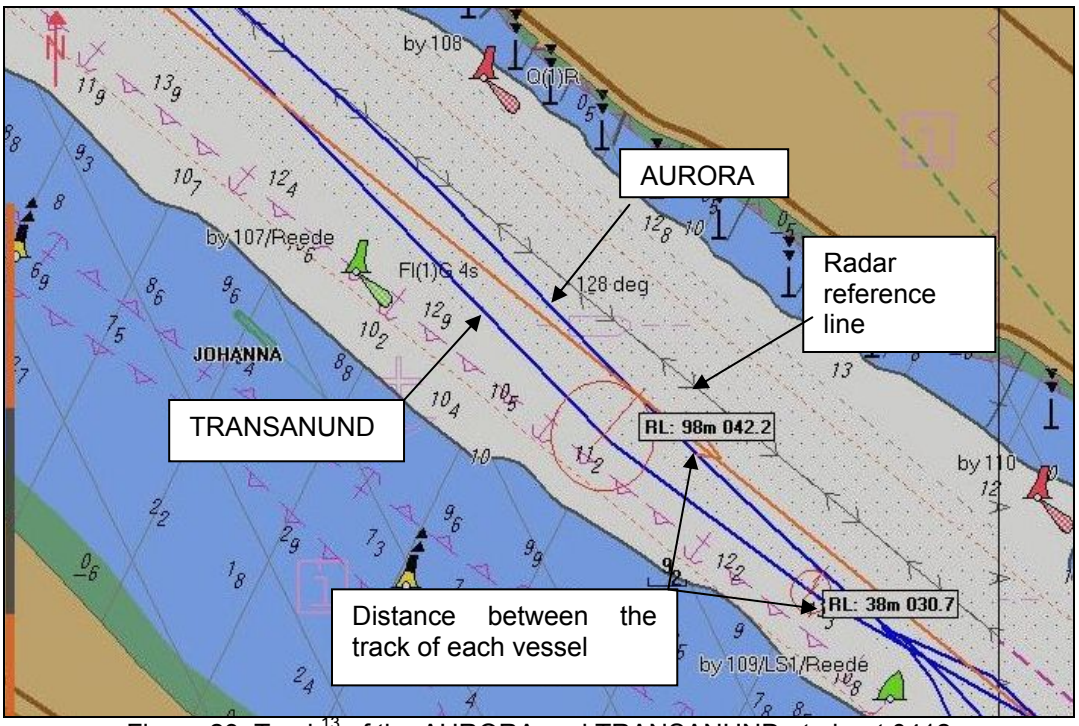

Figure 23: Track[13] of the AURORA and TRANSANUND at about 0412

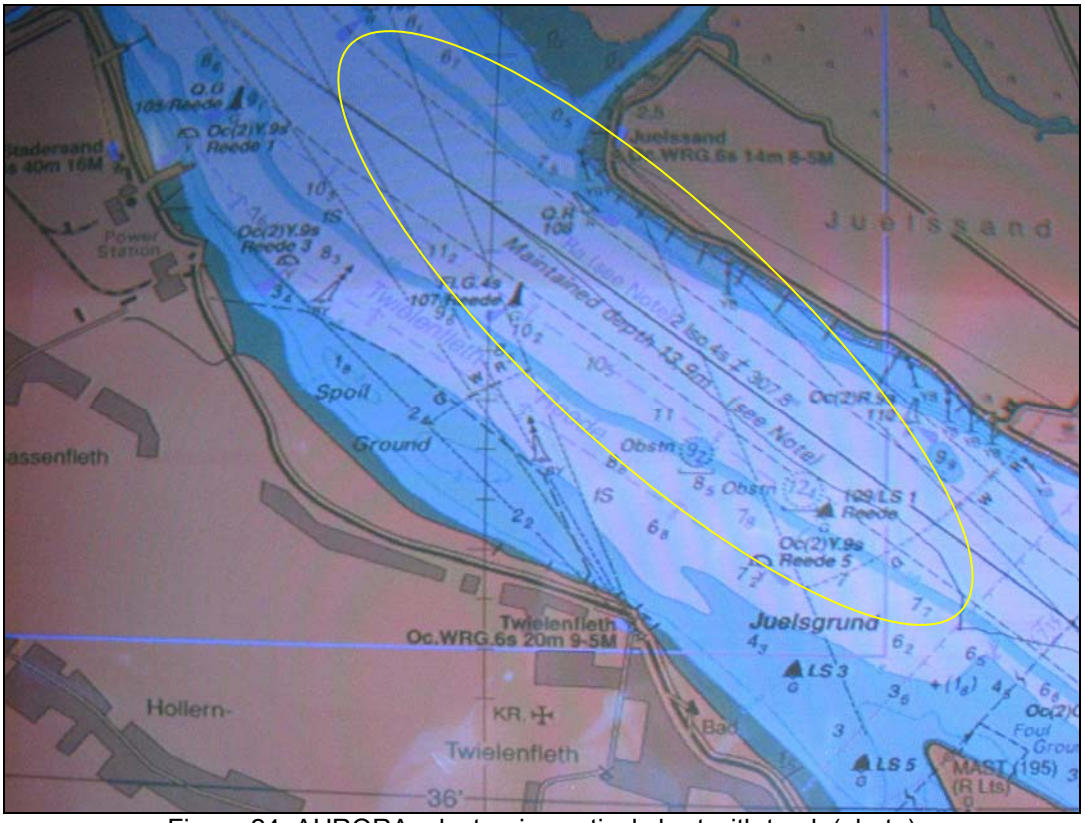

Figure 24: AURORA, electronic nautical chart with track (photo)

[13] From the ECDIS of TRANSANUND

Date / Time	Event	Latitude	Longitude	Bearing	Spd/Other
06/29/09 02:10:01	OShip	N 53 38.07	E 009 31.64	150.0	12.5
06/29/09 02:10:31	Alarm	N 53 37.98	E 009 31.72	149.5	12.5
06/29/09 02:11:01	OShip	N 53 37.88	E 009 31.80	145.6	12.5
06/29/09 02:11:39	Alarm	N 53 37.77	E 009 31.91	143.5	12.5
06/29/09 02:12:00	Warn	N 53 37.71	E 009 31.98	139.3	12.5
06/29/09 02:12:01	OShip	N 53 37.71	E 009 31.99	139.3	12.3
06/29/09 02:12:59	Alarm	N 53 37.56	E 009 32.20	128.5	12.1
06/29/09 02:13:02	OShip	N 53 37.55	E 009 32.22	128.1	12.0
06/29/09 02:14:01	OShip	N 53 37.43	E 009 32.48	125.1	12.1
06/29/09 02:14:18	Alarm	N 53 37.40	E 009 32.55	125.8	12.1
06/29/09 02:15:02	OShip	N 53 37.30	E 009 32.76	126.3	12.5
06/29/09 02:15:34	Alarm	N 53 37.24	E 009 32.90	127.0	12.8
06/29/09 02:16:01	OShip	N 53 37.17	E 009 33.04	128.5	13.1
06/29/09 02:16:06	Alarm	N 53 37.16	E 009 33.05	128.8	13.1
06/29/09 02:16:46	Alarm	N 53 37.06	E 009 33.24	130.6	13.5
06/29/09 02:17:01	OShip	N 53 37.02	E 009 33.31	131.1	13.6
06/29/09 02:18:01	OShip	N 53 36.86	E 009 33.59	128.6	14.0
06/29/09 02:18:04	Alarm	N 53 36.85	E 009 33.60	128.6	14.0
06/29/09 02:18:24	Warn	N 53 36.80	E 009 33.70	128.5	14.1
06/29/09 02:19:01	OShip	N 53 36.70	E 009 33.89	125.8	14.1
06/29/09 02:19:21	Alarm	N 53 36.65	E 009 33.98	114.4	14.3
06/29/09 02:19:35	Alarm	N 53 36.63	E 009 34.07	111.9	14.0
06/29/09 02:20:01	OShip	N 53 36.59	E 009 34.21	128.8	13.3
06/29/09 02:20:06	Warn	N 53 36.58	E 009 34.23	131.3	13.3
06/29/09 02:21:01	OShip	N 53 36.43	E 009 34.44	174.5	12.0

Figure 25 AURORA, log-file with compass course and speed[14]

[14] For better readability edited by the BSU

Date	Time	Kompass-kurs	Kurs über Grund
29.06.2009	02:15:00	131,1	134,4
29.06.2009	02:15:10	130,8	134,9
29.06.2009	02:15:20	130,4	134,2
29.06.2009	02:15:30	130,1	133,7
29.06.2009	02:15:40	130	132,8
29.06.2009	02:15:50	130,1	132,6
29.06.2009	02:16:00	130,2	133,5
29.06.2009	02:16:10	129,3	135,6
29.06.2009	02:16:20	126,9	136,8
29.06.2009	02:16:30	124	131,3
29.06.2009	02:16:40	122,9	125,6
29.06.2009	02:16:50	123,6	123,5
29.06.2009	02:17:00	123,7	128,2
29.06.2009	02:17:10	122,3	127,7
29.06.2009	02:17:20	121,3	124,6
29.06.2009	02:17:30	121,1	123,1
29.06.2009	02:17:40	121,4	122,6
29.06.2009	02:17:55	121,9	123,9
29.06.2009	02:18:00	121,9	124,0
29.06.2009	02:18:10	121,8	124,3
29.06.2009	02:18:20	121,6	124,2
29.06.2009	02:18:30	121,5	123,5
29.06.2009	02:18:40	121,4	123,7
29.06.2009	02:18:50	121,6	122,4
29.06.2009	02:19:00	121,9	124,3
29.06.2009	02:19:10	120,8	127,8
29.06.2009	02:19:20	117	127,6
29.06.2009	02:19:30	112,1	129,8
29.06.2009	02:19:40	112,7	101,6
29.06.2009	02:19:50	118	105,7
29.06.2009	02:20:00	120,7	110,6
29.06.2009	02:20:10	125,4	108,4
29.06.2009	02:20:20	134,4	111,8
29.06.2009	02:20:30	146	127,8
29.06.2009	02:20:40	153,5	147,6
29.06.2009	02:20:50	155,5	157,7
29.06.2009	02:21:00	155,4	159,0
29.06.2009	02:21:10	155,8	160,3

Figure 26: TRANSANUND, compass course and course over ground

The radar plot of VTS Brunsbüttel (Figure 27) provides another perspective of the sequence of events. The northern edge of the navigation channel has been marked to provide better insight on the traffic area available to the CSCL EUROPE. The width of the navigation channel at buoy pair 109/110 is approximately 300 m. On the CSCL EUROPE's heading, the channel then widens moderately to about 340 m off buoy pair 107/108. The fairway itself is approx. 440 m wide off buoy pair 109/110. Since the CSCL EUROPE was reliant on the fairway, 350 m of water was available as traffic area to all three vessels off buoy number 109.

The radar plot also provides insight on the course of the KAGU and the resulting increased requirement for advice from the radar pilot. The vessel was at risk of running aground or colliding with buoy number 111 and crossing the stem of the CSCL EUROPE.

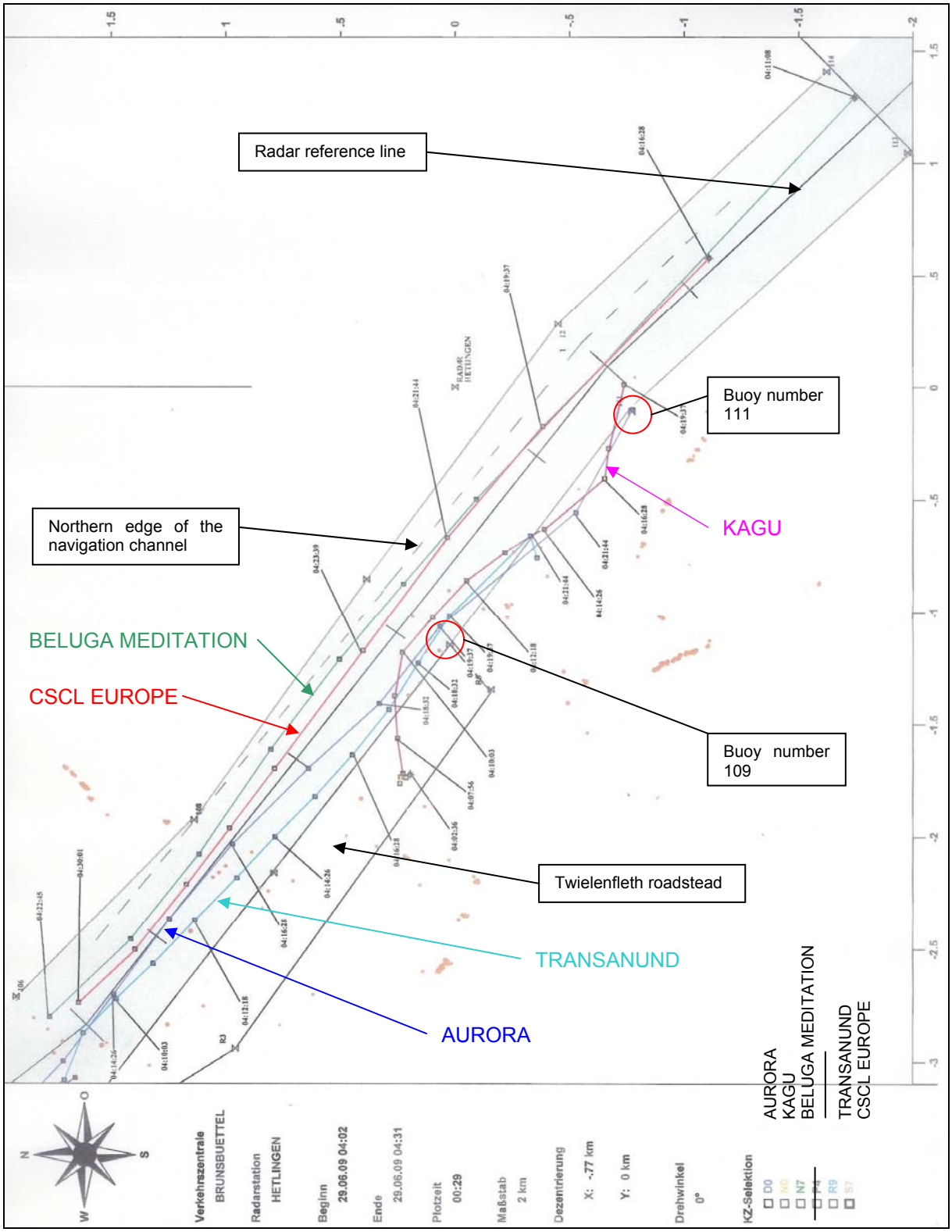

Figure 27: Radar plot of Hetlingen Radar from VTS Brunsbüttel over the period 29 June 2009, 0402 to 0431

4 ANALYSIS

4.1 AURORA

4.1.1 Bridge manning and communications

Watchkeeping on seagoing vessels is based on the STCW Code[15].

Section A-VIII/2, part 3, (9) and (12) deals with bridge manning while a vessel is underway. This states that the master is not required to navigate the vessel for the entire length of the voyage. He is permitted to hand the navigational watch over to one of the officers:

9[16] *The master of every ship is bound to ensure that watchkeeping arrangements are adequate for maintaining a safe navigational watch. Under the master's general direction, the officers of the navigational watch are responsible for navigating the ship safely during their periods of duty, when they will be particularly concerned with avoiding collision and stranding.*

12[17]The officer in charge of the navigational watch is the master's representative and is primarily responsible at all times for the safe navigation of the ship and for complying with the International Regulations for Preventing Collisions at Sea, 1972[18].

The master of the AURORA handed over the watch to the officers for the passage of the Elbe. Basic arrangements for the navigational watch could not be submitted. There were also no special arrangements in the form of watch orders for the passage of the Elbe.
At the time of the accident, the bridge of the AURORA was manned only by the officer on watch and the pilot.
According to the established watch roster, the officer in charge of the navigational watch at the time of the accident went on duty at 0400. At this point, the vessel had already been advised by the Elbe pilot for some time.

As a rule, the bridge must be manned by a look-out while the vessel is underway:

13 A proper look-out shall be maintained at all times in compliance with rule 5 (...) (COLREGs).

14 The look-out must be able to give full attention to the keeping of a proper look-out and no other duties shall be undertaken or assigned which could interfere with that task.

[15] The STCW Code lays down standards on Seafarers' Training, Certification and Watchkeeping; set below in italics
[16] Section A-VIII/2 – Arrangements and principles to be observed in keeping a navigational watch, here part 3 – Watchkeeping at sea
[17] Part 3-1 – Principles to be observed in keeping a navigational watch.
[18] Regulations for Preventing Collisions at Sea (COLREGs)

The exemptions in para. 15, according to which the officer on watch may also perform the task of look-out, are basically limited to daylight and then only if, inter alia, visibility permits.
A look-out was not stationed on the bridge of the AURORA at the time of the accident. It is assumed that there was no look-out on the bridge at least since the change of watch at 0400.

According to para. 17, the composition of the navigational watch must be established. In connection with para. 35.1, to be able meet international requirements at all times, the officer on watch shall evaluate the need to have a helmsman on the bridge. If there is such a need, the helmsman may not be used simultaneously as a look-out.

15 The duties of the look-out and helmsman are separate; the helmsman shall not be considered to be the look-out while steering (...).

There was no helmsman on the bridge of the AURORA. That was not necessary to begin with because the vessel was steered by means of the autopilot. It is apparent that the autopilot was operated by the pilot alone. While approaching the TRANSANUND, the officer on watch switched the autopilot to manual mode without stationing a helmsman on the bridge. However, he did not receive any helm commands from the pilot, meaning the pilot continued to steer the vessel using the manual helm after it was switched over.

The STCW Code also defines the tasks to be performed during a watch:

24[19] During the watch the course steered, position and speed shall be checked at sufficiently frequent intervals, using any available navigational aids necessary, to ensure that the ship follows the planned course.

29 In cases of need the officer in charge of the navigational watch shall not hesitate to use the helm, engines and sound signalling apparatus. (...)

31 A proper record shall be kept during the watch of the movements and activities relating to the navigation of the ship.

On the AURORA, evidence to suggest that the course of the vessel was checked or recorded was found neither in the nautical chart nor in the submitted recordings. The position at 0400, the time of the change of watch, was not recorded.

The AURORA had registered for radar pilotage, i.e. she was mentioned for the first time in Hetlingen Radar's information loop at 0414. This clearly indicates that the vessel was sailing in 'restricted visibility'.

45 When restricted visibility is encountered or expected, the first responsibility of the officer in charge of the navigational watch is to comply with the relevant rules of the (...) (COLREGs) *with particular regard to the sounding of fog signals,*

[19] Carrying out the navigational watch

proceeding at a safe speed and having the engines ready for immediate manoeuvre. In addition, the officer in charge of the navigational watch shall:
.1 inform the master;
.2 post a proper look-out;
(…).

The onset of restricted visibility did not lead to the posting of a look-out on the AURORA. There was no indication that the master was informed by the officer on watch.
During the passage of the Elbe, the AURORA was sailing in busy waters:

47 The largest scale chart on board, suitable for the area and corrected with the latest available information, shall be used. Fixes shall be taken at frequent intervals, and shall be carried out by more than one method whenever circumstances allow.

The electronic chart with the largest scale was used on the AURORA. However, an ARCS[20]electronic nautical chart was used on the approved ECDIS device in spite of ENCs being available for the Elbe. At the time of the survey by the BSU there was no planned route on the electronic nautical chart.

The planned route on the shipboard paper nautical chart consisted of the course line to and from Hamburg. However, the course lines would only partly have assisted in orientation because course changes were only roughly shown at bends. No positions were recorded on the paper nautical chart. Therefore, it was not possible to establish clearly whether the paper nautical chart or electronic nautical chart was used for navigation.

An Elbe pilot boarded the vessel before she left the lock at Brunsbüttel.

49 Despite the duties and obligations of pilots, their presence on board does not relieve the master or officer in charge of the navigational watch from their duties and obligations for the safety of the ship. The master and the pilot shall exchange information regarding navigation procedures, local conditions and the ship's characteristics.
The master and/or the officer in charge of the navigational watch shall cooperate closely with the pilot and maintain an accurate check on the ship's position and movement.

50 If in any doubt as to the pilot's actions or intentions, the officer in charge of the navigational watch shall seek clarification from the pilot and, if doubt still exists, shall notify the master immediately and take whatever action is necessary before the master arrives.

It was not possible to obtain evidence as to the extent to which the pilot and ship's command exchanged information regarding the vessel or discussed and determined the distribution of tasks during the passage of the Elbe. The pilot did not give a

[20] See footnote 6

statement on the course of the voyage or accident. However, the statement of the ship's command implies that the pilot operated the helm in autopilot mode independently and without consulting the officer on watch. It was also not possible to determine whether the rates of speed were changed. If the tasks had indeed been distributed in such a manner, it was apparently neither questioned by the officer on watch nor did he ask for it to be changed.

IMO Resolution A.960 (23)[21] provides a further indication as to the way pilots and ship's commands should cooperate. Annex 2 (6.3) of the above states that:

> *When a pilot is communicating to parties external to the ship, such as vessel traffic services, tugs or linesmen and the pilot is unable to communicate in the English language or a language that can be understood on the bridge, the pilot should, as soon as practicable, explain what was said to enable the bridge personnel to monitor any subsequent actions taken by those external parties.*

The statement of the ship's command of the AURORA describes how the pilot confirmed his intention to overtake the TRANSANUND only after being questioned. The communication with the shore-based radar pilotage service and the TRANSANUND at least was in German and not properly passed on or explained to the officer on watch.

4.1.2 Cooperation between the pilot and officer on watch

The legal position and duties of a pilot are defined in articles 21 to 26 SeeLG[22] Art. 23 SeeLG deals with the pilot's position on board and with respect to the master. It states the following:

> *(1) The maritime pilot shall advise the master in navigating the vessel. Such advice may also be provided from another vessel or on shore.*
> *(2) The master remains responsible for navigating the vessel even if he permits the maritime pilot to independently issue orders which concern navigation thereof.*
> *(3) If several maritime pilots are tasked, the master shall only be advised by one of these and the remaining maritime pilots will provide support. The master shall be informed of who the advising maritime pilot is before the task is undertaken.*

Paragraph 2, according to which the pilot may issue orders independently, i.e. the pilot is permitted by the master to issue instructions to perform an action directly to other crew members, is relevant to this accident. The usual procedure, whereby the pilot recommends that the master perform an action and, after consideration, the master passes this on to his crew, is dispensed with and the pilot may communicate directly with the other crew members. Aside from emergency situations, it is debatable whether the pilot may also operate the manoeuvring equipment (helm and control lever) on the bridge at the request of the ship's command. The Law governing Maritime Pilots does not explicitly provide for operation of manoeuvring equipment by pilots even though this is quite common in day-to-day pilotage. Without regard to the

[21] Recommendations on training and certification and operational procedures for maritime pilots other than deep-sea pilots
[22] SeeLG – Law governing Maritime Pilots (Seelotsgesetz)

current status of debate on this aspect of pilotage, it remains to be noted that for this particular case the BSU is of the opinion that operation of the helm and control lever by the pilot on the AURORA was not required for ship safety. This is particularly valid in the sector of the Elbe through which the AURORA was passing as there is sufficient space available for manoeuvring without the need for the pilot to operate the controls directly in order to prevent a delay.
The wording in para. 2 is, in essence, also consistent with the STCW Code[23] (see above), according to which the master and/or officer in charge of the navigational watch cooperate closely with the pilot and maintain an accurate check on the ship's position and movement.
It seems apparent that the officer on watch on the AURORA had assumed a passive role. Cooperation in terms of navigating the vessel did not take place. However, this was evidently not requested by the pilot as well.
The pilot did not communicate the information he received and agreements with the VTS, shore-based radar pilotage service and other vessels sufficiently.

4.1.3 Overtaking manoeuvre

The investigation file of the waterway police for the public prosecutor reveals that the ship's command of the AURORA did not have an unusually tight deadline by which the vessel had to be in Hamburg.

In the area where the overtaking manoeuvre took place there was no restriction in the German Traffic Regulations for Navigable Waterways or the notices of WSD North with respect to overtaking, encountering or speed limits.
The pilot advising the AURORA carried out the required manoeuvre agreement[24] with the vessel to be overtaken and received the intended confirmation by the master of TRANSANUND.
The overtaking manoeuvre took place in an area where visibility was low. The pilot of the AURORA was sufficiently informed about the traffic situation by the shore-based radar pilotage service. At 041459, he was even made explicitly aware of the two oncoming vessels. He was also aware from the radar pilotage service that the second oncoming vessel, with a draught of 12 m, was dependent on the navigation channel. He was also able to grasp the current position of the oncoming vessels from the radar pilotage service's information loop.
The shore based radar pilotage service “Hetlingen Radar” did not assess or approve the overtaking procedure. However, this would not have been the task of these “advice”.
The electronic nautical chart available to the pilot of the AURORA did not permit the display of other vessels as AIS targets. Accordingly, taking into account his own knowledge of the area he could only determine the actual position of other vessels in the fairway by means of the radar image and information from the radar pilot. With regard to the CSCL EUROPE this was disadvantageous insofar as the course of the navigation channel is not visible on the radar. In that respect, he was reliant on the information from the radar pilot since it was him who defined the position in the fairway in relation to the radar reference line. According to the information from the radar pilot, the CSCL EUROPE had her port side on the radar reference line at 0414.

[23] Part A, Chapter III, Section A-VIII/2 (49
[24] § 23 Abs. 4 SeeSchStrO (German Traffic Regulation for Navigable Maritime Waterways)

Therefore, it was only at 041945 that she was 15 m to the north. Accordingly, the AURORA and the TRANSANUND theoretically had 200 m of water available between the radar reference line and the green buoy line. This area narrows to about 150 m after the breadth of each vessel is deducted.

4.2 TRANSANUND

The ship's command of the TRANSANUND responded to the deteriorating visibility by increasing the manning on the bridge and registering for radar pilotage.
The request by the pilot of the AURORA to support the planned overtaking manoeuvre was complied with and the vessel was steered to the starboard side of the fairway, where the course and speed were maintained.
The initiated course change and increase speed manoeuvre was unable to sufficiently counteract the suction effect during the immediate overtaking manoeuvre by the AURORA.

5 CONCLUSIONS

5.1 Bridge manning

The manning on the bridge of the AURORA was not consistent with requirements. During the night, a look-out should have been posted on the bridge and performed this task at all times. On entering the fog, the ship's command ought to have reconsidered whether the seaman situated in the superstructure should have been called to the bridge.
Furthermore, on entering the fog the ship's command ought to have checked whether a helmsman should have been posted.
In this regard, the officer on watch would have been provided with long-term support if the master's standing or special watchkeeping orders had contained corresponding, explicit guidelines.

5.2 Ship's command

Documentation of the course of the voyage, i.e. the entries in the nautical chart, bridge bell book or logbook of the AURORA, was inadequate. It did not provide a basis for tracing the course of the voyage.

The distribution of tasks between the officer on watch and the pilot did not conform to legal requirements. The pilot was left to operate the manoeuvring equipment by the officer on watch without any consultation. This situation also persisted without further questioning. Furthermore, the pilot conducted any communication with shore-based stations and other vessels and did not discuss it with the officer on watch. Therefore, it was not possible for the officer on watch to obtain an overview of the traffic situation. In consequence, the pilot navigated the vessel.

5.3 Overtaking manoeuvre

The overtaking manoeuvre of the AURORA was discussed with the TRANSANUND and initiated by the pilot. The AURORA's officer on watch was only informed of this intention after asking.
The overtaking manoeuvre was initiated at a time at which it was apparent that two oncoming vessels would be passed during manoeuvre. In that respect, it was to be expected that the space available for manoeuvring would reduce substantially. Moreover, the overtaking manoeuvre was not aborted even after the radar pilot referred explicitly to the developing situation.
In addition, it was to be expected that a hazard lay ahead of the vessel due to the KAGU, since she had already attracted attention because of manoeuvring in an unusual manner and the radar pilot had spent much of his time advising this vessel. This situation did not result in the overtaking manoeuvre being aborted either.

6 SAFETY RECOMMENDATIONS

The following safety recommendations do not attribute a presumption of blame or liability in respect of type, number or sequence.

6.1 Ship's command and operator of the AURORA

The Federal Bureau of Maritime Casualty Investigation recommends that the ship's command and the operator of the AURORA review the accident within the scope of their safety management. Thereby the principles of watch duty, the conduct during restricted visibility and in waters with a large amount of traffic as well as navigating with pilot advice should particularly be addressed.

6.2 Pilots Association Elbe

The Federal Bureau of Maritime Casualty Investigation recommends that the Pilots Association Elbe reviews this accident within the framework of their quality management. The distribution of tasks between ship's crew and pilot, navigating in restricted visibility and carrying out overtaking manoeuvres under unfavourable conditions should be particularly observed.

7 SOURCES

- Findings of Waterway Police (WSP) Hamburg, WSPK 1
- Written statements
  - Ship's command of the TRANSANUND
  - In part, ship's command of the AURORA
- Witness accounts
- Nautical charts, Federal Maritime and Hydrographic Agency (BSH)
- Official weather report by Germany's National Meteorological Service (DWD)
- Radar and VHF recordings of VTS Brunsbüttel
- VDR recording from the TRANSANUND
- Photographs (Figures 4 and 5) by BSU, photographs in figures 4, 6 and 8 by waterway police Hamburg