



Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Marine casualty Investigation
Bundesoberbehörde im Geschäftsbereich des Bundesministeriums
für Verkehr, Bau- und Wohnungswesen

Investigation Report 382/03

Serious marine casualty

**Collision of
MV BOUNDER with MV BBC SWEDEN
in the Kiel Canal, canal kilometre 43
at 18:15 h on 19 December 2003**

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 24 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.

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Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation (BSU)
Bernhard-Nocht-Str. 78
D-20359 Hamburg

Director: Dieter Graf
Tel.: +49 40 31908300, Fax.: +49 40 31908340
posteingang-bsu@bsh.de www.bsu-bund.de

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1 Summary of the marine casualty

On 19 December 2003 at 18:15 h CET ¹ on a level with Canal kilometre 43 of the Kiel Canal there was a collision between MV BOUNDER sailing westwards and MV BBC SWEDEN sailing eastwards.

Both vessels were manned with Canal pilots and classified in traffic group 3, but were not mandatorily obliged to take on a canal helmsman.

Due to the differing statements of the parties involved it is not possible to clarify the cause of the accident clearly. However, it is established that MV BOUNDER suddenly turned to port and thus hit MV BBC SWEDEN midships.

Substantial property damage was sustained by both vessels. There were no personal injuries and there was no environmental pollution.

¹ Time data without any particular suffix are always local times in the following.

2 Scene of the casualty

Nature of the incident: Serious marine casualty, collision
Date/time: 19 December 2003 / 18:15 h CET
Location: Kiel Canal, km 43



Figure 1: Scene of the casualty – Chart excerpt

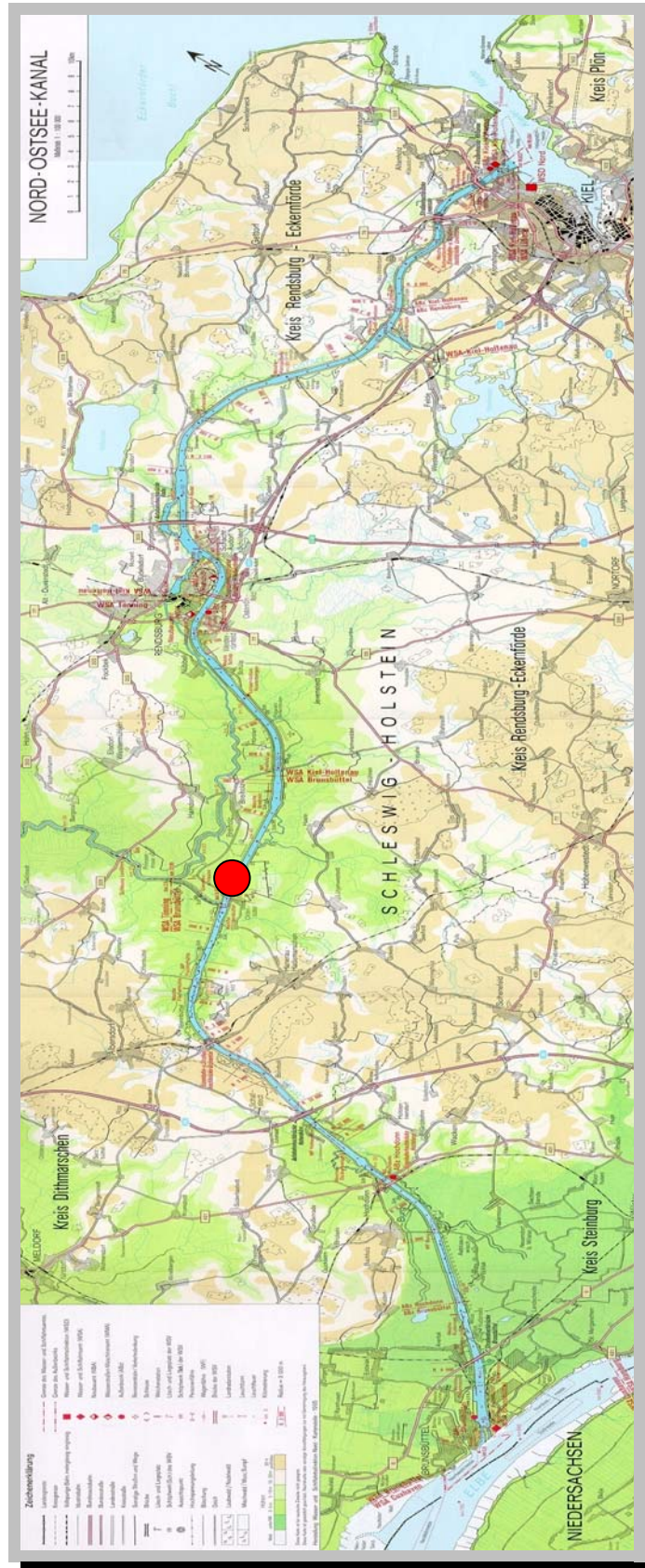


Figure 2: Scene of the casualty – Overview - Kiel Canal

3 Vessel particulars

3.1 Photo MV BOUNDER



Figure 3: MV BOUNDER

3.2 Particulars MV BOUNDER

Name of vessel	MV BOUNDER
Type of vessel	General cargo vessel
Nationality/flag	Antigua & Barbuda
Port of registry	Hamburg
IMO number	8611192
Call sign	V2AU3
Operator	Erwin Strahlmann
Year built	1989
Building yard/building number	B.V. Scheepswerf Damen Gorinchem
Classification society	GL
Length overall	89.32 m
Width overall	12.50 m
Gross tonnage	1984
Deadweight	3223 t
Draft at time of casualty	4.80 m
Engine rating	1566 kW
Main engine	Caterpillar Tractor Co. (Diesel) - 3516 B DITA
Speed	11.5 kn
Hull material	Steel
Hull design	Double-bottomed
Number of crew	6+1 Pilot

3.3 Photo MV BBC SWEDEN



Figure 4: MV BBC SWEDEN

3.4 Particulars MV BBC SWEDEN

Name of vessel	MV BBC SWEDEN
Type of vessel	General cargo vessel
Nationality/flag	Gibraltar
Port of registry	Gibraltar
IMO number	9278600
Call sign	ZDFM8
Operator	Briese GmbH & Co. KG
Year built	2003
Building yard/building number	Rousse Shipyard Ltd.
Classification society	GL
Length overall	98.86 m
Width overall	13.80 m
Gross tonnage	3198
Deadweight	4303 t
Draft at time of casualty	5.0 m
Engine rating	2880 kW
Main engine	Caterpillar Motoren MaK 6 M 32 C – MC E3 AUT
Speed	13.0 kn
Hull material	Steel
Hull design	Double-bottomed (partly)
Number of crew	11+1 Pilot

4 Course of the casualty

4.1 Statement by the Master of MV BBC SWEDEN

MV BBC SWEDEN was on a voyage from Vlissingen to St. Petersburg. The vessel left the Brunsbüttel lock on 19 December 2003 at 15:36 h and sailed into the Kiel Canal.

On a level with Canal kilometre 43 there was a collision with MV BOUNDER sailing westwards. The westward sailing vessel had run out of the rudder and approached MV BBC SWEDEN at an angle of approx. 45°. The port post of MV BOUNDER had first collided with the forward part of BBC SWEDEN and then slipped along the port side. The helm had been put "hard to starboard" and the variable pitch propeller set at "STOP", but shortly after this it was set at half ahead again in order to continue the voyage. The speed at the time of the casualty had been the customary 15 km/h on the Kiel Canal. At 22:00 h the vessel had made fast in the Nordhafen dock of Kiel-Holtenau. The damage had only then been inspected in detail.

4.2 Statement by the Master of MV BOUNDER

The Master was born in Szczecin in 1968 and was still living in Poland. He had started his career at sea in 1988 via "classic" training from deckhand to sailor. In 1994 he obtained his certificate as 3rd Nautical Officer after studying at a college of navigation. In the course of the years he had worked throughout the world on various vessels of different sizes, from small freighters through container vessels up to bulk carriers with 150,000 tdw.

In 1996 he had been appointed Second Mate and in 1997 Chief Mate. He had served on MV BOUNDER as Chief Mate from December 2002 to April 2003, and since August 2003 he had been in command of the vessel as Master.

He had passed through the Kiel Canal about 50 times. He knew that vessels of traffic group 3 could only be steered manually and that as of traffic group 4 it was necessary to take on a canal helmsman.

His vessel had left the Kiel-Holtenau locks at 14:15 h. At this time the vessel had been steered manually. The Pilot from Kiel had steered so well that he, the Master, had decided to leave the Pilot alone with his Chief Mate in order to rest a little. A crew member could have been called up onto the bridge as helmsman at any time.

At 18:15 h he had noticed changes in the running of the main engine and shortly after this there had been a heavy collision. He had jumped up and run to the bridge. There he had taken over the helm from the Pilot, who in the meantime was from Brunsbüttel. His subsequent investigation revealed that the counter rudder setting of the automatic steering system was at 4.2. He had thereupon asked the Pilot whether he had changed anything on the automatic steering system. The Pilot had confirmed that he had changed the settings and suddenly the automatic steering system had given an alarm. The Master thereupon asked him who had allowed him to do this and the Pilot had answered that he was very sorry, it had been his fault. Furthermore the

Pilot stated that he was aware of the serious difficulties he would now encounter with the Canal Authorities due to inadmissible use and adjustment of the automatic steering system.

The Master then steered the vessel manually to Brunsbüttel.

4.3 Statement by the Chief Mate of MV BOUNDER

He, the Chief Mate, has also been born in Szczecin in 1961 and was still living in Poland. He had started his career at sea in 1981 with a five-year course at the college of navigation. He had been working as Third Mate on a bulk carriers since 1987. In 1989 he had become Second Mate and continued to work on bulk carriers throughout the world. In 1995 he had changed to shore work and worked at a shipyard in Szczecin until January 2001. Then he started to work at sea again as Second Mate and had become Chief Mate in April 2002. He had joined MV BOUNDER as Chief Mate on 18 December 2003 in Vierow, Germany, where the vessel was taking on cargo. He had not been on board this type of vessel before, but had experience with similar smaller craft.

After he joined the vessel the Master had familiarised him with the bridge equipment including the automatic steering system. This automatic steering system had been new for him, which is why the Master had given him detailed instruction.

From Vierow the vessel had sailed directly after Kiel to the Kiel Canal. He had already passed through the Kiel Canal about 20 times. During his watch on the passage to Kiel the automatic steering system had been working normally. The vessel had simply reacted a little sluggishly due to the cargo on board.

The vessel had passed through the Kiel lock at 14:15 h local time on 19 December 2003. The Pilot had steered the vessel manually up to the Pilot Station Rüterbergen. The first part of the passage through the Canal had been completely without any problems. The vessel had not yawed particularly, at most by 1°, often only 0.5°.

At 17:20 h the vessel had reached the Pilot Station Rüterbergen and reduced speed to 5 kn. The previous Pilot had left the bridge and the Chief Mate had taken over the helm. This first Pilot had not waited for the relieving Pilot. When the second Pilot reached the bridge he had informed him that the vessel was running at low speed and was accordingly difficult to steer. About 5 to 10 minutes later the Pilot had ordered an increase in speed and called on the Chief Mate to switch over to automatic steering. The Pilot had taken over the watch and the adjusting of the automatic steering system. In the appraisal of the helmsman the changes to the basic settings for yawing and counter rudder had not been necessary.

This Pilot had neither tried to steer manually nor asked for a helmsman. In addition to the Master, there had been three crewmembers who would have been able to steer the vessel. One of them had even been particularly experienced in this work.

Instead the Pilot had asked about the evening meal and with his consent the Chief Mate had very quickly gone down to the cook in order to collect the meal. He had been away from the bridge for at most two minutes.

While the Pilot was eating the Chief Mate had steered the vessel by correcting the courses only on the automatic steering system too. After that the Pilot had taken over again.

The Chief Mate stressed that this Pilot had not asked him about the running properties of the vessel and that he had therefore assumed that the first Pilot had informed him of this during their meeting on deck.

The Chief Mate had tried to start a conversation by telling the Pilot that he had only been on board for two days, but the Pilot had not replied. Evidently the Pilot had not wished any conversation and the helmsman too had thereupon concentrated on what was most necessary.

Then the Chief Mate had noticed how the Pilot adjusted the basic settings of the automatic steering system. However, since it had already been dark he had not been able to see what the Pilot changed. Although the operating face was illuminated, the lighting was so weak due to dimming, that he had only been able to see that the Pilot placed something on the left side of the unit. The Chief Mate had not made any comment on this since he had assumed that the Pilot was familiar with the unit.

When a vessel sailing in the opposite direction had passed very close in his opinion, he had felt ill at ease. Suddenly, as they were approaching the second vessel coming towards them, which then turned out to be BBC SWEDEN, the BOUNDER's rudder had gone hard to port and the alarm had sounded. A small red lamp on the left at the bottom on the display of the automatic steering system marked "steering fail" had lit up. This alarm reportedly occurred when the set value of the rudder limit was reached. When the BOUNDER now suddenly changed its course by 20° to port he had immediately switched over to manual operation and moved the engine lever to stop in order to reduced the collision. However the Pilot had placed his hand over that of the Chief Mate and moved the lever back to "Full ahead" in order to achieve the full rudder effect. The Chief Mate had seen how the Pilot - in his opinion already in panic - had turned the manual rudder first to port and then to starboard. Apparently he had first confused the sides. It had no longer been possible to prevent the collision due to the short distance of less than one ship's length.

Immediately after the collision the Master had appeared on the bridge and had taken over the rudder manually from the Pilot.

The next vessel approaching them had then been passed without any problem.

A little later the Master had found out that the setting for "counter rudder" on the automatic steering system had been changed from its original setting of "1" to "4.2". He had asked the Pilot and the Pilot had admitted that he had made these changes. Furthermore the Pilot had said that he was aware of the serious difficulties that he would now have with the Canal Authorities due to inadmissible use and adjustment of the automatic steering system.

After the collision the Pilot had talked to the Vessel Traffic Services (VTS). However since this communication had been conducted in German he had not been able to understand anything.

4.4 Statement by the Pilot of MV BOUNDER

The Pilot on the bridge of MV BOUNDER at the time of the collision stated that he had taken over the vessel at about 17:20 h on 19 December 2003 in Rüsterbergen. Only the Polish helmsman had been on the bridge, who was steering the vessel by hand.

The Pilot stressed that he knew this type of vessel well as a result of many pilot operations and that these vessels could normally be steered well. He stated that both

steering engines had been switched on. He had observed that the vessel had been yawing unusually. He had complained of this. The helmsman had answered "I am only two days on board. I do not have a lot of experience."

The Pilot had thereupon asked for another helmsman but none had been available. The Pilot had then declined to steer the vessel himself by hand which was why there had been a switchover to the automatic steering system.

Initially the helmsman had checked the automatic steering system. However, since the vessel had still been yawing too strongly the Pilot had the automatic steering system explained to him. The system had still been set for sea operation. According to the statement by the Pilot he and the helmsman had readjusted the system jointly. "Yaw" had been set lower and "Counter " higher. Thereupon the vessel had steered soundly with minor course and rudder deflections.

After passing the Breiholz siding the vessel had proceeded along the straight stretch of the Canal up to Oldenbüttel with a true course of 250° just to the right of the middle of the Canal. The Pilot had known that they would encounter a convoy of three vessels on this stretch. These were MV ASSI SCAN LINK (traffic group 5), MV BBC SWEDEN and ALTELAND (both traffic group 3). MV ASSI SCAN LINK had been passed without any problem. About five minutes later the vessel approached MV BBC SWEDEN. Up to this time MV BOUNDER had steered the course properly. When the distance to BBC SWEDEN had been reduced to about one ship's length the Pilot had noticed that his vessel had unexpectedly turned to port. At the same time he had noticed that the warning lamp "Steering Fail" had lit up and the rudder angle indicator (with a 5° division) had shown a rudder angle between 10° and 15° port.

The Pilot had called for the helmsman who had been sitting directly behind him. At the same time he had switched over to manual rudder and put the helm "hard to starboard". The helmsman had moved the engine lever to "full astern" without any recommendation from the Pilot. The Pilot had immediately demanded "full ahead" in order to increase the rudder effect and achieve the necessary starboard turn. It had been possible to stop the port turn of MV BOUNDER, but it had no longer been possible to prevent the collision between the port forecastle of his own vessel and the port midship area of BBC SWEDEN.

The Pilot had thereupon continued to steer manually himself. He had placed the vessel lengthways in the Canal again, and MV ALTELAND had been passed "green to green" as agreed.

According to the statement by the Pilot the collision had occurred at about 18:13 h at Canal kilometre 43. The Traffic Steering Service had been informed. Both vessels had sustained damage in the above water area, but this had not impaired the floating and manoeuvring capabilities of the two vessels. Both vessels had thereupon been allowed to proceed further.

The Master of MV BOUNDER had appeared on the bridge immediately after the collision. He had then steered the vessel manually up to Brunsbüttel. The Pilot had

observed that the Master had switched on the second steering engine again after a short time.

The Master had evidently asked his helmsman about the details, but in Polish which the Pilot did not understand. Afterwards the Master had explained to the Pilot that the automatic steering system had only been installed a few weeks before and that he was not satisfied with its performance. The Pilot had not been supplied with any information about the causes of the failure.

5 Summary of the damage

Both vessels sustained considerable property damage above the waterline so that it was necessary for them to visit a yard. There were no personal injuries and no environmental pollution. MV BOUNDER sustained heavy destruction of the bulwark on the port bow. MV BBC SWEDEN was set in over a wide area on the sidewall on the port side. As a result container supports were destroyed and one ballast water tank developed a leak.



Figure 5: Photo of damage MV BBC SWEDEN



Figure 6: Photo of damage 1 MV BOUNDER



Figure 7: Photo of damage 2 MV BOUNDER

6 Analysis

The result of the investigations by the BSU was that it was not possible to prove the initial event for the sudden port rudder position leading to the collision. The following information was received in response to an enquiry made of the manufacturer of the automatic steering system:

"With the additional information, that the alarm "Steering Fail" occurred at the same time as the sudden turn to port, the following possible course of events is assumed:

- The automatic steering system is connected to the steering gear via relays
- As a result of progressive wear, accumulating soil, rusting, these relays can jam
- In the case under review here the relay responsible for port rudder positions was probably affected
- If the relay is jammed here, for instance in a course correction, the system recognises a port course deviation and tries to counteract this with a starboard rudder position
- However, as a result of the jammed relay the automatic steering command for the starboard rudder position cannot be executed, the system identifies "Steering Fail" and triggers the corresponding alarm
- It is certainly possible that after jamming like this the relevant relay subsequently functions without irregularities, since the soil can have been dislodged again by the jamming."

Consequently a technical defect in the automatic steering system is conceivable, but can no longer be proved.

6.1 Hypotheses regarding the cause of the casualty

At the time of the casualty an automatic steering system of type NT990G AUTOPILOT from Messrs. NAVITRON SYSTEMS LTD was installed on board MV BOUNDER. This device has the following setting controls that are relevant in this case:

COUNTER: stands for **counter-rudder** and can be set infinitely variably from 1 to 5. This value ensures an appropriate counter-rudder position in good time. Mainly conceived for major course changes, this setting also works for sudden and swift course deviations, unexpected for the device, which do not cover the YAW function.

RUDDER LIMIT: means **limit of the rudder position** and can be set in steps of 5 degrees between 5° and 45°. This setting determines the maximum rudder angle and for manual course changes with the automatic steering system switched on it also determines automatic course corrections in the event of yawing. This value is ignored by the COUNTER function, however.

YAW: determines the **sensitivity** or **lag/delay** in the reaction of the automatic steering system to a course deviation. This value can be regulated infinitely variably between 1 and 5. The value 1 stands for maximum sensitivity, or fastest reaction time of the device to a course deviation of +/-0.5°. The value 5 means that the automatic steering system only reacts at a course deviation of +/-10°.

RUDDER: stands for the **rudder angle** used for course correction (manual and automatic) depending on the course deviation. This value too can be set infinitely variably from 1 to 5. In the manufacturer's presetting the minimum value 1 means that the rudder is moved 0.5° per 1° course deviation and at the maximum value 5 it is moved 1.5° per 1° course deviation.

The manufacturer suggests the following values as basic settings:

COUNTER:	1
RUDDER LIMIT:	25°
YAW:	1
RUDDER:	3

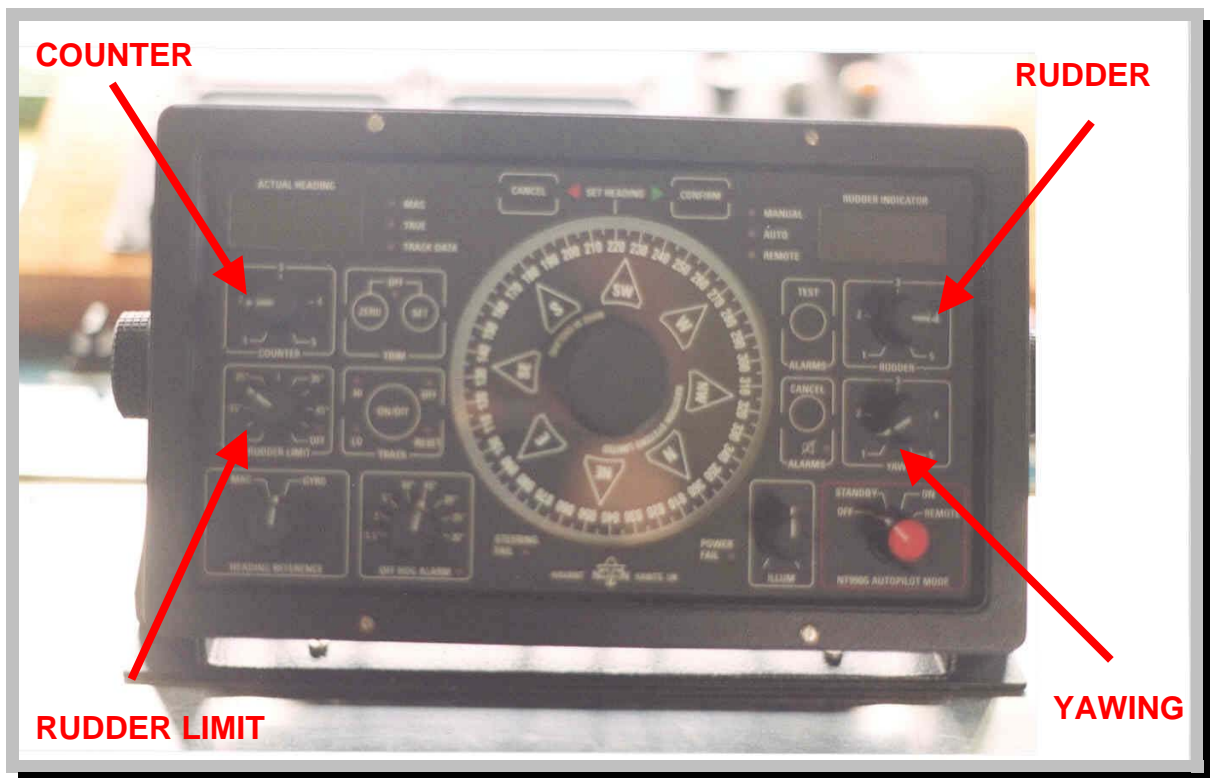


Figure 8: Automatic steering system MV BOUNDER

According to the statement by the pilot the vessel was not sailing properly straight ahead at the start of his pilot activity.² The BSU considers that a possible cause of this was formed by the small course corrections made by the pilot that are necessary on passing through the Kiel Canal. On the grounds of the photos taken of the automatic steering system after the casualty it appears that the value for RUDDER was set too high.

Since this value was not mentioned by witnesses in any of the statements, the BSU assumes that this setting was not altered. It can be seen clearly that the control is set at **4**. This means that the automatic steering system performed each small manual course change with a relatively large rudder angle. At the same time the statements by the witnesses indicate that the YAW value was reduced, in other words it was originally higher than **1**. Thus the automatic steering system initially reacted with a slight delay; not during the new course set, but probably during the following automatic course adjustment. To summarise, this means that on each small course change by the pilot the automatic steering system tried to reach the course required with a clear time lag, but with a large rudder angle.

However, COUNTER was set so low that it did not have any notable influence and so the vessel repeatedly shot over the required course and then steered back again. This resulted in a behaviour pattern that the pilot tried to stop by reducing the YAW control and turning up the COUNTER. By setting the control at YAW **1** the pilot achieved a situation in which the automatic steering system reacted immediately to each course deviation, although still with large rudder angles due to the fact that the RUDDER value was still high. The new setting of COUNTER did not have any notable effects since the course deviations were slight.

However, when the first oncoming vessel was passed with a relatively small space between the two vessels it is conceivable that as a result of the bow wave of MV BOUNDER meeting the stern wave of the oncoming vessel, the bow of MV BOUNDER was pressed away to starboard. This unexpectedly strong change in course activated the COUNTER function that was set high and thus triggered an incommensurately strong rudder angle to port, going beyond the rudder angle limit, which led to the collision with BBC SWEDEN. However, this hypothesis does not apply if one takes the distance of ASSI SCAN LINK to BBC SWEDEN of 2000 to 2500 m into account. This distance appears credible since it was not only stated by the pilot, but also recorded indirectly by Vessel Traffic Services (VTS) NOK I Brunsbüttel.

The pilot on MV BOUNDER further stated that ASSI SCAN LINK had been passed without any problem and that the vessel had continued to sail straight ahead. As is usual for encounters on the Kiel Canal, both vessels sail clearly towards each other and then turn off to their respective starboard side shortly before the encounter. The BSU now assumes that the pilot wanted to take evasive action one to two degrees to starboard and set this on the automatic steering system. It is conceivable that as a result of the bow waves meeting each other, the intended slight change of course to starboard was suddenly reinforced and now the automatic steering system reacted as already described above. However, this is contradicted by the fact that nothing like this happened on the preceding encounter - unless the evasive action before ASSI

² The analysis relates only to the period after the Canal speed of 15km/h was reached.

SCAN LINK was taken so early that the distance between the vessels did not have any hydrodynamic influence.

Since the manufacturer of the automatic steering system could not find any explanation either and as the vessel continued its voyage with this system without any technical intervention and without any problem after leaving the Kiel Canal, the actual cause of the collision cannot be ascertained.

6.2 Other infringements against existing regulations

In addition infringements against existing regulations (helmsman; lookout) occurred on board MV BOUNDER, which at least promoted the collision.

Within the framework of the investigation it was ascertained that the relevant bridge manning regulations were not observed on board MV BOUNDER. In addition to the Chief Mate and the Pilot, there should have been a helmsman and a lookout on the bridge. Both pilots of MV BOUNDER should have notified the Master of this omission on the part of the vessel's command before starting their pilot activity (§ 8 of the Regulation on Sea Pilot Districts and their Boundaries (General Pilot Regulations - ALV): implementation of pilot activity:

*"(2) The sea pilot can decline to perform pilot activities due to unreasonable conditions if the vessel or its equipment show major defects **or the manning is not sufficient...**".*

For the rest it should be noted here that the transfer of pilot activities on deck or even in passing each other appears to give rise for concern.

Furthermore, the vessel was sailing with the automatic steering system contrary to regulations, since on the basis of its features MV BOUNDER was classified in Traffic Group 3. It is stated in the publications of the Regional Directorate for Waterways and Shipping Nord on the German Collision Regulations under § 42 Para. 4 SeeSchStrO concerning the use of automatic steering or cable remote systems on the Kiel Canal:

*"24.1 Automatic steering systems may only be used by vessels...
of Traffic Groups 1 and 2 under the conditions set out in
No. 24.2.*

*24.2 The use of automatic steering systems is only permitted when ...
visibility is at least 2 nautical miles and the vessel switches over to manual
operation in good time before an encounter or overtaking manoeuvre."*

6.3 Summary of the analysis

When the second pilot appeared on MV BOUNDER there was no other crew member on the bridge apart from the Mate, in particular no helmsman, so that the bridge was not manned in accordance with the regulations³. Thus the under-manning of the bridge was the basic cause of the further happenings.

At the instruction of the pilot the voyage was thereupon continued with the automatic steering switched on. It was not possible to determine conclusively whether this decision by the pilot was taken following an enquiry about calling in a helmsman or without such an enquiry. It is not admissible for vessels of traffic group 3 to use automatic steering systems in the Kiel Canal⁴. Proceeding with the automatic steering system was a contributory cause of the subsequent collision.

During the further voyage the settings on the automatic steering system were altered. It was not possible to determine conclusively whether these alterations were carried out exclusively by the pilot, or jointly with the Mate. After passing the first vessel in the oncoming convoy without any problem and shortly before the encounter with the following vessel, the automatic steering system of MV BOUNDER suddenly put the helm far to port for no detectable reason. The changes carried out in the settings are considered to have promoted the subsequent collision. A technical failure at this precise point in time cannot be ruled out completely, but is highly improbable on the basis of all the findings on hand.

The presence of a pilot does not relieve the vessel's command from its responsibility regarding the safety of the vessel, and the vessel's command and the pilot are called upon to cooperate closely with each other. The cooperation between the Mate and the pilot, especially as regards the use of the automatic steering system, is considered as unsatisfactory and thus as a factor promoting the subsequent collision⁵.

³ STCW A-VIII/2, Part 3-1

⁴ §42 (4) SeeSchStrO in conjunction with. Section. 24.1 Publication WSD-N omn SeeSchStrO

⁵ STCW A-VIII/2, Section. 49 + 50

7 Safety recommendations

- The Masters of sea vessels are instructed that in accordance with the general principles for watch duty (STCW-Code Part A) they are obliged to make sufficient arrangements for safe watch duty and, in accordance with the regulations, to ensure the assignment of a helmsman (and a look-out if appropriate).
- The watch officers on duty are instructed that even in the presence of a Pilot, as representative of the Master they are responsible for safe command of the vessel and accordingly all specified navigational aids must be set optimally in order to ensure that the intended course is maintained.
- The Pilots are instructed that they must work closely with the Master and / or the Officer on watch and accordingly must notify them of planned measures concerning the manoeuvrability and the properties of the vessel. Furthermore, close cooperation also includes, as far as necessary, notifying the vessel's command of specific instructions and regulations in the sea pilot's waters (according to § 11 ALV).
- The Pilots are called upon to observe bridge manning in accordance with regulations and if appropriate to inform the Vessel Traffic Services (VTS) of deviations in order to give the Vessel Traffic Services the possibility of preventing the vessel from continuing its voyage.
- The Pilot associations are requested to ensure that active pilots are provided with training and upgrading. Special attention should be paid to complex understanding – not necessarily to concrete operation - of modern ship running systems (such as e.g. automatic steering systems).

8 Sources

The Investigation Report refers to the investigations of the Federal Bureau of Maritime Casualty Investigation, of the River Police Brunsbüttel, the Local Office for Waterways and Shipping (WSA) Brunsbüttel, and to

- Written statements by the Masters and the Pilot
- Photos of the vessels MV BOUNDER and MV BBC SWEDEN – Foto Hasenpusch
- Chart of the Kiel Canal – issued by Regional Directorate for Waterways and Shipping (WSD) Nord – Kartenstelle – 1995