



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

**Investigation Report 607/07**

**Serious marine casualty**

**Personal accident on the tug**  
**BUGSIER 11**  
**on 17 December 2007**  
**in Brunsbüttel**

**1 December 2008**

The investigation was conducted in conformity with the law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law - SUG) of 16 June 2002.

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

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

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

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## 1 Summary of the marine casualty

At around 13:50<sup>1</sup> on 17 December 2007, the bulk carrier SENANUR CEBI, sailing under the Turkish flag, moored at the Elbe port in Brunsbüttel. The berthing manoeuvre was supported by the tugs BUGSIER 11 and BUGSIER 12. BUGSIER 11 acted as stern tug. The SENANUR CEBI berthed with the starboard side. At the time of the accident there was an ebb tide running at approx. 1.5 to 2 kn.

While the towing connection to BUGSIER 11 was singled up, a large section of the messenger line which was secured to the towing cable fell into the water. This line was picked up by and wound around the SENANUR CEBI controllable pitch propeller which was running at zero pitch. Subsequently the entire towing cable was torn off the tug. A member of the tug's crew was severely injured on his left leg by the tripping line running out last.

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<sup>1</sup> All times are local time = UTC + 1 h

## 2 Scene of the accident

Type of event: Serious marine casualty, personal accident on board the tug BUGSIER 11  
Date/time: 17 December 2007/13:55  
Location: Brunsbüttel, Brunsbüttel Elbe Pier  
Latitude/longitude:  $\varphi$  53°53.25'N  $\lambda$  009°10.9'E

Section from chart 46, Bundesamt für Seeschifffahrt und Hydrographie (BSH)<sup>2</sup>

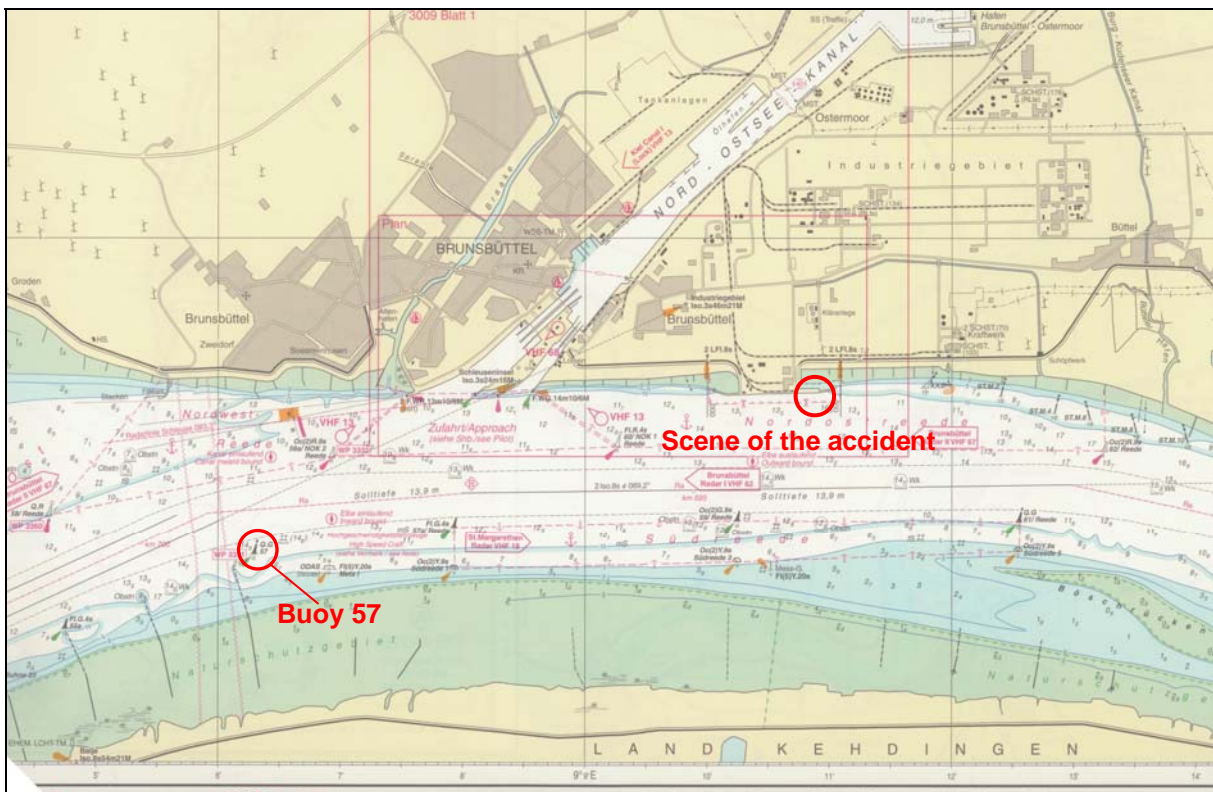


Figure 1: Chart

<sup>2</sup> BSH - Federal Maritime and Hydrographic Agency

### 3 Vessel particulars

#### 3.1 SENANUR CEBI

##### 3.1.1 Photo



Figure 2: Photo of the vessel SENANUR CEBI

##### 3.1.2 Vessel particulars

|                              |   |
|------------------------------|---|
| Name of the vessel:          | SENANUR CEBI                              |
| Type of vessel:              | Bulk carrier/container ship               |
| Nationality/flag:            | Republic of Turkey                        |
| Port of registry:            | Istanbul                                  |
| IMO number:                  | 9180956                                   |
| Call sign:                   | TCYB                                      |
| Owner/operator:              | Cebi Denizcilik Ve Ticaret Anonim Sirketi |
| Year built:                  | 1999                                      |
| Shipyard:                    | Selah Shipbuilding Industry Inc./Turkey   |
| Classification society:      | Nippon Kaiji Kyokai                       |
| Length overall:              | 149.50 m                                  |
| Breadth overall:             | 22.60 m                                   |
| Gross tonnage:               | 12.388                                    |
| Deadweight:                  | 16,211 t                                  |
| Draught at time of accident: | fore = 8.82 m, aft = 9.53 m               |
| Engine rating:               | 4900 kW                                   |
| Main engine:                 | MAN B&W 7S35SC                            |
| Drive:                       | 1 x controllable pitch propeller          |
| (Service) Speed:             | 14.5 kn                                   |
| Hull material:               | Steel                                     |
| Number of crew:              | 19  |

## 3.2 BUGSIER 11

### 3.2.1 Photo



Figure 3: Photo of the BUGSIER 11

### 3.2.2 Vessel particulars

|                              |  |
|------------------------------|--|
| Name of the vessel:          | BUGSIER 11   |
| Type of vessel:              | Towing boat <sup>3</sup>                                       |
| Nationality/flag:            | Germany  |
| Port of registry:            | Hamburg  |
| IMO number:                  | 7700192  |
| Call sign:                   | DB8003   |
| Vessel operator:             | Bugsier-, Reederei- und Bergungs-<br>Gesellschaft mbH & Co. KG |
| Year built:                  | 1977   |
| Shipyard/yard number:        | Shipyard Max Siegholt /177                                     |
| Ship's certificate:          | Inspection Body for Inland Waterway Vessels                    |
| Length overall:              | 26.67 m  |
| Breadth overall:             | 8.84 m   |
| Gross tonnage:               | 181  |
| Deadweight:                  | 108 t  |
| Draught at time of accident: | fore = 5.1 m, aft= 4.8 m                                       |
| Engine rating:               | 1280 kW (2 x 640 kW)   |
| Main engine:                 | Klöckner-Humboldt-Deutz AG, SBA6M528                           |
| Drive:                       | 2 x Schottel propeller in Kort nozzle                          |
| Hull material:               | Steel  |
| Number of crew:              | 3  |

<sup>3</sup> Term acc. to the ship's certificate (Schiffsattest). At the time of the accident, the tug boat was registered as an inland waterway vessel.



## 4 Course of the accident

### 4.1 Course of the voyage of SENANUR CEBI

The SENANUR CEBI had loaded copper concentrate in Vitória/Brazil. Entry into the Elbe River began on 17 December 2007 at 07:37 when weighed anchor at Aussenelbe-Reede. At 08:30 the pilot for the Elbe was on board. Around 13:00, the ship was abeam from the Brunsbüttel locks. A short time later, the vessel began to approach the berth on the east side of the pier of Brunsbüttel Elbe Port.

### 4.2 Course of the voyage of BUGSIER 11

After one hour work assignment, the crew of three of the tug settled down for the night around 00:30 on 17 December 2007. Work began again at 08:00. At 08:25, the Ship Reporting Service informed that the SENANUR CEBI had passed the Elbe 1 buoy and that she was heading for the Elbe port and the vessel's command was requesting two tugs.

BUGSIER 11 is acting as a so-called "dispatching tug boat" in the Brunsbüttel region. All tug orders are directed to this vessel and from there they are allocated to the tugs of both tug boat companies active in Brunsbüttel, depending on need and availability.

The tug order for the SENANUR CEBI was to be carried out by tugs BUGSIER 12 and BUGSIER 11.

Between 10:15 and 10:30, both tugs sailed through the Alte Südschleuse (Old Southern Locks) in the Alter Vorhafen (Old Outer Harbour) in Brunsbüttel and moored there afterwards.

After receiving further information about the position of the SENANUR CEBI, both tugs left the berth around 12:30 to be nearby Buoy 57 around 12:45. This is the usual area for contact with vessels heading for the Elbe port.

The BUGSIER 11 acted as a stern tug and mad fast by around 12:50. The crew at that point was made up of tug master, the machinist<sup>4</sup> and a seaman.

### 4.3 Course of the event

The SENANUR CEBI was to moor with the starboard side as from here the three shipboard cranes located at the port side would not obstruct unloading. At the time of berthing, there was an ebb tide running at approx. 1.5 - 2 kn. This means that the current was set from east to west and acting on the stern of the SENANUR CEBI. At 13:42, according to the tide table, it was low tide in Brunsbüttel but the current runs after for a longer period of time. On the day of the accident this happened until 14:40 with decreasing force.

According to the recording of the Vessel Traffic Service (VTS) Brunsbüttel, during the entire towing and berthing process there was a 3 Bft wind from a 087° direction, turning back to 066°.

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<sup>4</sup> Precise term according to certification of the crew by the Zentralstelle Schiffsuntersuchungskommission/Schiffseichamt (ZSUK) [Inspection Body for Inland Waterway Vessels]: Seaman-motorman

The turning manoeuvre and berthing at the wharf had been carried out without difficulty or abnormality. Communication between the vessel's command and tug boats had been established in German language on VHF channel 06. Once the SENANUR CEBI had been brought into a berthing position with the assistance of both tugs, she had been held there initially using her own engine power and the stern tug. At the same time, the crew of the SENANUR CEBI had brought out the mooring lines. The pitch of the variable pitch propeller had been laid to zero at 13:46. The bow tug BUGSIER 12 had cast off the tow at 13:50 on request of the pilot and had been used to push against port side between shipboard cranes 1 and 2. Due to a bend in the shape of the wharf at the intended berth, approx. 20 m of the aftship of the SENANUR CEBI had been lying non-parallel to the wharf.

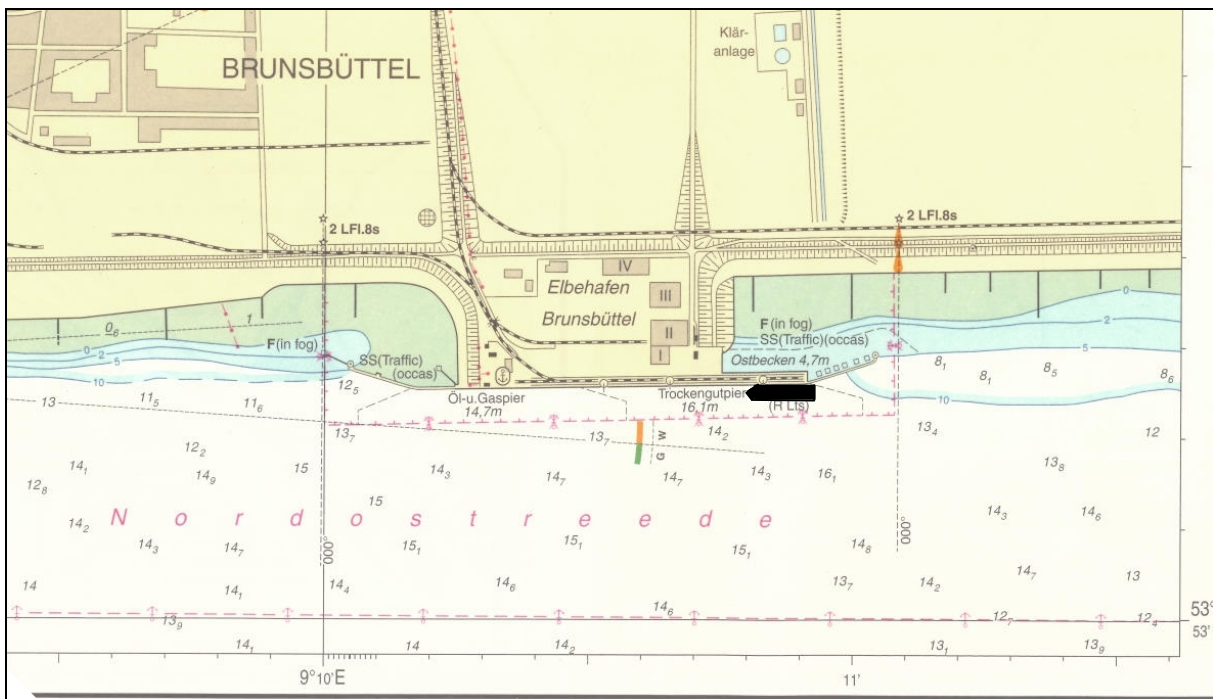


Figure 4: Wharf and berth of the vessel, section from chart 46, Plan B of the BSH

The four<sup>4</sup> crew members had worked at the stern paying out two stern lines first. While the first line had been heaved tight, the line coming from port side had been sagged to the water surface and had been floating under the stern of the SENANUR CEBI. This fact, combined with the notice not to run the ship's main engine, had been communicated by the tug master to the pilot. This message had been confirmed by an affirmative comment not to start up the main engine<sup>5</sup>.

The tug master had known nothing about the type of propeller. There had been no visible propeller wash from the SENANUR CEBI.

The tug master had informed the pilot once both stern lines had been set up. At the same time he had asked if he could cast off to give some support pushing the vessel. The pilot was said to have confirmed at about 13:55 that the stern towing connection could be cast off.

Thereupon, the tug master had called his crew on deck using a bell signal. The seaman and machinist had taken up their usual working positions on the aftdeck. The

<sup>4</sup> See also point 5.3

<sup>5</sup> The statement of the pilot deviating from this statement, see point 5.4 Communication

tug then had been approached closer to the SENANUR CEBI. This had made the towing cable sag, giving the machinist and seaman the opportunity of placing the towing cable into the hawsehole. Subsequently, the tug had been manoeuvred towards the middle of the river to achieve an angle of approx. 30° to the middle line of the seagoing vessel, and thus to maintain a certain distance from the stern lines and to avoid basically any potentially direct interaction with the propeller wash from the ship.

In the meantime, both men on deck had released the towing cable from the stretcher<sup>5</sup>. Therefore the machinist had placed the tripping line with three turns onto the capstan. After tightly heaving the tripping line and thus slackening the connection between stretcher and towing cable, the towing cable had been unshackled from the stretcher. The towing cable had then been heaved in using the capstan. The machinist had operated the capstan using a foot switch. He had stood facing the capstan, i.e. with his back to the stern of the tug, and steadily removed cable from the capstan. The tripping line, which was fed through at first, had been placed by the machinist under the towing cable. The seaman had then taken over the following towing cable and placed it in a circle on the starboard side of the working deck of the tug. In order to avoid obstructions, the seaman had first pushed the towing hook, with stretcher placed in the hook, right over to the starboard side.

On the SENANUR CEBI the towing cable had been guided through the stern end middle hawse. The eye of the towing cable had laid around one side of a double bollard during the towing. In order to cased off the towing connection, the manoeuvring crew at the aft station had placed the messenger line onto the warping head of the port side winch and heaved it in tight. This had made it possible to lift the eye of the towing cable off the bollard. Then the messenger line had slowly been slackened to make it possible for the tug to slowly take in the towing cable. The entire manoeuvre had been monitored by the officer of the aft manoeuvring station.

According to the vessel's command on the SENANUR CEBI, the towing cable had been cast off by hand by two crew members.

At the same time as taking-in the towing cable, the tug had been manoeuvred closer to the SENANUR CEBI. While this was happening, the tug master had made sure that the towing cable always maintained a certain amount of sag. The tug master had stood as usual facing the stern of the tug. The stern of his vessel had been visible to him directly and via a video monitor.

However, direct visibility was obscured by two funnels and the aft mast.

The tug crew was said to have had the impression up to this point in time, that the towing gear had been passed back in a controlled manner by the crew of the aft manoeuvring station of the SENANUR CEBI.

Once the tug was said to have been at a distance of 8 to 10 m from the stern of the seagoing vessel, the tug master was said to be able to have had a look to the central hawse (Figure 10) for a moment by making a side-step to starboard. At this point, the messenger line had been hanging vertically at the stern of SENANUR CEBI and had

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<sup>5</sup> Further explanations in para. 5.1 and figures 5 to 8

not been floating at the water surface. The seaman had been busy making the second bight of the towing cable.

After having returned to the operating levers the tug master was said to have noticed a jerk in the tug. He firstly was said to have thought about grounding or bumping.

In fact, the towing cable had run out and had severely injured the machinist thereby.

The tug master saw the machinist lying on the deck at the bulwark starboard aft end. The seaman was at his side. The towing cable was not on deck any more.

#### **4.4 First measures**

The BUGSIER 11 had been manoeuvred away from the vessel by the tug master. At the same time, the tug master had informed the Vessel Traffic Service and the Elbe port about the incident using the corresponding VHF channels, and had requested help. Then he had hurried on deck to find out what the condition of the injured person was.

The machinist had suffered a severe injury to the left leg and was unconscious. The vessel master and seaman applied first aid measures. Later the vessel master took over one of the watermen which helped to care for the injured person on board. The tug was moved under a port crane which was used to lift the injured up on a barrow on shore. This is when an emergency doctor took over care of the injured person. After being stabilised, a rescue helicopter took the machinist to a hospital.

On the way to the berth, the seaman reported to the tug master that he had also sustained injuries to his knees. The towing cable had hit him there when it ran out. The injuries were later treated at a hospital. The injuries did not result in any long period off work.

As BUGSIER 11 passed the Brunsbüttel lock, the waterway police came on board and began their investigations.

In order to clarify the cause of the accident, an initial dive by police divers was commissioned by the Itzehoe public prosecutors on 18 December 2007. This established that the cable was wound around the hawser protection and propeller on the SENANUR CEBI. No damage was evident on the BUGSIER 11.

#### **4.5 Consequences of the accident**

The machinist of BUGSIER 11 suffered, among other things, a severe injury to his left leg.

The only damage on BUGSIER 11 caused by the accident was to the storage crate located behind the towing hook. The cable had destroyed several wooden boards as it ran out (Figures 6 and 7).

Apart from some minor damage to the propeller blades, there was no further damage identified on the SENANUR CEBI.

## 5 Investigation

SENANUR CEBI and BUGSIER 11 were inspected by a team from the BSU a day after the accident. The BSU also accompanied the salvage of the towing cable by a diving company on the following day.

### 5.1 BUGSIER 11

The BUGSIER 11 is tug boat with hook, that is a tug boat that does not have a variable length towing cable on a towing winch, but uses a towing cable with a preset length on a towing hook.

Handling of the towing cable is supported by a capstan located on the port side. The capstan stands on a small platform and has a height of 0.94 m above the deck. The capstan only turns clockwise. It can be operated using a mobile foot switch. After being switched on, it turns a half rotation slowly, then switches automatically to a higher speed. Approx. 5 s are required for one rotation. This gives a speed of approx. 0.41 m/s.

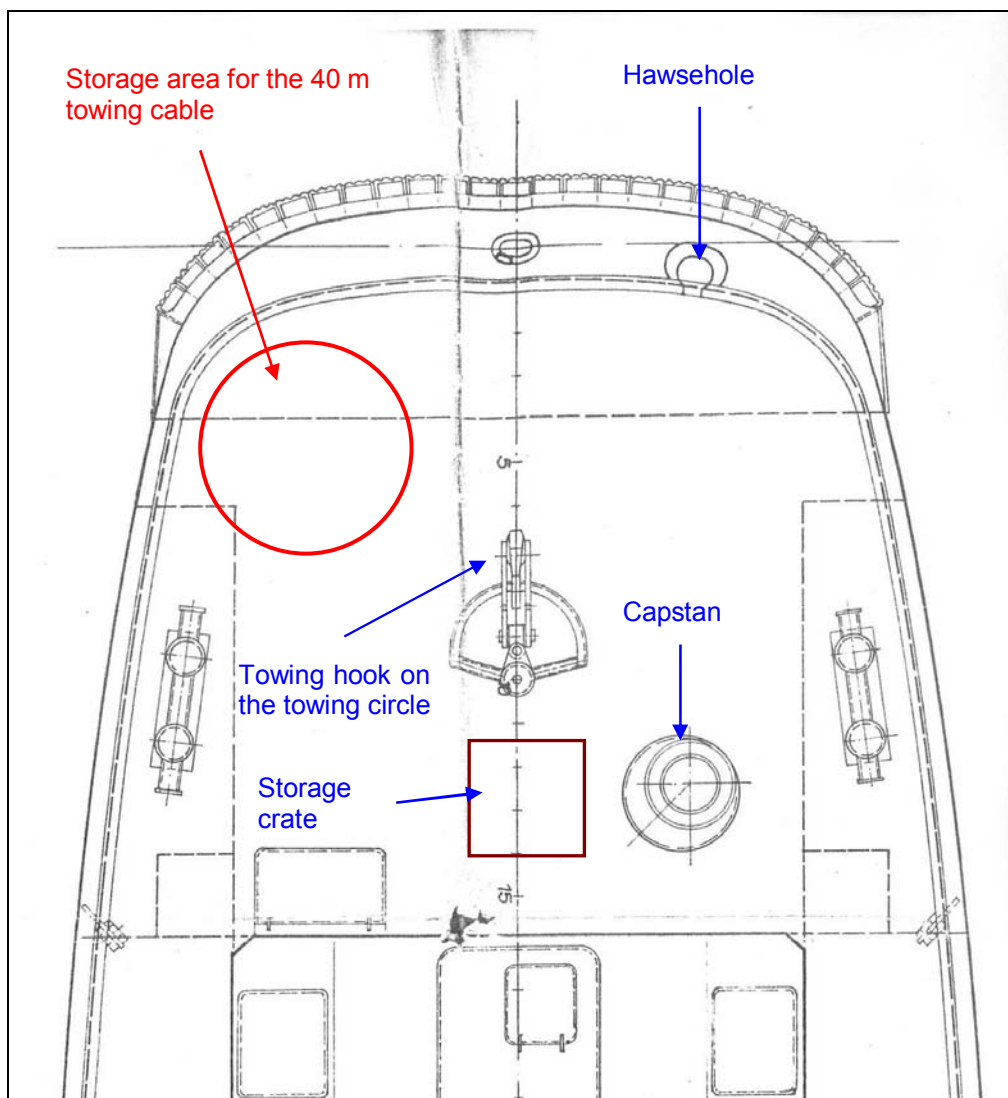


Figure 5: BUGSIER 11, plan view of stern





Figure 6: BUGSIER 11, plan view of stern

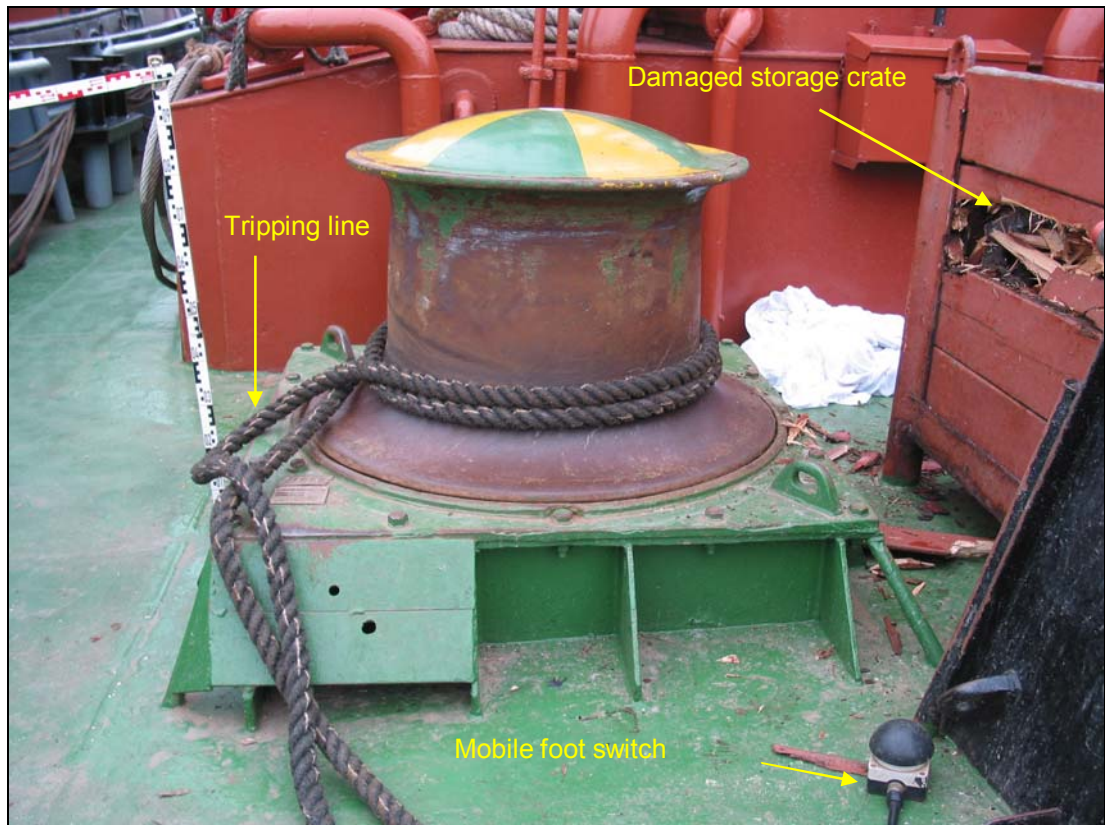


Figure 7: BUGSIER 11, capstan

Ref.: 607/07

On the BUGSIER 11 there was a towing cable 30 m long and a cable 40 m long available. The choice is generally made by the tug master depending on the size of the vessel being towed. The longer cable was used for working with the SENANUR CEBI.

The cable had the following technical specifications: "Steel rope 6 x 36 SES<sup>6</sup> zn Ø 32 mm, 1960 N<sup>7</sup>, 40 m<sup>8</sup>, 1 eye 2.2 m spliced, 1 thimble".

The towing cable had two different ends. One end had a spliced eye. This part was designed to be belayed on the vessel. The other end also had a small eye. A pressed-on sleeve was used as a connection on that part. The eye was protected by a thimble. For towing work, this eye was shackled to the so-called stretcher. The stretcher itself always lay fixed on the towing hook. Its job was to reduce the strain of the towing cable. The stretcher was made of Ti-Flex-HP rope, Ø 56 mm, 1.6 m long, endlessly spliced.

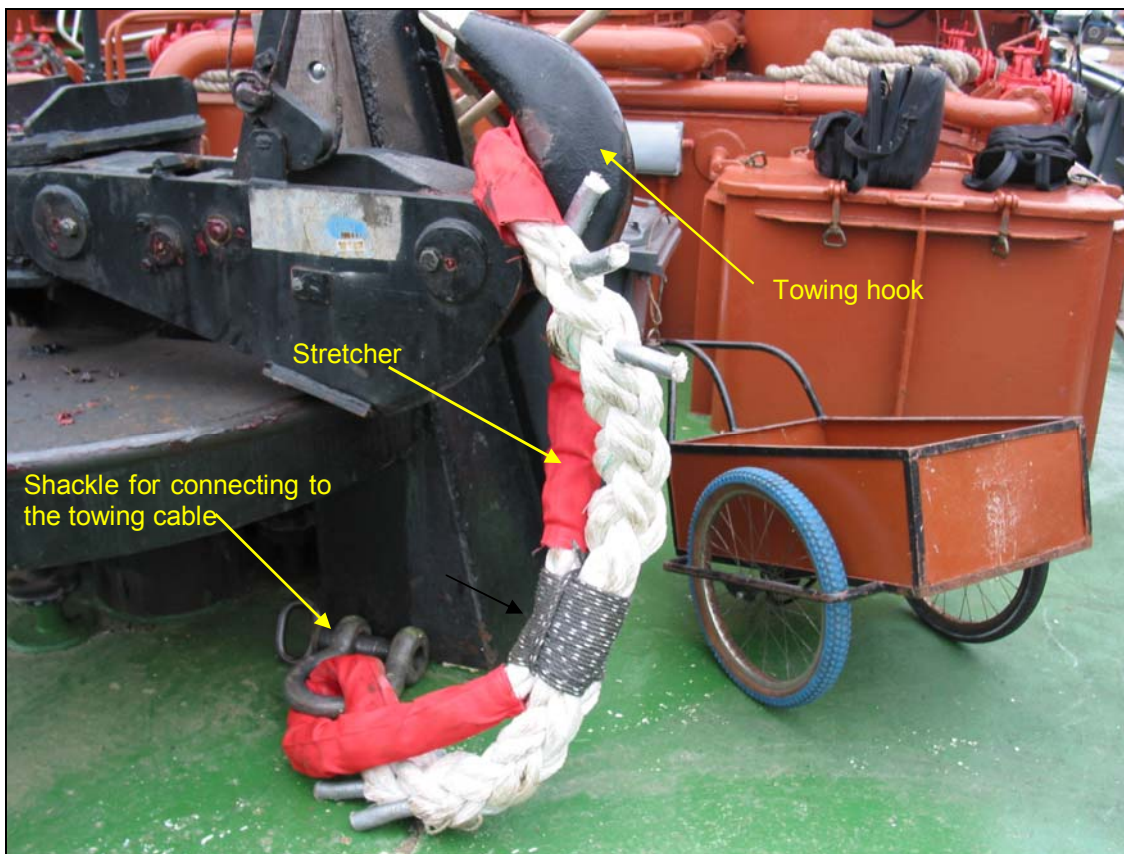


Figure 8: BUGSIER 11, stretcher on the towing hook

Lines were always attached to both ends for handling the towing cable. These lines were made of floatable, triply bound, black polypropylene material and had a diameter of approx. 35 mm.

The line on the side intended for the seagoing vessel is called messenger line or hauling line.

In this instance, it was 30 m long and secured with a special shackle to the eye of the towing cable.

<sup>6</sup> SES – Seele Einlage Stahl (core of cable made of steel)

<sup>7</sup> Strength of individual cable

<sup>8</sup> Overall length of the finished hawser

A heaving line from the vessel is bended to it and hauled back to the vessel. The messenger line is then used as a type of forerunner to the towing cable and is heaved hand over hand or using a warping head onto the deck of the ship until the spliced towing cable eye can be placed over a bollard.

The messenger line is also used when cast off the towing connection. It is used to pull enough cable towards the ship by hand, but mostly using a spill, until the eye of the cable can be lifted off the bollard again. Then the messenger line is used to slowly slacken the cable until the cable is back on the deck of the tug boat.

The line on the tug side is called the tripping line. On BUGSIER 11 this line was 10 m long and secured to the Elliot eye of the towing cable using a cable pulled through the eye and a shackle. It is only used when hauling in the towing cable. At first it is used to relief the connection between stretcher and towing cable. Thereto three turns of the tripping line are placed on the capstan of the tug and then the tripping line is hauled in tight. After this, the shackle between stretcher and cable can be released. Further operation of the capstan will then heave in the towing cable.

On the BUGSIER 11, the machinist operated the capstan using the foot switch and removed the cable from the capstan. The seaman took the cable and lay it in a circle on to the deck. To do this he stepped into the centre of the circle which had a diameter of approx. 2.90 m.

During the actual towing manoeuvre on this type of tug, the towing cable runs freely between towing hook and vessel. Only when it is time to take in the cable is it placed into the hawsehole (cf. Figure 6). This process involves having the hawsehole opened at the top end by a mechanical device. The hawse is a U-shaped opening reinforced around the edges and located in the bulwark at the port side of the stern. Laying the cable into the hawse serves as a secure guide way for the cable being heaved in, even if the tug is manoeuvring at the same time.

## **5.2 Workplace of the tug master**

During the entire tug operation the tug master was on the bridge of the BUGSIER 11. He stood in the centre of the bridge, where the operating controls were in direct range.

His direct visibility to aft was limited by the two funnels and the aft mast with the fire extinguish tower (Figure 3 and 9).

In order to improve the visibility on the aftship a camera is installed inwards the portside funnel, whose image is transmitted to the bridge by a cable on the monitor. The image displayed provides an overview on the aftship of the BUGSIER 11 (Figure 11). The monitor has a screen diagonal of 28 cm and is mounted at a distance of 160 cm to the tug master. An inspection of the work sequence on the aftship is thus only roughly possible. The camera does not provide the visibility on the aft manoeuvre station of any seagoing vessel since it can not pivot.



Photo: WSP Brunsbüttel



Figure 9: Field of vision of the tug master towards aft, limitation of the visibility by the funnels and the aft mast; above left the monitor

Photo: WSP Brunsbüttel



Figure 10: Field of vision of the tug master towards aft, if he makes one step from the control position to starboard



Photo: WSP Brunsbüttel

Figure 11: Close-up view of the monitor image of the aftship of BUGSIER 11

### 5.3 SENANUR CEBI

The aft manoeuvring station of SENANUR CEBI was manned by a nautical officer and three deckhands<sup>10</sup>.

The warping head of the port winch was used to handle the messenger line. The messenger line was guided around two bollards. The messenger line was placed on the warping head coming from below, as otherwise it would not have been possible to guide it over the double bollard in front of the winch.

The distance from central hawse to warping head with the guiding around the bollards was approx. 10 m.

The eye of the towing cable was placed over the port double bollard nearest to the central hawse.

The port side double bollard had no stopper eye facing the central hawse to which a cable or chain stopper could have been secured. Also the second double bollard used for direction change was only equipped on the outward facing side with an stopper eye. For this reason it was not possible to stop the messenger line without further ado.

The mooring lines were also unreeled from below off the winch drums.

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<sup>10</sup> According to the statement of the vessel command with two deckhands, according to the statement of officer on manoeuvring station with three deckhands

The winch drive is installed between both winch drums. This allows both drums to be independently heaved or slackened. The warping head is connected to the drum facing the outside of the ship. Rotational direction depends on the drum.

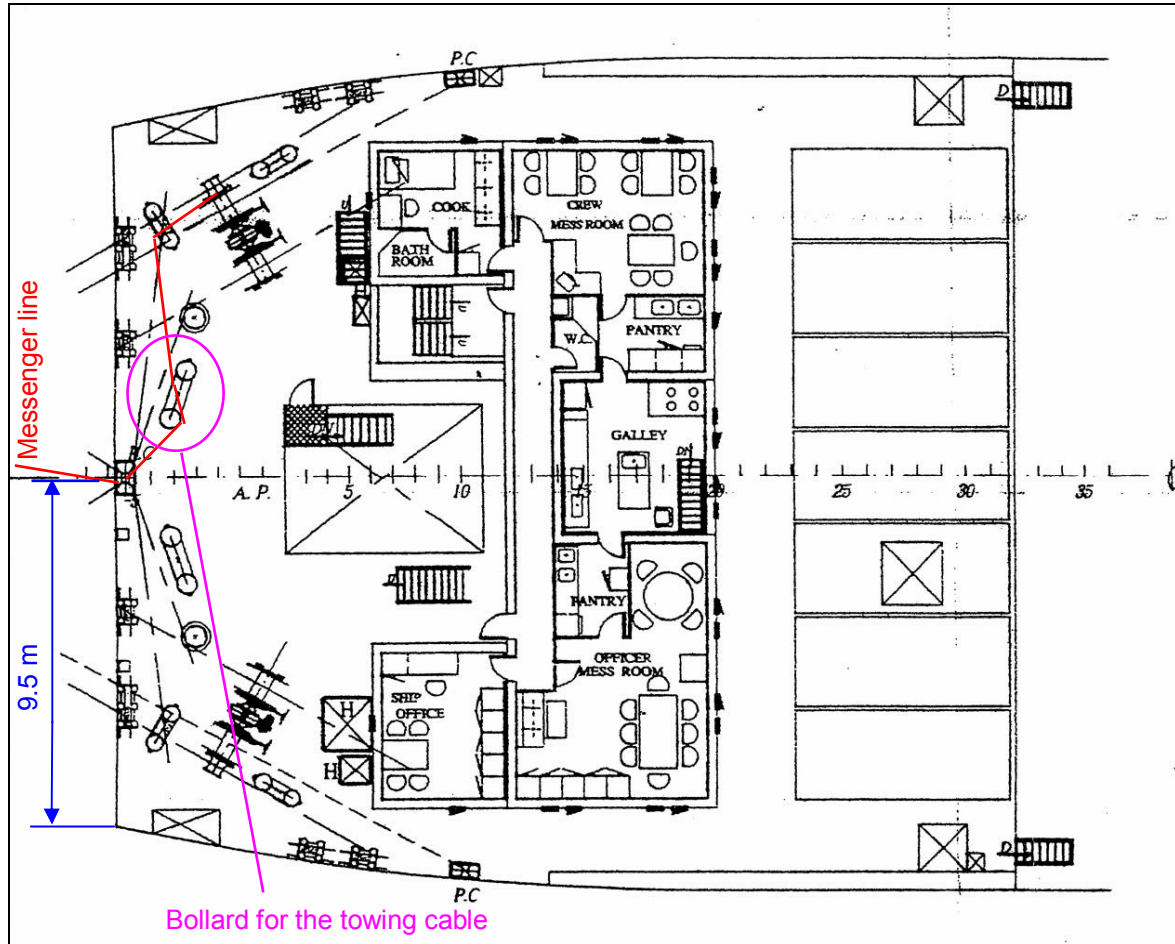


Figure 12: View of the poop deck on the SENANUR CEBI; guide way for the messenger line

## 5.4 Communication

Communication between tugs and pilots is generally carried out via VHF channel 06. In addition to basic instructions regarding setting up and releasing the towing connection, the tug master is also given instructions by the pilot as to which direction and with what force the tug should pull. This VHF channel is not recorded by the Vessel Traffic Service Brunsbüttel.

The agreements of the pilot with the watermen on shore were made on VHF channel 06 too. For this purpose the watermen gangs assigned to bow and stern were each equipped with an hand-held VHF set.

The radio communication of the tug master with the pilot<sup>11</sup> about the fact that the stern rope drifted towards the propeller was confirmed by two witnesses. This was on one hand the able bodied seaman, who allegedly was on the bridge of the tug at this time and on the other hand an external witness. The response of the pilot was not confirmed by neither of the witnesses.

<sup>11</sup> cf. p. 4.3



The pilot declared in this statement, that he didn't notice the information of the tug master, if it was provided at all. If the information had been provided he would have acknowledged receipt.

A communication is also possible and usual between the deck crew of the tug and crew members on the aft manoeuvring station of the ship. Normally this communication is effected by hand signals. Thereby they use the normal international signs for "faster", "slower", "steady" or "stop". Communication by shouting or whistling is usually only used as attention signal.

On BUGSIER 11, the seaman was responsible for communicating with the aft manoeuvring station of the seagoing vessel. This was due to his working position on the starboard side of the tug from where he could view the towing cable. However, the vessel was also behind him so he had to turn around to face the ship during his work. So it was impossible for him to monitor the towing cable permanently. According to statements from those involved, there was no direct communication between tug boat and aft manoeuvring station of the vessel. Since all manoeuvres ran as normal, neither party saw the necessity for such communication.

In principle, work was also observed by the tug master. He could intervene by means of speaker announcements. Normally communication on the tug between bridge and working deck was only carried out by using hand signals. There was no radio contact.

On the SENANUR CEBI there was a radio contact between bridge and manoeuvring station. This was used for forwarding instructions and information. The aft manoeuvring station was not visible from the bridge of the ship; the view of the stern tug was limited.

The nautical officer was responsible for supervising work, for exchanging information with the vessel's command and for direct communication with the deck crew of the tug boat.

## **5.5 Taking in tow and towing operation**

To take in tow, BUGSIER 11 manoeuvred at the SENANUR CEBI with the stern. Towing cable and stretcher were already shackled together. The heaving line coming from the vessel was fastened to the messenger line. The crew members of the SENANUR CEBI heaved the messenger line on deck using the heaving line and then used the port winch with messenger line to heave the towing cable onto their ship. The manoeuvre was carried out in the routine manner without problems.

After taking in tow, the machinist and seaman left the deck area of the tug for safety reasons and only returned after the bell signal of the tug master.

Turning and berthing of the SENANUR CEBI was also uneventful up to the time of passing the stern lines to land.

### 5.6 Casting off tow

Once the SENANUR CEBI lay alongside the pier, the crew of the aft manoeuvring station began to bring out the stern lines. The communication between tug master and pilot about casting off the tow took place when two stern lines had been heaved through.

According to the watermen standing on shore, the third stern line was already moving at this time and when the tug was casting off.

It is certain that the first stern line came from the starboard side.

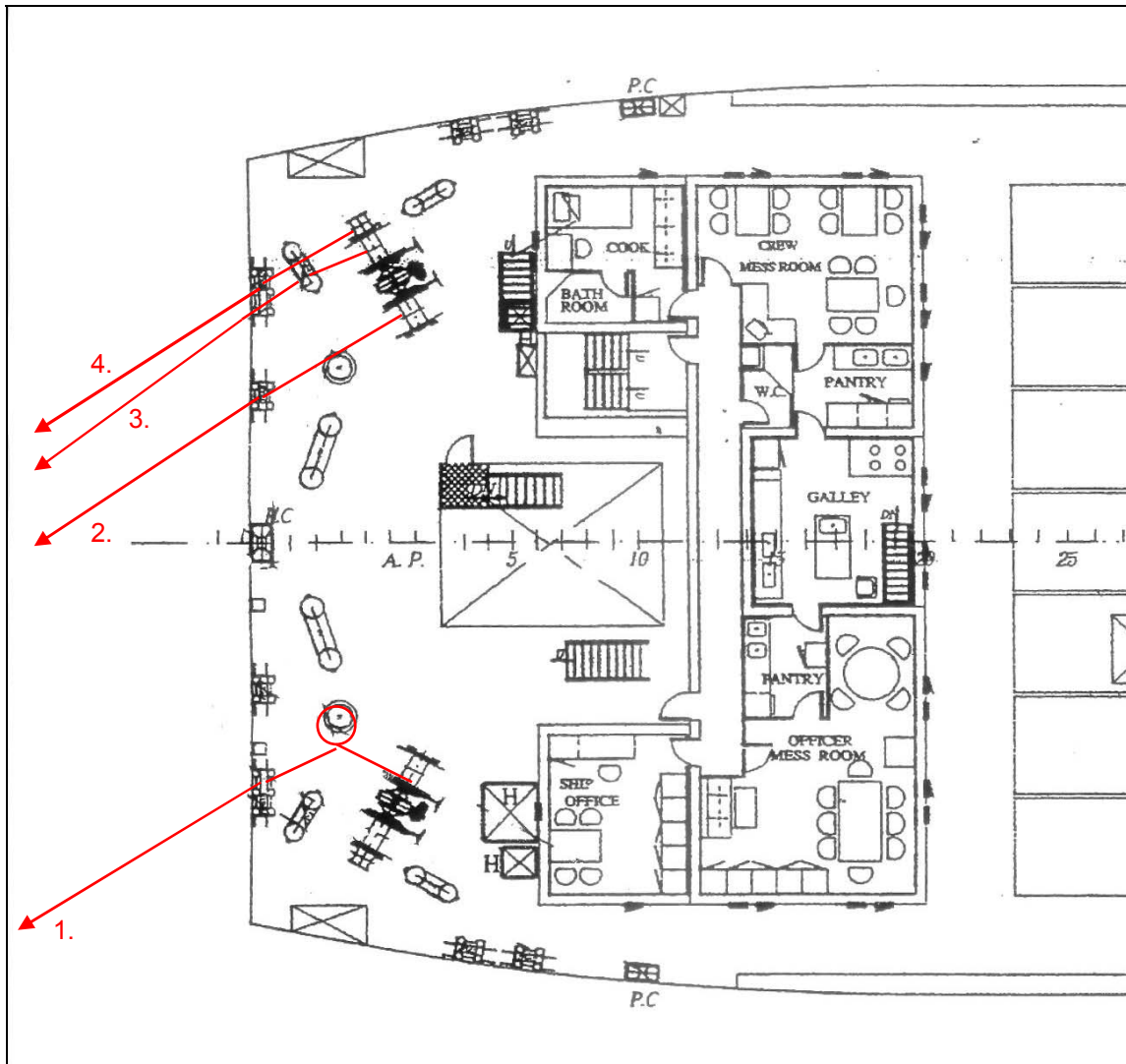


Figure 13: Stern lines at the time of the onboard investigation<sup>9</sup>, numbering denotes the sequence in which they were used

The cast off tow on the SENANUR CEBI was released in the way described in para. 5.1.

The BUGSIER 11 drew near the vessel slowly at an angle of 30° to the centre line of the SENANUR CEBI.

<sup>9</sup> The aft situation was established as follows during the investigation onboard the vessel: From the starboard side, one stern line (1) came from the winch drum onto the pier; at the port side, two stern lines came from the winch drums (2 and 3); another line lay on the spill head (4).

There were different statements regarding the distance of the stern of the tug to the stern of the vessel at the time of the accident. The tug boat crew stated a distance of 8 m to 10 m. The watermen remembered distances which differed between 10 m and 30 m.

The real position, motion direction and speed of the tug could not be determined reliable. The tug possibly stayed in his position. The investigators are of the opinion that the midships line of the tug was parallel to the midships line of the SENANUR CEBI. This results from the fact, that the tug master was not able to view the complete towing cable. This would have been the case if the midships line of the tug had been in the imaginary extension of the towing cable. This opinion is backed by the statement, that the tug master made a side-step to starboard in order to follow the course of the towing cable.

The distance from the hawsehole to the capstan of the BUGSIER 11 is 4.30 m. From a measured circumference of the capstan at the narrowest point of 2.03 m, and with three layers of towing cable, this gives a length of approx. 6 m. The distance from the capstan to the beginning of the positioned cable was measured to be 3 m. The towing cable was placed by the seaman in a circle with a diameter of approx. 2.90 m. With a 1.5 x circle, this gives a length of cable measuring 13.50 m. From this we can deduce a length of towing cable on the deck of the tug of approx. 27 m. 13 m of towing cable was therefore outside BUGSIER 11.

According to a statement by the tug master, shortly before the accident, the messenger line was hanging down vertically. The distance of the tug to the stern of the SENANUR CEBI was therefore approx. 13 m. With the given speed of the capstan of 0.41 m/s, taking up the towing cable would have taken approx. 32 s. To take up the cable and the messenger line using the capstan, they would have needed a total of 105 s.

With the load condition at that time, the distance from water surface to central hawse of the SENANUR CEBI was approx. 7 m. Shortly before casting off, there was still approx. 23 m of messenger line on the seagoing vessel's deck.

## **5.7 Course of the event**

Handing over the towing gear was conducted safely until just before the accident occurred. The final casting off itself was not noticed by the tug crew.

The officer on the aft manoeuvring station of SENANUR CEBI did not provide detailed statements as regards the handling of the messenger line. The vessel command stated, that the towing cable had been manually cast off by two crew members.

The final casting off of the messenger line was done at a time when the towing cable had not completely been taken in. In doing so the complete length of the messenger line got into the water.

The BSU assumes that the end of the towing cable sank down after casting off the messenger line onboard the SENANUR CEBI. Due to the weight of the towing cable a part of the basically flutable messenger line got under water too. Due to the prevailing tidal current the messenger line drifted underneath the stern and was

picked up by and wound around by the rotating propeller, which turned with “zero-pitch”. Subsequently this happened to the complete towing gear. The machinist tried to escape the out-running cable, but the tripping line caught him there at the foot.

### **5.8 Engine manoeuvre**

The tug master and the other members of his crew had no knowledge of the type of propeller on the SENANUR CEBI. Because the vessel's propeller was rotating at a "zero pitch", there was no propeller wash visible to the tug boat crew. The upper edge of the propeller blade lay about 4.40 m below the surface of the water. The propeller hub was about 6.60 m down and at a distance of over seven metres from the stern.

The tidal current and the lack of visibility into the water worsened the chance of perception of the rotating propeller for the tug boat crew.

The pilot conveyed no information about the propeller or its use to the tug.

The entries in the logbook of the SENANUR CEBI for the relevant period say: „12:50 aft and fore tugs fasted, 13:40 first line, 13:50 fore tug let go, 13:55 aft tug let go, 14:30 all fast, 14:45 p(i)lot left". The following entries were made in the engine diary: „06:00 M/E start, 14:35 M/E stop".

The SENANUR CEBI is equipped with a Voyage Data Recorder (VDR). After the accident, the vessel's command did not initiate an emergency backup. On request by the waterway police, the vessel's command backed up the data. Due to an error in the process, no data could be retrieved.

### **5.9 Crews**

All crew members on the BUGSIER 11 had been permanent crew of this tug for many years and were also active in this area previous to that. The investigation showed no indications of any limitation of ableness to work due to fatigue or alcohol.

The casualty crew member of the tug was unable to remember the details of the accident.

The times sheets submitted by the vessel operator of the SENANUR CEBI for the crew members of the aft manoeuvring station also did not confirm any suspicion by means of impairment from fatigue.

The officer in charge on the aft manoeuvring station of the SENANUR CEBI had already left the ship when the investigators arrived, due to planned signing off. The statement of this officer was made available to the BSU afterwards.

Copies of the log book, the engine log book as well as time sheets as regards the working times of the crew and a general arrangement plan were submitted to the BSU. Copies of the pages of the ISM manual relating to mooring operations/tug boat operations were not submitted despite request.

## 6 Analysis

### 6.1 Basics

Literature research on the work of tug boats with harbour assistance and the handling of the towing cable and lines did not produce much information. Questioning of third parties did not give a uniform impression as different tugs and different technologies are used. In principle, it was established that to release a towing connection the tug should approach as closely as possible to the vessel. This makes it easier to take in the cable and allow the ship's crew to hand over the messenger line by throwing it over onto the stern of the tug directly. Otherwise the vessel's crew should control the messenger line so that the tug is able to approach the vessel riskless. This requires the messenger line to be controlled in such a way that the towing cable is always above water. This prevents the towing cable from being run over by the tug. In any case the end of the messenger line should be hold on board the seagoing vessel as long as possible. This enables a safe taking-in of the towing gear by the tug.

### 6.2 Course of the event

Following an evaluation of the accident, the BSU assumes that on the SENANUR CEBI tight heaving of the third stern line should have begun while BUGSIER 11 started to take in the towing cable. Prior to this, the first stern line on the starboard side and the second stern line on the port side had been hauled tight. Both stern lines lay on the drum of the winches which was not equipped with an additional warping head. The third stern line was lowered by the crew from the port side. This stern line was payed out from the drum connected with an warping head. Due to the connection the working direction of warping head and drum was the same. Heaving in the stern line, however, required an opposite rotational direction of the winch as for slackening the messenger line. In this way it was, consequently, impossible to carry out two counter-turning jobs on the port winch at the same time.

Alternatively, the crew could have placed the messenger line on one of the double bollards to be able to continue slowly slackening the messenger line until the tug had taken up the entire towing cable. For that purpose the messenger line should have been stopped. However, there was no possibility provided on the double bollards to stop the messenger line in direction of pull. In the opinion of the BSU, this led to the crew of the SENANUR CEBI finally casting off the messenger line, although the tug was not directly at the stern and, respectively, the towing gear was not taken in so far. This enabled the messenger line to be drifted under the ship due to the ebb tide and its length. There she was caught be the turning controllable pitch propeller and wound up.

It was not possible to establish in retrospect to what extent the running main engine or the rotating propeller were noticed by the crew of the aft manoeuvring station.

### 6.3 Communication

Communication by the SENANUR CEBI with the tug BUGSIER 11 via VHF radio was poor. Essential information, such as the type of propeller and its operation, were not passed on to the tug. On the other hand the tug master did not request this information.



The direct exchange of information between the crew of the aft manoeuvring station on the SENANUR CEBI and the crew of the tug also did not comply with the requirements of good seamanship. On the one hand, the tug crew could have pointed out immediately that the stern line was being floated under the stern. On the other hand, a warning to the tug should, in any case, have been given before casting off the messenger line.

#### **6.4 BUGSIER 11**

The tug master manoeuvred the BUGSIER 11 in a position out of the midships line of the SENANUR CEBI. In doing so the tug master had carried out a standard manoeuvre which should prevent the tug from being affected by propeller wash from the seagoing vessel directed to aft. In this position the tug master positioned the tug in such a way that the midships line of the tug was parallel to the midships line of the SENANUR CEBI. Therewith the tug was also parallel to the current and was less or more manageable affected by the current. The tug would have been affected more by the current if the tug with its midships line would had been in the extension of the towing cable.

Due to the position of the tug to the midships line of the seagoing vessel and the restricted view the tug master was not able to view the towing cable at all times.

Based on the construction of the tug, direct visibility for the tug master from the conning position onto the own stern and onto the stern of the seagoing vessel was limited by the two funnels and the aft mast. A screen only just made it easier to monitor work on the own aft deck. Consequently, it was only possible for the tug master to view the first few metres of towing cable. He could only monitor the rest of the cable by leaving the conning position.

Casting off the messenger line was not observed by the tug master.

The seaman on the BUGSIER 11 was in a working position that only allowed him a limited opportunity to supervise the cable and communicate with the crew of the SENANUR CEBI. He did not observe the messenger line being cast off either.

The machinist was surprised by the events. Due to his working position he was unable to check the course of taking-in the towing gear.

#### **6.5 SENANUR CEBI**

Due to a lack of recordings of the Voyage Data Recorder it was not possible to evaluate the conversations and the radio communication. For this reason an analysis about the co-operation of the bridge team was also not possible.

Furthermore, due to a lack of technical recordings it was only possible to achieve information about engine orders and engine manoeuvres from the bridge bell book and the engine log book. Obviously the main engine was only stopped at 14:35 which was more than half an hour after the accident.

## **7 Action taken**

The vessel operator of the BUGSIER 11 reported that the following action has been taken or is planned following an assessment of the accident:

- The case was discussed in detail in the vessel operator's work safety committee and the results were communicated to the crews of all tug boats.
- The Brotherhood of Elbe Pilots were informed of the circumstances of the incident.
- Following a conversion on the BUGSIER 11, the last tug boat with hook of the vessel operator, the towing cable will in future be hauled in using a winch with drum.

The Brotherhood of Elbe Pilots evaluated this accident within the scope of its quality management system. In addition the accident was included in the conception for the training of the pilot trainees in order to, exemplary, illustrate the necessary communication of vessels with variable pitch propellers.

## **8 Safety recommendations**

The following safety recommendations shall not create a presumption of blame or liability, neither by form, number nor order.

### **8.1 Operator of the SENANUR CEBI**

The Federal Bureau of Maritime Casualty Investigation recommends to the operators of the SENANUR CEBI to carry out structural measures to improve the options for handling lines and cables. In particular, they should ensure that such measures could enable stopping or shifting of the messenger line.

### **8.2 Vessels' commands**

The Federal Bureau of Maritime Casualty Investigation recommends to the vessels' commands and tug masters, jointly with their crews, to carry out an analysis of work procedures and hazards involved in establishing and releasing towing connections and to introduce measures to reduce any recognised hazards.

### **8.3 Vessels' commands, pilots and tug masters**

The Federal Bureau of Maritime Casualty Investigation recommends to the commands of seagoing vessels and the pilots advising them to improve communication to the effect that relevant information regarding vessel propulsion or the thrusters is passed on to tug masters and that tug masters demand such information respectively.

## 9 Sources

- Findings of the Waterway Police Brunsbüttel
- Written statements
  - Vessel's commands for the SENANUR CEBI and BUGSIER 11
  - Bugsier-, Reederei- und Bergungsgesellschaft mbH & Co. KG
- Witness accounts
- Bellbooks and logbooks, time sheets
- Diver report and video of the BALTIC Taucherei- und Bergungsbetrieb Rostock GmbH
- Appraisal of the accident by shipping expert Mr Fechner Dip. Eng. commissioned by Bugsier-, Reederei- und Bergungsgesellschaft mbH & Co. KG
- Appraisal by the Federal Waterways Engineering and Research Institute Hamburg and the Waterways and Shipping Office Cuxhaven on currents in front of the Elbe port
- Documents containing safety instructions and relating to the education of crews from the Bugsier-, Reederei- und Bergungsgesellschaft mbH & Co. KG
- Radar and wind recordings from the Vessel Traffic Service Brunsbüttel