



Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Bundesoberbehörde im Geschäftsbereich des Bundesministeriums
für Verkehr, Bau und Stadtentwicklung

Investigation Report 39/05

Less Serious Marine Casualty

**Collision of MT STOLT FULMAR
with the ferry link span
in Hamburg on 29 January 2005**

1 May 2006

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. By contrast with investigation reports the summary report only provides information on the vessels involved in the accident and the circumstances of the accident.

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

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

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

Table of Contents

1	SUMMARY OF THE MARINE CASUALTY	5
2	SCENE OF THE ACCIDENT	6
3	VESSEL PARTICULARS	7
3.1	Photo	7
3.2	Particulars	7
4	COURSE OF THE ACCIDENT AND INVESTIGATIONS	8
4.1	Accident.....	8
4.2	Accident damage.....	9
4.3	Steering gear and manoeuvring characteristics	10
4.4	Rudder steering, automatic pilot system and gyro compass	10
4.5	Inspection by BSU on 19 July 2005 in Rotterdam and questioning of Messrs. Northrop Grumman Sperry Marine in Hamburg on 5 August 2005, as well as of Stolt-Nielsen ITS GmbH in Duisburg on 27 September 2005.....	11
4.6	Investigations by the Waterway Police in Hamburg.....	12
4.6.1	Evaluations by the BSU.....	13
4.7	Harbour Traffic Regulations.....	15
5	ANALYSIS.....	16
6	SOURCES	17

List of Figures

Figure 1: Chart.....	6
Figure 2: Photo of vessel.....	7
Figure 3: Link span Blankenese	9
Figure 4: Steering mode selection switch with automatic pilot.....	11
Figure 5: Steering stand.....	12
Figure 6: Rudder position indicator	12
Figure 7: Bridge Plan.....	13
Figure 8: Electronic chart, turning to starboard.....	14
Figure 9: Electronic chart, collision with link span.....	14
Figure 10: Radar recording by Vessel Traffic Services (VTS) Hamburg.....	15

1 Summary of the marine casualty

At 04.15 h CET on 29 January 2005 the Motor Tanker STOLT FULMAR sailing under the flag of the Cayman Islands collided in the port of Hamburg with the Blankenese ferry link span and rammed the tug SCHLEPPKO 7 lying there. The ferry link span and tug sustained partly considerable property damage, while the starboard side of STOLT FULMAR was only slightly deformed at the bulbous bow. The vessel sustained paint abrasion on its outer plating as well as an approx. 20 cm long crack. No environmentally harmful substances were released to any notable extent in the course of the accident.

2 Scene of the accident

Nature of the incident: Less serious marine casualty, collision with ferry link span
 Date/Time: 29 January 2005, 04.15 h CET
 Location: Hamburg
 Latitude/Longitude: ϕ 53°33.4'N λ 009°48.3'E

Section from Chart 3010, BSH

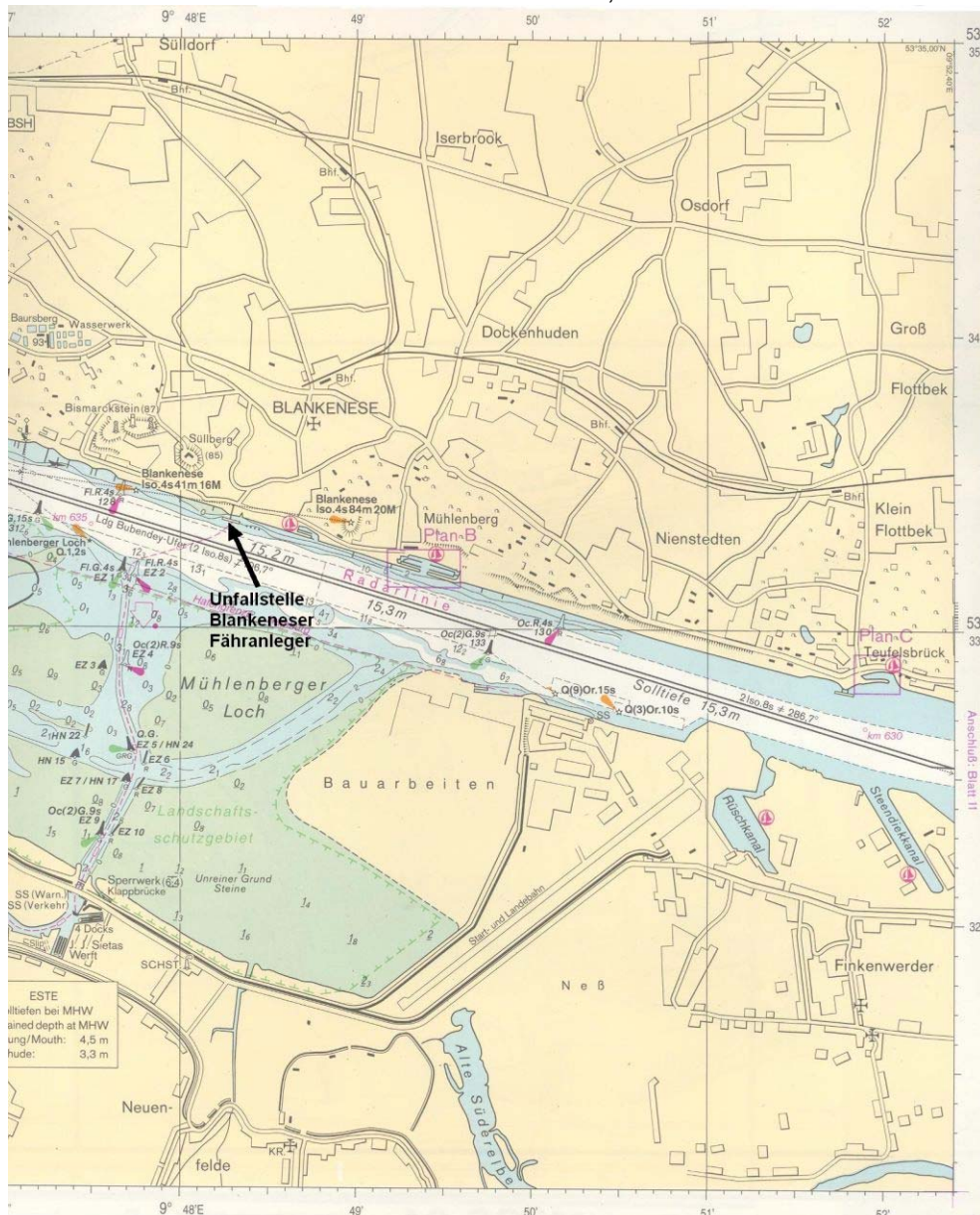


Figure 1: Chart

3 Vessel particulars

3.1 Photo



Figure 2: Photo of vessel

3.2 Particulars

Name of vessel:	STOLT FULMAR
Type of vessel:	Motor Tanker
Nationality/Flag:	Cayman Islands
Port of Registry:	George Town
IMO – Number:	9148972
Call sign:	ZCSY9
Vessel operator:	Stolt-Nielsen Transportation Group B.V.
Year built:	2000
Building yard/Building No.:	Imma/San Marco No. 4262, Italy
Classification Society:	Lloyd's Register of Shipping
Length overall:	96.19 m
Width overall:	16.33 m
Gross tonnage:	3818
Deadweight:	5498 t
Draft at the time of the accident:	Fore: 6.22 m Aft: 6.68 m
Engine rating:	2760 kW
Main engine:	Electric diesel, 4 x Wärtsilä
Speed:	12.5 kn
Hull material:	Steel
Hull design:	Double-hull tanker
Number of crew:	13

4 Course of the accident and investigations

The Federal Bureau of Maritime Casualty Investigation (BSU) was notified of the collision on 31 January 2005. At this time STOLT FULMAR was already on her way to Antwerp.

The following description of the circumstances of the accident relates to the investigations conducted by the Waterway Police Hamburg on the day of the accident, a visit by BSU to the Waterway Police on 8 March 2005, and an inspection of the vessel by BSU in Rotterdam on 19 July 2005.

4.1 Accident

At 03.30 CET on 29 January 2005 the Motor Tanker STOLT FULMAR carrying a cargo of 4,900 t 94% sulphuric acid from Petroleumhafen in Hamburg laid off en route to Antwerp. The Master, the Second Officer and the port pilot were on the bridge. The Master was standing at the helm. In this load condition the vessel steered sluggishly and could only be kept on course with large rudder angles.

The pilots changed at 03.45 h off Bubendey Ufer. At this time there was a flood current and a weak wind was blowing from a westerly direction. Visibility in thick fog was less than 100 m. There was a lookout on the forecastle and both radar equipment were in operation. After the change of pilots STOLT FULMAR increased her speed to 7 kn over the ground. At 03.55 h the vessel passed the Teufelsbrück link span. In view of the poor steering behaviour of STOLT FULMAR, steering was switched over to the automatic pilot in expectation that the ship could then be steered better.

When it turned out that using the automatic pilot system did not improve the steering behaviour, it was decided to switch back over to manual steering off Blankenese Yachthafen. The Second Officer thereupon took over the steering stand midships. When he took over the helm, however, he had no control over the manual steering. Directly after this, at 04.15 h, off the Blankenese ferry link span, STOLT FULMAR ran out of the rudder with a fast turning motion over starboard. The rudder position indicator showed "hard to starboard".

The Master then immediately took over the helm from his conning position, but was not able to stop the turning movement to starboard by contra rudder and using the bow thruster. When the collision with the ferry link span became evident, attempts were made to stop the vessel by a "full astern" manoeuvre in order to reduce the collision damage.

The tug SCHLEPPKO 7 lying at the west pontoon was ripped loose by the collision and subsequently taken alongside in the navigation channel by the tug JOHANNES MATTHIES that was lying at the Ost pontoon and returned back to the pontoon. STOLT FULMAR then turned astern through the port side and continued its voyage to Wedel Power Station where it anchored at 04.55 h.

4.2 Accident damage

The ferry link span was heavily damaged by the collision (see Fig. 3) and the property damage was estimated at euro 2 million. SCHLEPPKO 7 was damaged aft on the port side and was taking in water. Slight quantities of fuels and lubricants spilled out. By way of precaution the fire brigade laid out an oil barrier and used drainage pumps. STOLT FULMAR was slightly deformed at the bulbous bow and had sustained an approx. 20 cm long crack in the outer plating on the port side of the bulbous bow on a level with the water line, as well as paint abrasion damage. No fuel or lubricants or sulphuric acid spilled out.



Figure 3: Link span Blankenese

STOLT FULMAR left her anchor position at 06.26 h and with tug assistance shifted to Wedel Power Station where it made fast at 07.00 h. Shortly after this representatives of the Waterway Police, the See-BG (Marine Insurance and Safety Association), the insurer Scandinavian Underwriters Agency, and the Classification Society Lloyd's Register arrived. No further damage was ascertained. The steering gear was examined and was fully operable.

On 30 January 2005 STOLT FULMAR was able to continue its journey to Antwerp with tug assistance up to the Elbe making buoy.

4.3 Steering gear and manoeuvring characteristics

The steering gear of type Barke-Steering Gear BST 100 is a hydraulically operated system with a maximum torque of 100 kNm. The maximum rudder angle on STOLT FULMAR is 45°. The time for shifting the rudder between positions "hard to port" to "hard to starboard" or vice versa is 28 s with one rudder drive and 15 s with two rudder drives. The minimum speed for achieving steering action is stated as 4 knots with stopped engine, neutral steering action is stated as 3°, and the turning circle radius as about 9 cable lengths (cbl = 0.1 nm) in shallow water and loaded condition. According to the bridge poster, the vessel would start to turn after 4 cables and begin the turning circle, whereby the position of the vessel after the turning circle is offset inwards by 2.5 cables. At slow speed (7 kn) the vessel can be stopped according to its characteristics with a direct "full astern" manoeuvre and the rudder "midships" after approx. 1 min. and after making 2 cables.

On 16 February 2005 the steering gear was inspected and serviced by the manufacturer Barkemeyer in Rotterdam. No defects were found.

4.4 Rudder steering, automatic pilot system and gyro compass

On 1 February 2005 the firm Sperry Marine Service Net examined the follow up (FU) and non-follow up (NFU) control system of the rudder steering and the automatic pilot Navipilot AD II and the gyro compass Navigat X. The inspection did not reveal any indications of malfunctions. The steering stand midships is a follow-up steering¹ with hand wheel without a spring, and a non-follow-up² that is operated with buttons. Tillers are located in the bridge wings and according to the information supplied by the crew are designed as follow-up steering. In addition to the steering mode selector switch, an override tiller³ is located at the conning position next to the steering mode selector switch, designed as a non-follow-up. All steering modes⁴ could be selected via the steering mode selector switch. The rudder angle feedback and rudder angle indicator as well as the electronic interfaces were also checked.

¹ In follow-up steering the rudder angle is selected on the mechanical rudder position indicator. The servo mechanism of the steering gear is operated by an amplifier until the actual rudder position coincides with the required rudder position. The actual rudder position is transmitted to the rudder position indicator by the feedback unit.

² In the case of non-follow-up steering, the steering gear is activated directly via contact making at the non-follow-up tiller. The rudder angle depends on the duration of the contact made at the tiller. The tracking of the actual rudder angle at the rudder position indicator must be checked here during the steering process.

³ The override tiller is a facility that is generally only superimposed on the automatic pilot system as a function of the directives of the classification society. According to the information supplied by the crew, the override tiller on STOLT FULMAR has priority over all other steering gears, however.

⁴ Hand-wheels and mini-hand-wheels are generally executed as follow-up steering, while tillers and buttons are executed as non-follow-up steering modes. When electrical rudder steerings are used, there must as a matter of principle be two facilities independent of each other. Separate cables and lines must be provided for these steering gears.

4.5 Inspection by BSU on 19 July 2005 in Rotterdam and questioning of Messrs. Northrop Grumman Sperry Marine in Hamburg on 5 August 2005, as well as of Stolt-Nielsen ITS GmbH in Duisburg on 27 September 2005

The steering mode selector switch (see Fig. 4) has 8 switch positions. The automatic pilot Navipilot AD II can be switched on via the positions "Auto" at the top and bottom. At the top on the right side is the position "Non Follow Up Tiller". This is used to switch over to the "Override-Tiller" directly next to the conning position. In the middle on the right and left it is possible to switch to the controls "Stb. Wing" and "Port Wing" in the bridge wings. The steering modes NFU and FU are not marked here. In the bottom half right and bottom half left "Follow Up" positions it is possible to switch the hand wheel at the steering stand (see Fig. 5). The turning angle of the hand wheel is approx. 90° to port and starboard. On the half left side at the top is the position "Non Follow Up Pushbutton" for push-button control at the steering stand (see Fig. 5). In front of the steering stand is a rudder position indicator (see Fig. 6) mounted on the bridge deck that can be read off by the helmsman from starboard and port. At the conning position there is a rudder position indicator on the console at eye level in front of the seat and on the multifunction screen. There are further rudder position indicators at the other steering stands. According to the information supplied by the crew, the rate of turn indicators received their signal from the gyro compass. By contrast with the autonomous turn indicator, this signal comes with a time lag.



Figure 4: Steering mode selector switch with automatic pilot



Figure 5: Steering stand



Figure 6: Rudder position indicator

4.6 Investigations by the Waterway Police in Hamburg

In addition to recording the accident and securing the vessel logbook, the bridge log, the printed manoeuvring list, the bridge poster, the bridge plan (see Fig. 7) and the recordings of the electronic chart and the radar surveillance, the Waterway Police conducted further investigations on board STOLT FULMAR and simulations with the rudder on 21 February 2005. In one scenario the rudder was placed "midships" at a secondary steering stand until the rudder angle indicator lay midships, while at the steering stand "midships" the hand wheel was placed "hard to starboard". After switching over the steering mode selector switch at the conning position, the rudder position indicator immediately moved to hard starboard within 8 s. After this the rudder was turned back by hand wheel to midships. The midships position of the rudder was reached after a further 10 s.

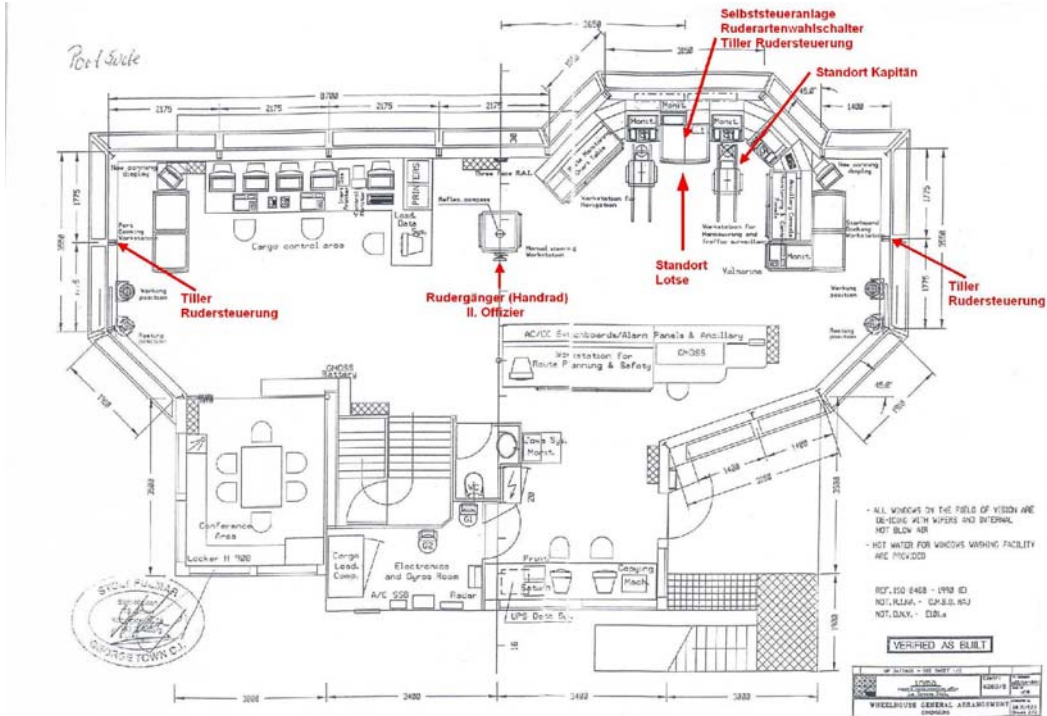


Figure 7: Bridge Plan

4.6.1 Evaluations by the BSU

The evaluation of the electronic chart by the Kelvin Hughes' replay system revealed that at 04.12.04 h CET⁵ STOLT FULMAR turned to starboard abeam with the dolphins off the Blankenese link span (see Fig. 8) and collided with the link span at 04.12.53 h (see Fig. 9). Before this the parallel distance to the ferry link span was approx. 1 cable. The speed and rudder angle recordings of STOLT FULMAR as sensor information were not available to the BSU. The speed was specified manually in the system. A synchronisation error occurred in the gyro compass course information. The courses displayed were plausible, however.

According to the radar records of the Vessel Traffic Services (VTS) Hamburg, directly after the vessel "ran out of rudder" before the ferry link span speed over ground was 6.6 kn, in other words approx. 3.4 m/s (see Fig. 10). The speed measurements coincide with the statements by the crew.

⁵ Converted displayed system time

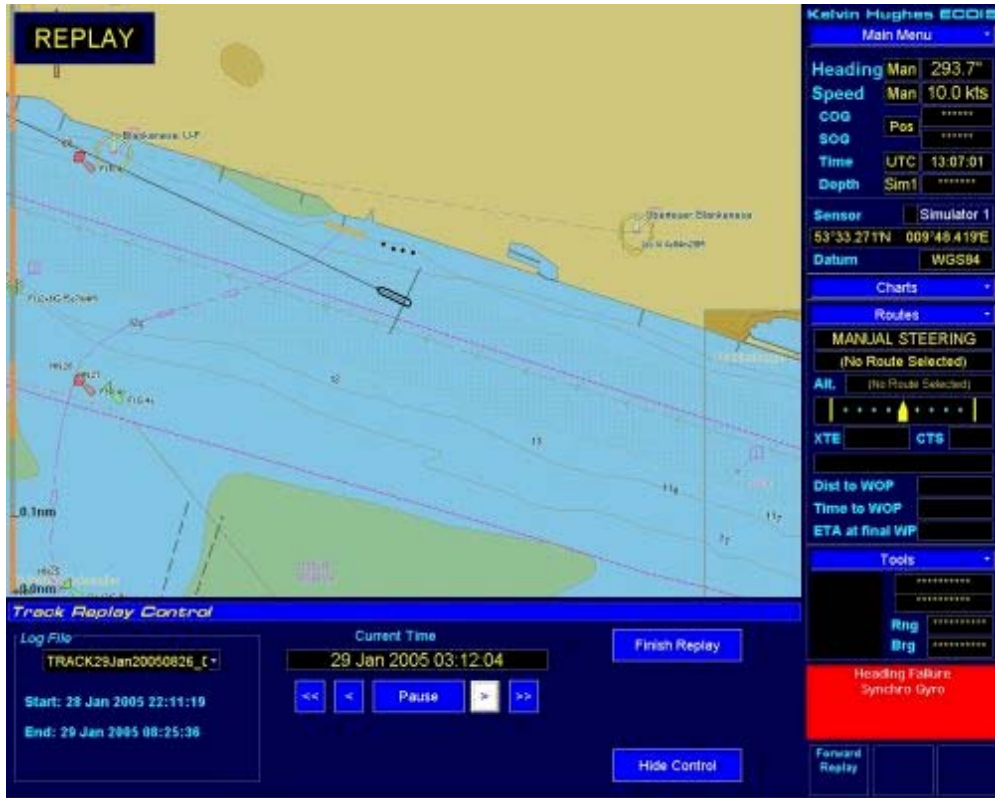


Figure 8: Electronic chart, turning to starboard

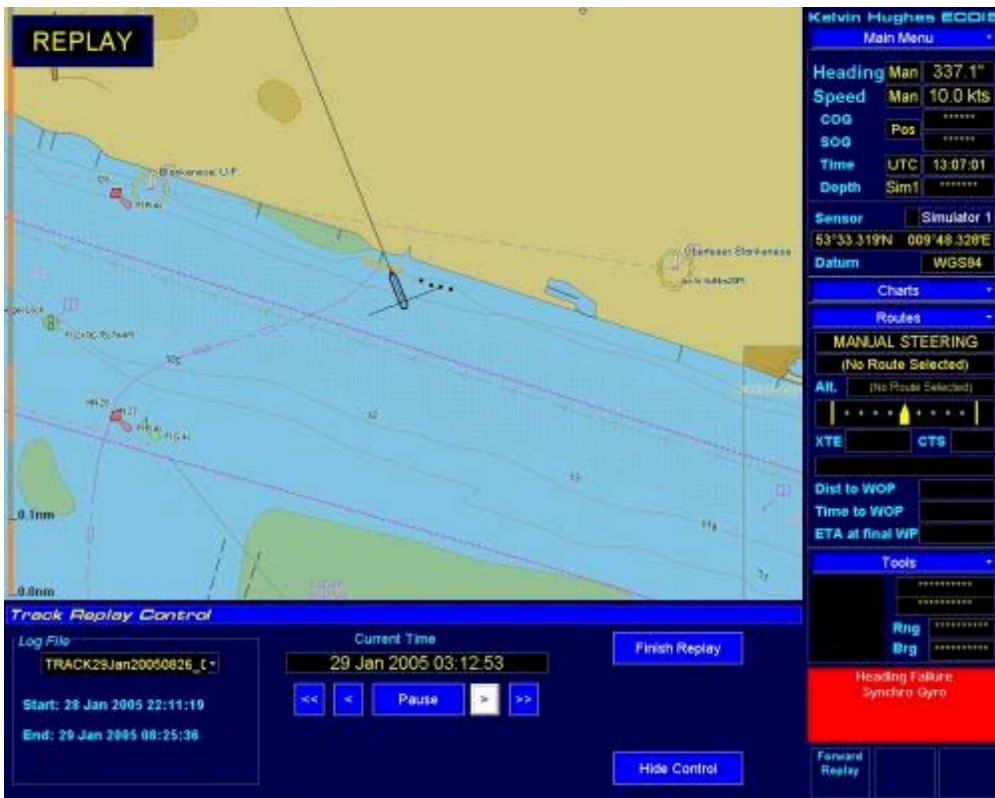


Figure 9: Electronic chart, collision with link span

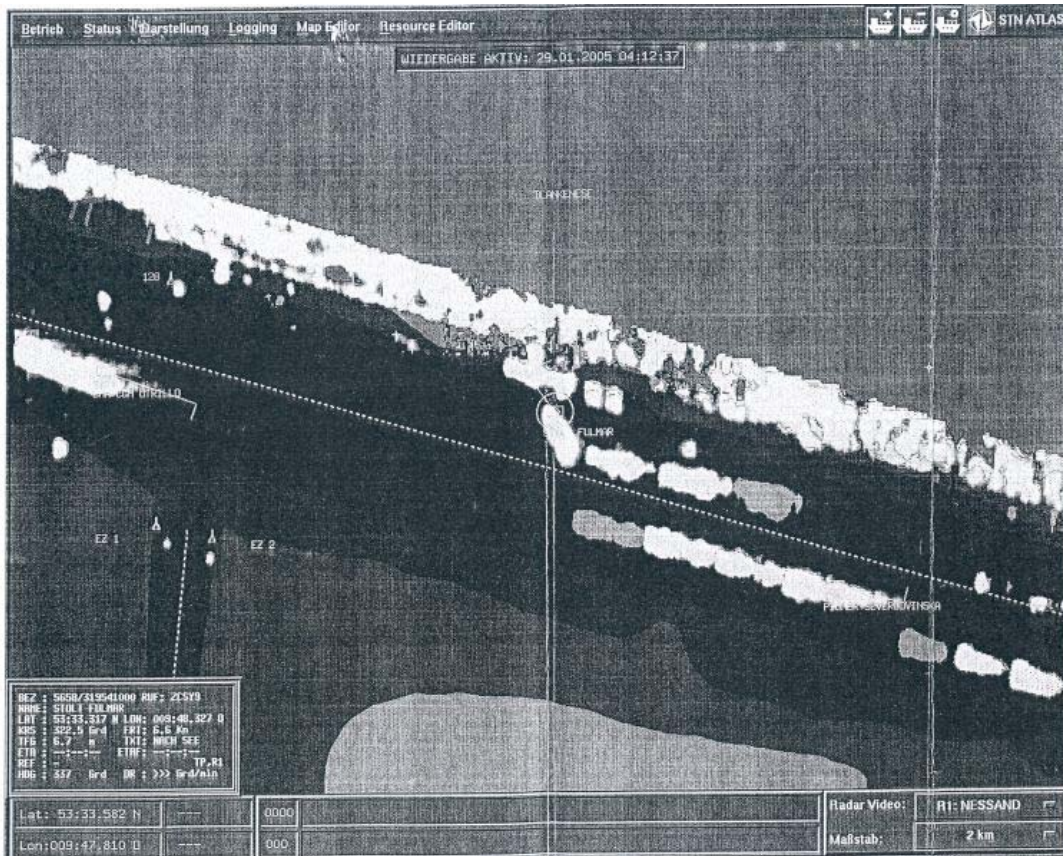


Figure 10: Radar recording by Vessel Traffic Services (VTS) Hamburg

4.7 Harbour Traffic Regulations

According to the Harbour Traffic Regulations in Hamburg in conjunction with the announcements by the Department of Economy and Labour of 10 September 1999, that entered into force on 1 October 1999, the use of automatic pilot systems is forbidden in cases of reduced visibility for all vessels in traffic. Even if the Master was unaware of this announcement, the advising pilots in the port of Hamburg must have known of it. At the time of the accident STOLT FULMAR had not crossed the port boundaries.

5 Analysis

The advising pilots were aware of the regulations applying in the harbour (see under Section 4.7). By switching over briefly to the automatic pilot an attempt was being made to improve the steering behaviour of STOLT FULMAR. After the subsequent switching back from automatic pilot to manual steering, the vessel ran out of the rudder.

The subsequent technical inspections showed no indication of any malfunction of the steering gear. The steering gear and the follow-up and non-follow-up steering functioned in accordance with their purpose on the day of the accident. The Master was able to take over the steering at short notice with the override tiller.

The accident does not reveal any safety vulnerability in the building and testing regulations for steering gears and controls.

When switching over the steering mode, constellations arise in which unintentional turning manoeuvres of the vessel can be started:

- Rudder at the steering stand is not in midships position
⇒ Rudder angle pre-selection is implemented directly
- Rudder at the wing positions port and starboard is not in midships position
⇒ Rudder angle pre-selection is implemented directly
- Override tiller at the conning position
⇒ Rudder is set immediately after moving the tiller

There is no procedure on STOLT FULMAR describing how to proceed when switching over the rudder control.

There is no indication that a communication problem between the Master, Second Officer and pilot promoted the course of the accident, or that the lighting at the steering mode selector switch was inadequate. Nor could it be clarified whether the Master had switched the steering mode selector switch to the steering stand as intended, or had unintentionally switched to the wing steering stands or actuated the override tiller immediately himself.

When switching over from automatic pilot to another steering mode, the Master was ultimately unable to stop the unintended turning of the vessel using the override tiller and hard rudder angle and the bow thruster too, and despite an immediate "full astern" manoeuvre, so that there was a collision with the link span and the tug SCHLEPPKO 7 lying there.

As a result of the collision the Blankenese ferry link span and the tug sustained considerable damage, while STOLT FULMAR only sustained minor damage. No environmentally harmful substances were released to any notable extent.

6 Sources

- Investigation by the Waterway Police (WSP) Hamburg

- Written statements/comments by
 - Scandinavian Underwriters Agency GmbH Hamburg
 - the Master
 - the Second Officer on STOLT FULMAR
 - the pilot on STOLT FULMAR
 - Northrop Grumman Sperry Marine Hamburg
- Testimony by witnesses
 - Master JOHANNES MATTHIES

- Service Report
 - Sperry Marine Service Net Antwerp
 - Barkemeyer Schiffstechnik Rotterdam

- Charts Federal Maritime and Hydrographic Agency (BSH)

- Photos Hasenpusch Photo-Production Schenefeld

- Radar recordings Schiffssicherungsdienst (VTS) Hamburg

- Recordings of the electronic chart and the course and rudder angle recorder on STOLT FULMAR

- Documents
 - Logbook, Scrap logbook, Bridge Poster, Ship's Certificate STOLT FULMAR
 - Rudder controls Northrop Grumman Sperry Marine
 - Manual of Barke-Steering Gear BST 100
 - Rules for Classification and Construction Germanischer Lloyd
 - Voyage and Evasion Rules, Hamburg Police
 - Regulation on traffic in Hamburg port and on other waters (Port Traffic Regulations)
 - Announcement by the authority for economics and work – Hamburg Port Authority