Investigation report

C5/2008M

F/V HENDRIK SENIOR and M/S BIRKA EXPORTER, Collision in International Waters 17 NM off the Netherlands, on 8.12.2008

SUMMARY

At 05:29 UTC on 8 December 2008, the UK registered, Dutch operated, fishing vessel HENDRIK SENIOR and the Finnish Ro-Ro cargo ship BIRKA EXPORTER collided in international waters approximately 17 NM off the Netherlands coast. There were no injuries and no significant pollution.

HENDRIK SENIOR was on passage from Harlingen, in the Netherlands, to her regular fishing grounds in the North Sea. She was crossing the south-bound lane of the Vlieland Traffic Separation Scheme, near West Terschelling, on an approximately west north westerly course. BIRKA EXPORTER was on passage from Finland to Antwerp, heading approximately south south west in the south-bound lane. It was dark; environmental conditions were benign. Each vessel had seen the other, initially by radar and later by eye.

HENDRIK SENIOR was the give way vessel; the watchkeeper saw BIRKA EXPORTER but did not take early and substantial action to keep clear. Instead HENDRIK SENIOR executed two consecutive starboard turns with a total heading change of 60 degrees towards the incoming vessel. BIRKA EXPORTER was the stand on vessel, and this she did. However, she did not subsequently take appropriate avoiding action before the vessels had a head-on collision.

The evasive manoeuvre carried out by HENDRIK SENIOR was commenced too late and with too small a course change in respect to the approach course chosen by the trawlers. An important observation from this accident is that if proper safety margins are not maintained a close-quarters situation can develop very quickly into an extremely serious one with possible catastrophic consequences.

Both vessels were extensively damaged; HENDRIK SENIOR was later declared a constructive total loss. BIRKA EXPORTER diverted to Amsterdam for repairs.

The ice strengthened bulb of the BIRKA EXPORTER had the potential to cause severe damages on HENDRIK SENIOR. This could have been the result, if the impact angle and its position had been only slightly different.

Assistance to HENDRIK SENIOR was rendered by the Dutch lifeboat service, and a radar replay of the incident was recorded by the Netherlands Coastguard radar station.

Both vessels failed to abide by the COLREGS, and as a result of complacency, two well equipped and modern ships collided in conditions of good visibility, even though each knew a risk of collision existed. Bridge equipment was not used effectively and no seaman lookout was present in either wheelhouse at the time.

Previous safety studies have shown that poor lookout, too small passing distances and sometimes intentionally violated procedures and regulations have contributed to collisions.

The Investigators give recommendations to the owners of both vessels regarding the use of lookout on the bridge and the guidance of safe navigational watchkeeping including the use of navigational equipment and the interpretation of COLREGS.

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AIBF	Accident Investigation Board of Finland
AIS	Automatic Identification System
ARPA	Automatic Radar Plotting Aid
Cable	Measure of distance equal to 0.1 nautical mile
CB	Citizens Band radio
CEC	Certificate of Equivalent Competency
COC	Certificate of Competency
COLREGS	The Merchant Shipping (Distress and Prevention of Collisions) Regulations 1996 (as amended)
CPA	Closest Point of Approach
DEFRA	Department for Environment, Food and Rural Affairs
DSC	Digital Selective Calling
FIT	Fatigue Investigation Tool
FMR	Forward Machinery Room
GMDSS	Global Maritime Distress Safety System
GOC	General Radio Operators Certificate
GPS	Global Positioning System
GT	Gross tonnage
IMO	International Maritime Organization
ISM Code	International Management Code for the Safe Operation of Ships and for Pollution Prevention
Knots	Speed in nautical miles per hour
KNRM	Koninklijke Nederlandse Redding Maatschappij (Dutch equivalent of UK RNLI)
kW	Kilowatt
LOA	Length Over All
LR	Lloyd's Register
LT	Port letters denoting Lowestoft, UK as a fishing vessel's port of registry
MAIB	Marine Accident Investigation Branch (UK)
MCA	Maritime and Coastguard Agency (UK)
MGN	Marine Guidance Note

NM	Nautical Miles (1852 m)
NSI	Netherlands Shipping Inspectorate
NUBO	Non UK Beneficially Owned
OOW	Officer of the Watch
Ro-Ro	Roll on – Roll off
SFIA	Seafish Industry Authority
SMS	Safety Management System
STCW	International Convention on Standards of Training, Certification and Watchkeeping
S-VDR	Simplified Voyage Data Recorder
TCPA	Time to Closest Point of Approach
TSS	Traffic Separation Scheme
UK	United Kingdom of Great Britain and Northern Ireland
UKLAP	UK Legal and Administrative Process
VDR	Voyage Data Recorder
VHF	Very High Frequency (radio)
VTS	Vessel Traffic Services

TIMES: ALL TIMES USED IN THIS REPORT ARE UTC UNLESS OTHERWISE STATED

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INTRODUCTION

The UK flagged fishing vessel HENDRIK SENIOR and the Finnish flagged Ro-Ro vessel BIRKA EXPORTER collided 17 NM off the Netherlands coast in the morning of 8 December 2008.

The UK Marine Accident Investigation Branch (MAIB) as the investigative body of the flag state of the fishing vessel was soon informed about the accident. The Accident Investigation Board of Finland (AIBF) was informed of the accident by the Netherlands Shipping Inspectorate by noon on 8 December 2008. The investigation bodies established contact the same day. It was decided that a joint investigation would be carried out by Finland and UK and that Finland would be the lead investigative state in accordance with IMO Code for the investigation of marine casualties and incidents Res.A.849(20).

An investigator of the Netherlands Shipping Inspectorate on the request from AIBF gathered much initial data and carried out some interviews in the Netherlands for the Finnish part of the investigation.

This is the report of the joint investigation on the accident by AIBF and MAIB.

1 OVERVIEW OF THE ACCIDENT AND THE INVESTIGATION

1.1 The vessels

1.1.1 General information

M/S BIRKA EXPORTER

Figure 1. M/S BIRKA EXPORTER.

Name of Vessel	M/S BIRKA EXPORTER
Type	Ro-Ro vessel
Flag	Finnish
Owner	Birka Cargo Ab Ltd
IMO Number	8820860
Call Sign	OJDA
Year built	1991
Gross/Net tonnage	6620/1986
Total length	122 m
Breadth	19 m
Draught	6.35 m
Speed	16.5 kt
Propulsion power	5920 kW
Cargo capacity	1278 lane meters
Class	DNV + 1A 1,

Birka Cargo Ab Ltd. is a shipping company specialized in transport of forestry products, unitized general cargo and trailers, on modern Ro-Ro vessels. Birka Cargo, former United Shipping Ltd. Ab, was founded in 1990 and is a part of the Eckerö Group. Birka Cargo presently operates a fleet of 7 modern Ro-Ro vessels under Finnish flag.

BIRKA EXPORTER was built as M/S GRANÖ and delivered in 1991. The ship was built at Fosen Mek. Verksteder A/S, Norway. GRANÖ has 5 sister ships. After the delivery GRANÖ was in traffic between Finland and Germany until 2000. After year 2000 the traffic area has been northern Europe. The name GRANÖ was changed 2002 to BIRKA EXPORTER.

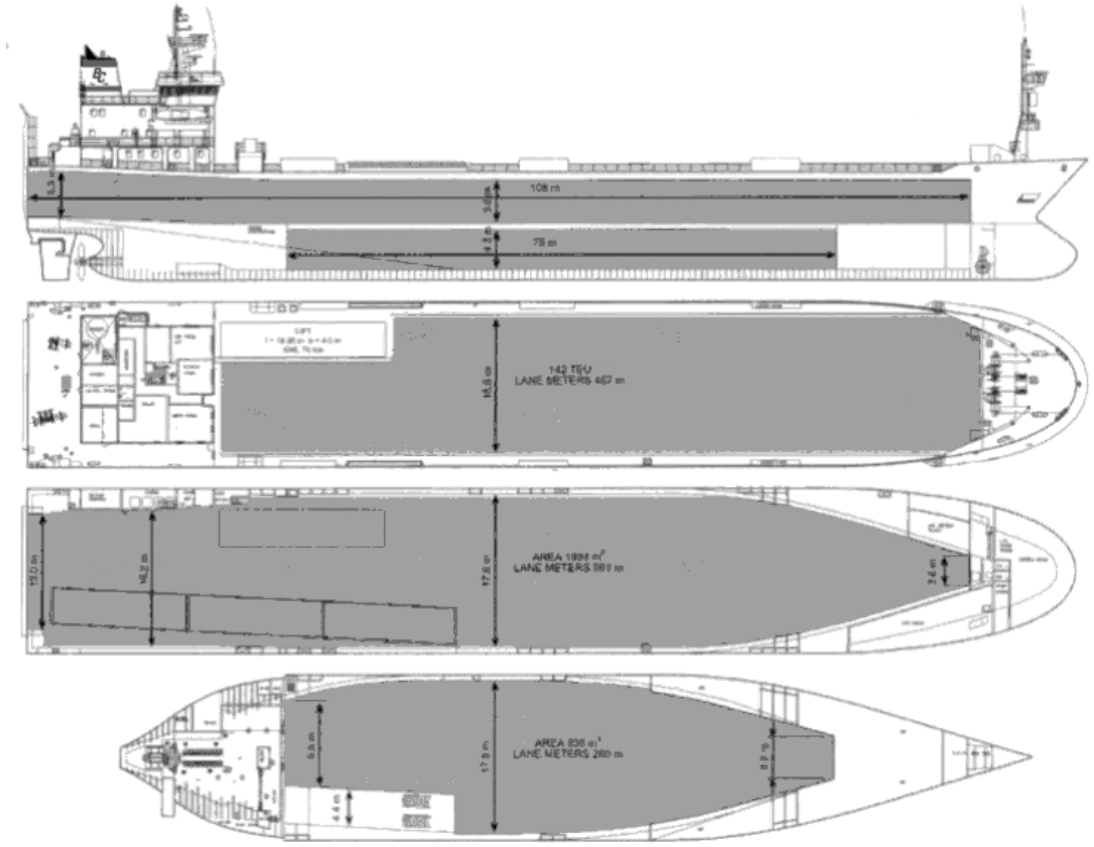


Figure 2 BIRKA EXPORTER deck plans.

HENDRIK SENIOR

Figure 3a. HENDRIK SENIOR.

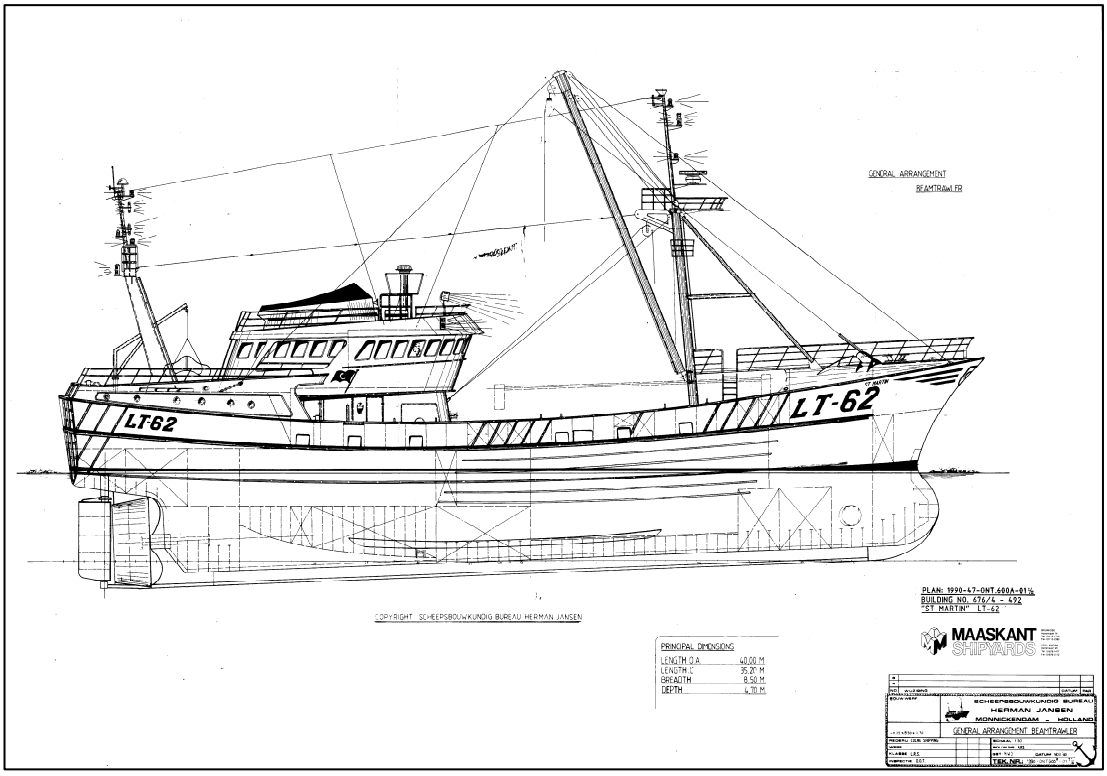


Figure 3b. HENDRIK SENIOR - profile plan.

Name of Vessel	HENDRIK SENIOR
Type	Beam trawler
Port of registry and flag	Lowestoft, UK
Owner	Mr Willem Brands and Mr Jacob Brands of Urk, The Netherlands
Port letters and number	LT 62
Base port	Harlingen, The Netherlands
Year built	1991
Construction	Steel – all welded
Gross tonnage	428
Total length	Registered 35.21 m, overall 40.00 m
Breadth	8.50 m
Draught	6.35 m
Speed	Maximum 13 knots, service 11 knots
Propulsion power	1343 kW
Classification society	Not classed; certified by UK MCA

HENDRIK SENIOR was built in 1991 in the Netherlands; she was one of two sister beam trawlers built for UK owners, and originally classed with Lloyd's Register of Shipping (LR). Originally named ST MARTIN, she operated from Lowestoft until January 2003 when she was sold to her current owners, and re-named HENDRIK SENIOR in March 2003; she was withdrawn from class at that time[1]. HENDRIK SENIOR was a family business, based in Urk in The Netherlands; the family has a great deal of experience in the fishing industry.

On 1 October 2007, the UK Maritime and Coastguard Agency (MCA) had issued HENDRIK SENIOR with an International Fishing Vessel Certificate valid until 14 May 2011.

HENDRIK SENIOR was part of the Anglo-Dutch element of the Non UK Beneficially Owned (NUBO) fishing fleet. Records for 2008[2] indicate that she was one of 32 vessels operated in this way.

Although the vessel was registered in the United Kingdom and operated under a UK Fishing Licence, she was owned and controlled by Dutch interests domiciled in The Netherlands.

An MAIB inspection of the vessel indicated that HENDRIK SENIOR appeared to be well equipped and in generally good condition prior to the accident. Vessel has been scrapped as a result of damage sustained during the collision.

1 As a result, the UK MCA was then responsible for the survey and certification of the entire vessel, with no involvement from LR.

2 Information from the Marine Fisheries Agency (MFA)

Construction. HENDRIK SENIOR was a beam trawler typical of her type and age. A substantial “goal post” style forward gantry supported the fishing derricks; each derrick was approximately 16 m long. A “whaleback” shelter protected the fish processing area on the forward part of the main deck, with an open working deck between the gantry and the deckhouse.

The wheelhouse and all accommodation spaces were aft. The trawl winch was housed in an enclosed compartment below the wheelhouse, at main deck level.

HENDRIK SENIOR was of fully welded steel construction, the hull being subdivided into seven main watertight compartments by steel bulkheads. Within these compartments various fully welded tanks were integrated into the ship’s structure. A full height water ballast tank was situated in the extreme bow, forward of the collision bulkhead.

Immediately aft of the collision bulkhead were the forward machinery room, containing a diesel generator, bow thruster motor, refrigeration plant and ice making machinery. This space was accessed from the main deck, via a hatch under the forward shelter. Aft of this was the fish hold, then a net store (below the winch room), followed by the engine room and steering gear compartment below the deckhouse.

The crew cabins and all domestic service compartments were inside the shelter deck aft, at main deck level. The skipper’s cabin was on the starboard side, on the deck above; directly behind and accessed from the wheelhouse.

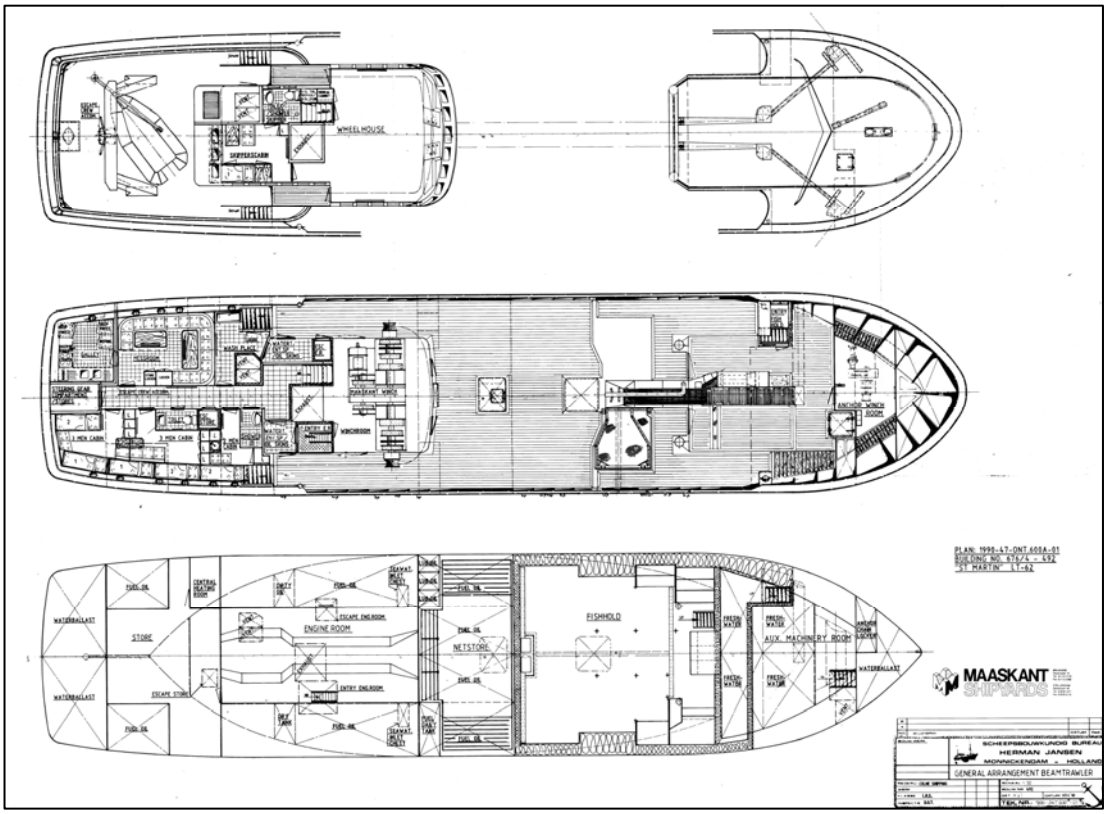


Figure 4. HENDRIK SENIOR – deck plans.

Sister vessel – WILHELMINA

HENDRIK SENIOR's sister vessel, WILHELMINA LT60, (originally named ST MATHEW LT60) also operated from Harlingen under a similar NUBO arrangement. The two vessels often fished in the same area.

Figure 5. HENDRIK SENIOR's sister vessel, WILHELMINA LT60.

1.1.2 Manning

BIRKA EXPORTER

BIRKA EXPORTER was safely manned on the voyage, with sufficient number of crewmembers according to the Minimum Safe Manning Document valid until 28.05.2012 for the vessel.

Duty on the Ship	Number as per Minimum Safe Manning Certificate	Manning at the time of the incident
Master	1	1
Chief Officer	1	1
Deck Officer	1	1
Able Seaman	2	2
Rating. Deck/Engine	1	1
Chief Engineer	1	1
I Engineer	1	1
Repairman	1	1
Cook Steward	1	1
Total	10	10

Experience of the Master and OOW at BIRKA EXPORTER

The master has been at sea since 1979, as officer since 1986 and as master on BIRKA EXPORTER from June 1995. Master held a captain licence issued by the Finnish Maritime Administration.

The OOW has worked as officer at sea since 1998 and as chief officer at BIRKA EXPORTER since June 2008. Chief Officer held a captain licence issued by the Finnish Maritime Administration.

HENDRIK SENIOR

There were six persons on board on HENDRIK SENIOR during the accident voyage.

Skipper. A Dutch national, and a long term fisherman, the skipper went to sea in 1988, aged 16. He had been mate on other vessels, and had been the skipper of HENDRIK SENIOR for two years.

He held a Netherlands Certificate of Competency (COC) permitting him to be the skipper of fishing vessels less than 60 m length, with a propulsion power of less than 3000 kW. As holder of a Netherlands COC he was required to hold a UK Certificate of Equivalent Competency (CEC) to allow him to be skipper a UK fishing vessel. In October 1999, the UK MCA issued him with a CEC, as a Class One (Restricted) Deck Fishing and a Class Two Engineer Fishing. This was the only UK CEC held by any of the crew on board HENDRIK SENIOR.

In 2003 the skipper completed a course on radar observation and plotting, a combined course on the operational use of Automatic Radar Plotting Aids (ARPA) and a radar simulator course; he was then issued a certificate as a radar navigator. The certificate stated that the courses were based on the syllabus for the International Convention on Standards of Training, Certification and Watchkeeping of Seafarers 1995[3] (STCW 95). The course was officially acknowledged by The Netherlands Shipping Inspectorate (NSI).

The Skipper also held a Global Maritime Distress Safety System[4] (GMDSS) General Radio Operators Certificate (GOC). He had completed a UK Seafish Industry Authority (SFIA) safety awareness course, which included accident prevention and risk assessment.

Watchkeeper. A 21 year old fisherman, who was a Dutch national; he trained at a specialised maritime college in the Netherlands, first going to sea in 2004, aged 17. He had previously sailed on board WILHELMINA, and had also sailed on another fishing vessel.

[3] The STCW 95 Convention prescribes minimum standards relating to training, certification and watchkeeping for seafarers which countries are obliged to meet or exceed.

[4] The Global Maritime Distress Safety System (GMDSS) is an internationally agreed-upon set of safety procedures, types of equipment, and communication protocols that are used to increase safety.

The watchkeeper passed a theoretical and practical radar training course in the Netherlands in 2005. The course was very similar to that attended by the skipper, it was an STCW 95 course acknowledged by the NSI. The syllabus included: radar technique theory; the regulations for preventing collision at sea; radar plotting and practical radar training. The watchkeeper also held a GMDSS GOC, and other safety training qualifications issued by The Netherlands. He held a COC issued by The Netherlands in June 2008, allowing him to be skipper of a fishing vessel less than 45 m in length, and a propulsion power of less than 1125 kW in Netherlands trading area one[5]. The same COC permitted him to serve as mate/engineer on a Netherlands Fishing vessel, without limitations. He did not hold any UK CEC, and no application for one had been made at the time of the accident.

Although qualified to act as a bridge watchkeeper, his primary function on board HENDRIK SENIOR was as the engineer. He had sailed in this position for the last year and was therefore fully familiar with both the vessel and the area of operation.

Certificates of Equivalent Competency

Certificates of Equivalent Competency (CECs) are mandated for foreign officers serving in UK registered vessels to ensure they hold an equivalent Certificate of Competence (COC) to those held by UK officers. A component of the CEC requires applicants to sit an aptitude test, known as the UK Legal and Administrative Process (UKLAP) 4. While the CEC does not formally require an applicant to be fully proficient in the English language, owners are required to ensure that at least one officer on board is competent in its use. In the case of HENDRIK SENIOR, only the skipper held a valid CEC. Competency in the English language was not an issue for the skipper or watchkeeper.

[5] *Trading Area one: Coastal waters 30 sea-miles out of the French, Belgium Netherlands, German and Danish westcoast, as far as the line Calais-Dover in the south, and in the north the parallel of 57 N.*(sic)

1.1.3 Wheelhouse arrangement

BIRKA EXPORTER

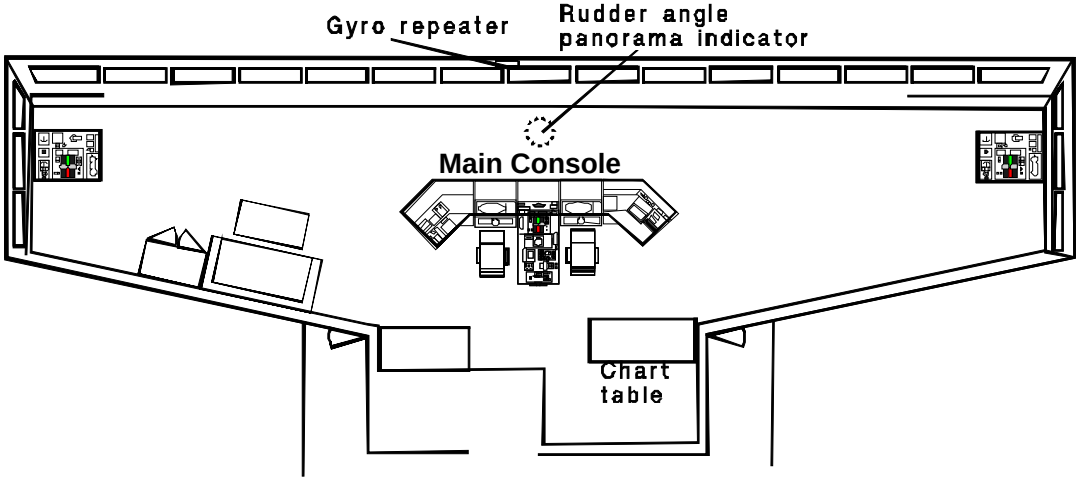
The wheelhouse on BIRKA EXPORTER is closed with covered bridge wings. The navigation console has cockpit lay-out for two persons. Information about the navigation equipment is based on the maritime declaration, the accident report and photos taken on the bridge.

Figure 6. Wheelhouse on BIRKA EXPORTER. The closest chair was the conning position prior the collision.

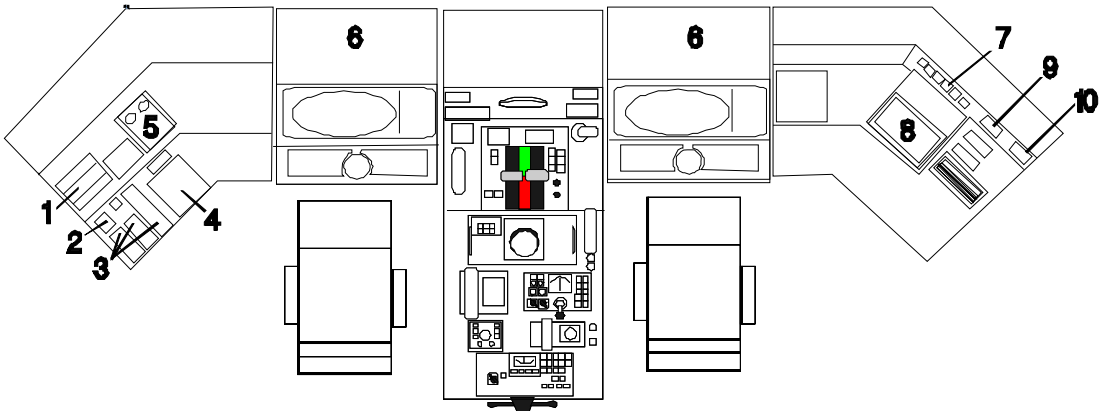
Table 1. Navigation equipments based on the accident report.

Equipment	Type
ARPA Radar in use	SAM 1000
”stand by” ARPA radar	SAM 1000
Gyro compass	Sperry X MK1
Magnetic compass	C.Plath
Autopilot in use	SAM Trackpilot
Echosounder in use	Philips Skipper Mk 10
Satellite positioning equipment	LEICA Mk 10 Philips
Fog-horn	Kockum SOMC

BIRKA EXPORTER had also AIS (Automatic Identification System) onboard. GMDSS (Global Marine Distress and Safety System), two GPS receivers and one DGPS receiver was placed in the chart table area. The ships' main controls, the compass and VHF are between the radars.



Birka Exporter Bridge layout



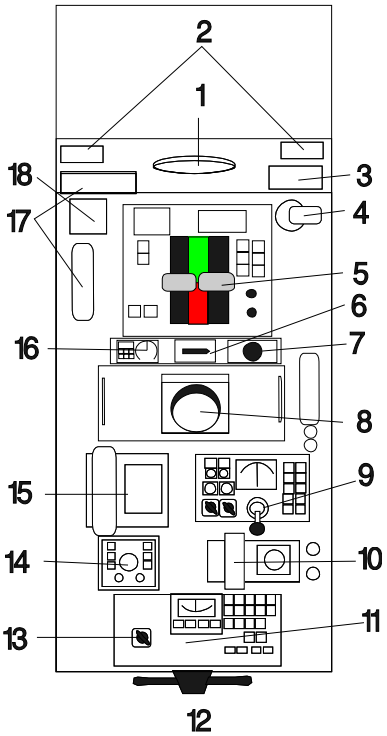
1. *Deck lights*
2. *UPS*
3. *Navigation lights*
4. *Echo sounder*
5. *Two clock's*
6. *ATLAS Radars and Multipilot*
7. *SAJ trim-draught meter. Speed.*
8. *Electronic Chart*
9. *Anemometer*
10. *Voyage Data Recorder, VDR*

Figure 7. Wheelhouse and main console on BIRKA EXPORTER.

The Main Console

The ship's main controls, the compass and VHF are located between the conning positions in the main console. A control for the manual steering is located in front of the compass. Officers can control the ship from both conning positions at any condition with the same controls. The helmsman's position is in the aft end of the main console. The control switch for the steering position is located at the helmsman's position.

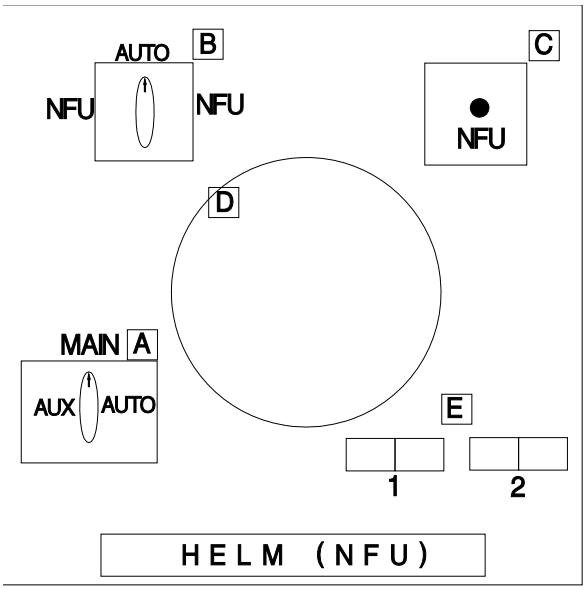
Figure 8. Helmsman's position is in the end of the main console.



1. Angle indicator for the list
2. Window wiper
3. Speed log
4. Morse light
5. Control of the engine
6. Switch for steering mode. NFU or autopilot.
7. Non Follow Up (NFU) steering.
8. Gyro compass
9. Bow thruster
10. Emergency telephone
11. Control panel for rudder pumps
12. Non Follow Up steering for the helmsman
13. Switch for steering positions: Bridge wing, officers conning position or the helmsman.
14. Back up system for engine orders.
15. Internal communication
16. Rudder angle indicator
17. VHF
18. Sign

Figure 9. Commonly used ships' main controls and navigation equipments for both conning positions in the main console.

The selection between different controls for the steering. There is no Follow Up steering onboard. Non Follow Up steering controls are on the bridge wing, Helmsman's position and between the conning positions.



A. MAIN: steering for the helmsman.
AUX: steering for the bridge wings.
AUTO: to Switch B, selection autopilot/NFU
B. Selection between manual (NFU) or autopilot steering (Multipilot)
C. Non Follow Up control between the radars
D. Gyrocompass
E. Rudderpumps
HELM = NFU control.

Figure 10. Wheelhouse steering arrangements.

If the autopilot steering is requested the switch beside the helmsman is switched to AUTO. The control goes then to the NFU/AUTO switch in front of the compass. If this switch is turned to AUTO the control goes directly to the autopilot, which begins to follow the actual heading in the HEADING mode.

If the manual steering is requested, the switch is turned to NFU position and the NFU steering control beside the radar is activated.

HENDRIK SENIOR

HENDRIK SENIOR was conned mainly from one of two chairs mounted in the centre of the wheelhouse, each set back about three metres from the forward windows. Both chairs were raised, generally giving a good view of the horizon; visibility directly astern was more restricted. The "goal post" gantry obscured part of the view directly forward, but visibility from the port and starboard bow, back beyond the beam, was not obstructed.

The main ships' controls and navigation equipment were arranged so as to be conveniently placed for the conning chairs. However, the watch alarm was positioned on a console next to the forward windows; it would have been necessary to leave the chair in order to cancel this alarm. The main engine speed control was also on this console.

Both the skipper and the watchkeeper usually conned HENDRIK SENIOR from the starboard chair.

Wheelhouse equipment

HENDRIK SENIOR's navigation aids and associated equipment included:

- Two Global Positioning System (GPS) units.
- Two radar sets, each provided with an Automatic Radar Plotting Aid (ARPA). The ARPA feature was regularly used.
- Autopilot Robertson AP 45; positioned in front of the starboard chair.
- Cruise control – an automatic system to control ships speed over the ground, by means of varying engine revolutions; this was primarily intended as an aid to fishing. Located above the starboard console.
- Two Digital Selective Calling (DSC) Very High Frequency (VHF) radios.
- Citizen Band (CB) radio – a radio set used for inter-ship communications with other fishing vessels; not a marine VHF radio.
- Electronic chart plotter,
- AIS receiver, but no transmitter (a transmitter was not a statutory requirement).
- Watch alarm - capable of either 3 or 12 minute intervals between reset and alarm. When triggered, the alarm sounds continuously in the wheelhouse for 60 seconds, before activating the general alarm throughout the vessel. *Hendrik Senior* usually operated with the alarm set at 12-minute intervals.

Other equipment

HENDRIK SENIOR was fitted with double tier navigation lights, operated via a combined switch/indication/alarm panel, as is commonly found on larger vessels. During this voyage, she was displaying steaming lights only, consisting of port, starboard, masthead and stern lights. Neither fishing lights nor deck working lights were switched on.

The vessel was provided with a whistle of an approved type, and a signalling lamp.

1.1.4 Cargo

BIRKA EXPORTER carried 45 containers in two tiers on weather deck and 71 trailers on main deck and in the lower hold. All the cargo with total weight of 1457 tons was loaded for Antwerp. The view ahead was unobstructed by the weather deck cargo. The cargo was not damaged in the collision.

HENDRIK SENIOR did not carry any cargo since she was heading for the fishing ground.

1.2 The accident

The descriptions of the event are based on the maritime declaration, Chief Officer and master interviews and VDR recording from BIRKA EXPORTER and Watch keeper and skipper interviews from HENDRIK SENIOR as well as Dutch coastal radar/AIS recordings (HITT system).

1.2.1 Location

The collision took place in position 53 26.50N, 004 32.91E at 05:29:01 UTC in the southbound lane of the Vlieland TSS, near West Terschelling, in international waters off the Netherlands coast. Local time in the area is UTC+1.

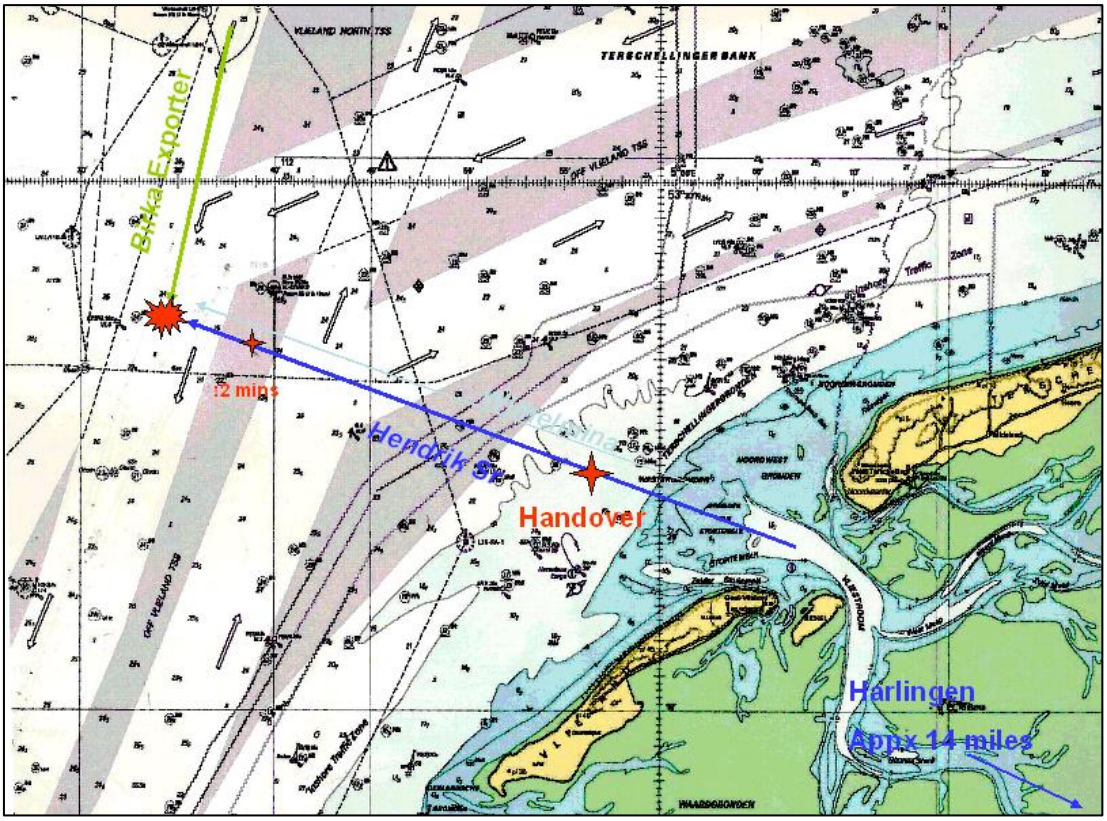


Figure 11. The location of the collision on the chart.

1.2.2 The environmental conditions

At the time of the collision it was a dark, cloudy night, with little moonlight. The sunrise in the area that day was 06:45 UTC. The visibility was good at 7–8 NM, and it was not raining. The wind was force 5–6 (8–13 m/s) from the southwest. The seas were moderate with a 2–3 metre swell running from the west.

Environmental conditions were gradually deteriorating; so the post-accident photographs show them to be slightly worse than those at the time of the collision.

1.2.3 The accident voyage

BIRKA EXPORTER

BIRKA EXPORTER sailed from Helsinki, Finland at 12:00 (UTC+2) on 05.12.2008 with the destination Antwerp, Belgium. Draught was forward 4.75 m and aft 5.45 m.

On the night of the accident Chief Officer took over the watch at 02:00 UTC as the vessel was approaching the Dutch coastal area. Chief Officer as OOW and one lookout were on the bridge. The weather was good with south westerly wind force 6. The Watch alarm was not in use.

At 03:22 UTC one ship was approaching BIRKA EXPORTER at her port bow with no signs of alteration of the course. The ship was heading 011 degrees with the speed of 11 knots while BIRKA EXPORTER was heading 209.7 degrees with the speed of 15 knots. The OOW on BIRKA EXPORTER used the EBL on the ARPA radar and AIS to determine if there was a risk of collision. To clear the situation BIRKA EXPORTER altered the course 17 degrees to starboard when the ship was at a distance of 4 NM (figure 12). There was no radio contact between the two vessels. BIRKA EXPORTER was using 12 NM range on the S-Band radar.

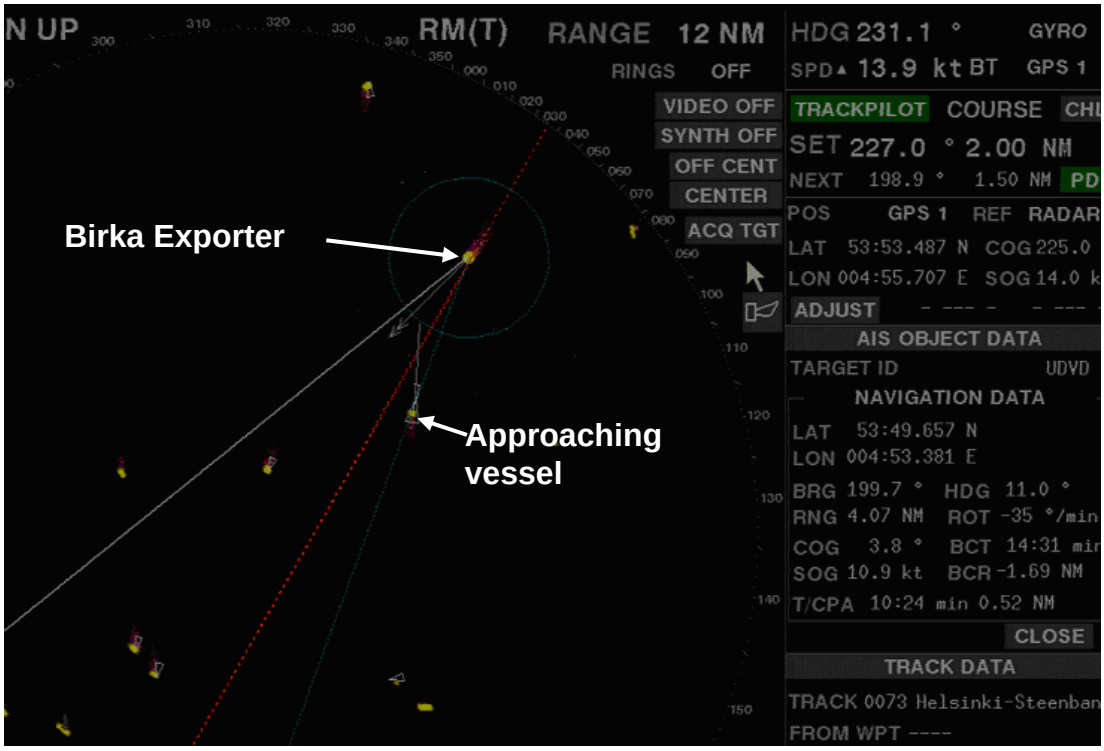


Figure 12. At 03:22 UTC BIRKA EXPORTER altered the course to starboard to avoid a close passing.

Lookout was sent down from the bridge without a releaser exactly at 06:00 ship time (04:00 UTC). According to the master of BIRKA EXPORTER adherence to this fixed

time was the custom onboard. The OOW continued the watch alone on the bridge. There was no watchman available since the next watchman would start to work at 08:00 ship time (06:00 UTC).

BIRKA EXPORTER passed a vessel on her port bow at 04:29 UTC with Closest Point of Approach (CPA) 0.64 NM and the range on the radar was 12 NM. There was heavy traffic in the area. The radar range was changed to 6 NM at 04:54:28 UTC and BIRKA EXPORTER passed a vessel on her starboard bow with CPA 0.46 NM.

At 05:03:13 UTC fishing vessels HENDRIK SENIOR and WILHELMINA could be seen for the first time on the radar screen on BIRKA EXPORTER. Range on the radar was 6 NM, the trails were set to 4 minutes/true and the vector time was 12 minutes.

At 05:23:59 UTC HENDRIK SENIOR and WILHELMINA entered into the ring of 2 NM VRM (Variable Range Marker) on BIRKA EXPORTER radar screen (figure 13). According to the OOW this was the first time he notices the fishing vessels visually and on the radar. He had a clear view ahead unobstructed by the cargo. The fishing vessels changed their headings to go astern of another ship 1.92 NM ahead of BIRKA EXPORTER on her port bow. Trails of HENDRIK SENIOR and WILHELMINA showed that they would pass close to BIRKA EXPORTER.

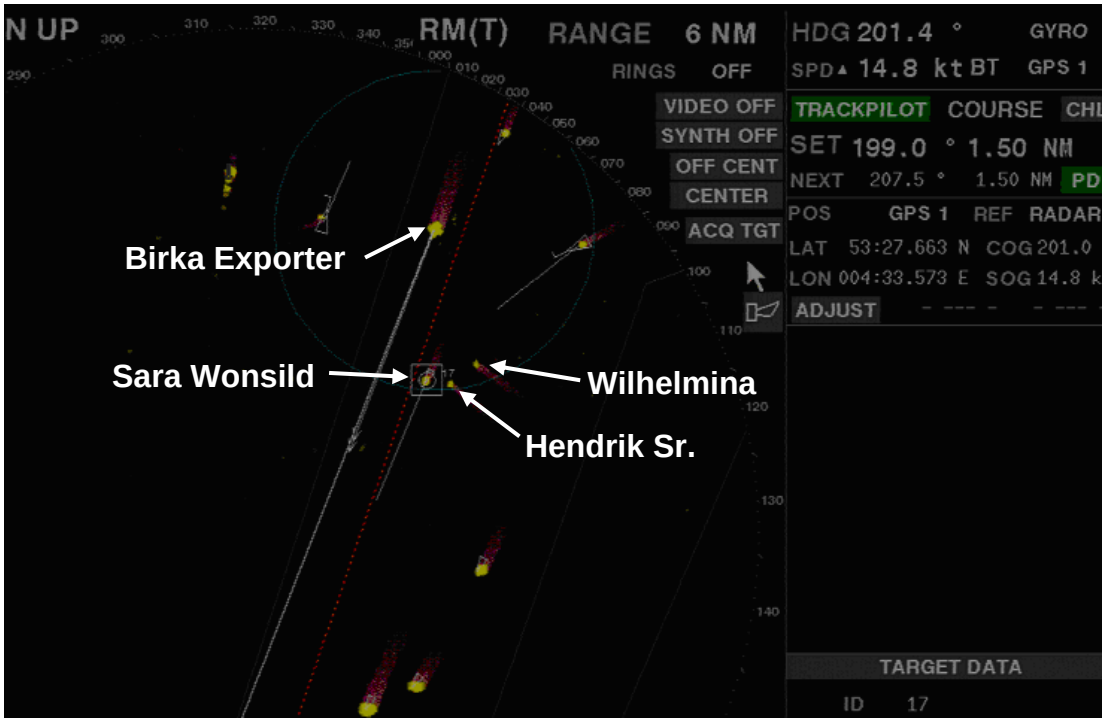


Figure 13. At 05:23:59 UTC fishing vessels HENDRIK SENIOR and WILHELMINA entered the 2 NM VRM area on BIRKA EXPORTER radar screen.

The OOW initiated the plotting of the fishing vessels with ARPA radar about one minute before the collision. WILHELMINA was (at 05:27:44 UTC) in bearing 127.7 degrees and distance 0.53 NM and HENDRIK SENIOR (at 05:27:59 UTC) in bearing 190.2 degrees

and distance 0.51 NM. When the ARPA vectors of the plotted fishing vessels appeared on radar screen, it showed that WILHELMINA would go astern and HENDRIK SENIOR ahead of BIRKA EXPORTER (at 05:28:14 UTC, figure 14). The CPA to HENDRIK SENIOR was 0.007 NM and the BCR (bow cross range) was 0.19 NM (at 05:28:29 UTC).

According to the OOW he was plotting them to get the heading and speed information of the fishing vessels so he would be able to contact them afterwards, to ask if it was necessary to come that close. He was not worried about the fishing boats at this stage because he thought they would pass BIRKA EXPORTER with a close distance as they had done with the previous vessel. AIS data was not available since fishing vessels were not obliged to carry AIS transmitters[6]. At this stage OOW determined that he could not change the course to starboard, because it could cause collision with HENDRIK SENIOR. Neither was he able to slack the speed because WILHELMINA was going astern of BIRKA EXPORTER with a close distance. No attempts to contact the fishing vessels were made by VHF or the whistle.

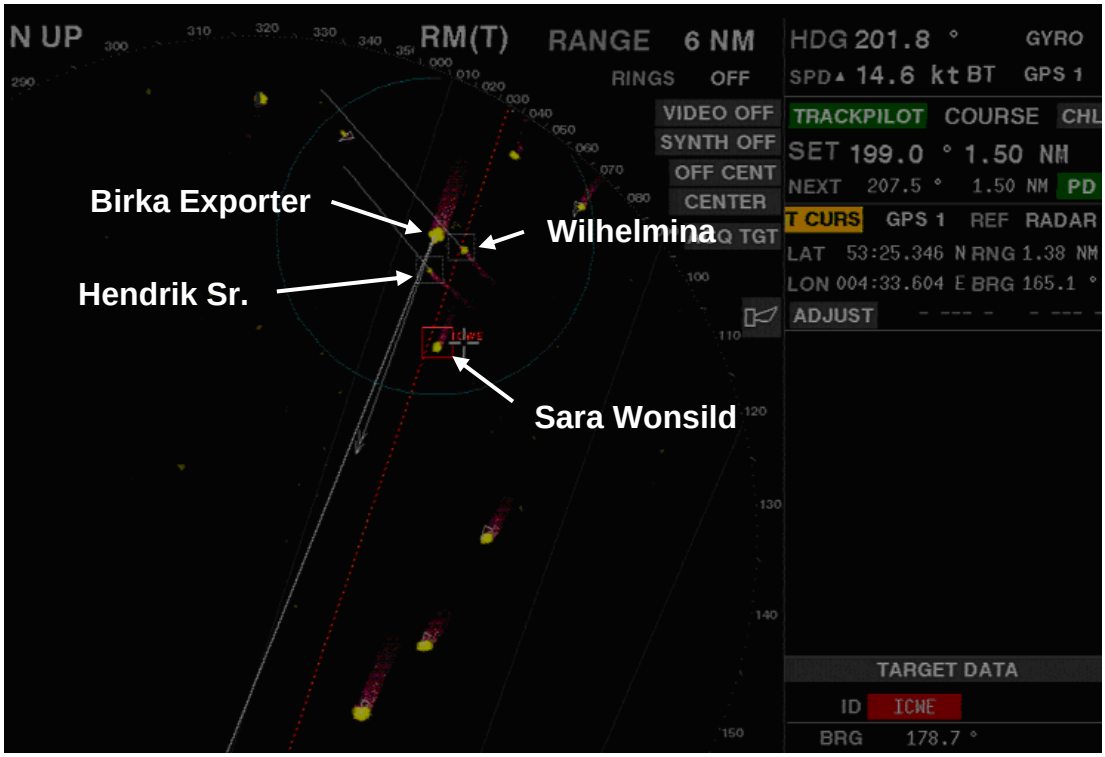


Figure 14. At 05:28:14 UTC (47 seconds before the collision) HENDRIK SENIOR is seen passing ahead of BIRKA EXPORTER with a close distance.

HENDRIK SENIOR passed the bow of BIRKA EXPORTER with a close distance (figure 14) and OOW could see the green and white navigation light on the starboard side. Suddenly HENDRIK SENIOR changed the course towards BIRKA EXPORTER

[6] Directive 2009/17/EC requires that all fishing vessels over 15 m plying in the European waters shall be equipped with AIS not later than 31 May 2014 (length over 24–45 m not later than 31 May 2012)

and OOW could see a red and a white navigation light. The head-on collision occurred at 05:29:01 UTC after HENDRIK SENIOR had turned to starboard practically to the opposite course with BIRKA EXPORTER. Due to the impact forces HENDRIK SENIOR turned 180 degrees to port and slid alongside of BIRKA EXPORTER with their bows pointing in the same direction.

OOW stated that he did not leave the bridge during his watch. The watch alarm was not in use but movements of the cursor on the radar can be seen at all time in the VDR replay. Smoking is not allowed on the bridge on BIRKA EXPORTER and therefore OOW opened the port door behind the bridge to smoke in the door opening. He was not smoking prior the accident.

Events immediately after the collision. OOW called for the master who entered the bridge and took over the command. The ship was stopped. At 05:35 UTC all crewmembers on BIRKA EXPORTER were notified about the accident. The checking of the damages was initiated. The general alarm was not sounded after the collision.

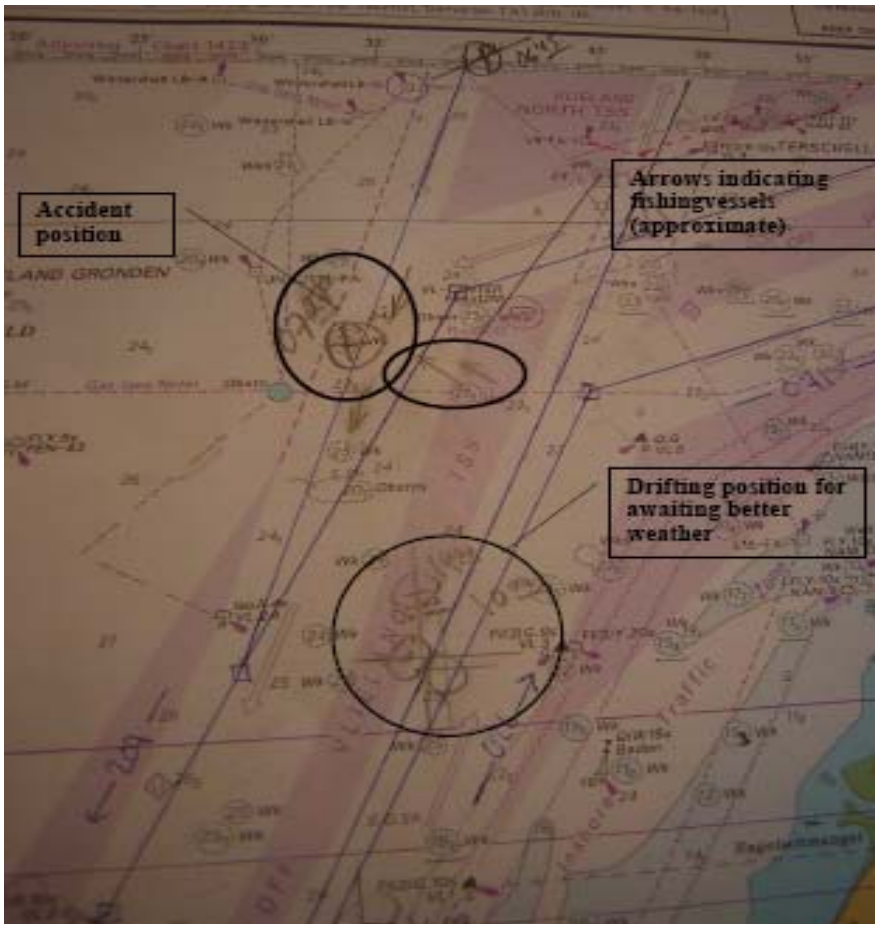


Figure 15. Picture of the chart used by BIRKA EXPORTER at the time of collision.

Master contacted the fishing vessel to check the other ship's condition, name and call sign. Check for damages were completed at 05:40 UTC on BIRKA EXPORTER and damages in the bow were reported.

The master informed the DPA of Birka Cargo at 05:45 UTC about the collision and contacted also the Netherland's coastguard and Den Helder rescue.

All ship tanks had been checked at 05:55 UTC and there were no leaks in any bunker or ballast tank. After a discussion with the DPA of Birka Cargo at 06:30 UTC the decision to go for Amsterdam, as port of distress, was made because the weather forecast was suitable for it. Den Helder Rescue were contacted and they released BIRKA EXPORTER from the scene to proceed to Amsterdam.

Picture of the chart used by BIRKA EXPORTER at the time of collision is in figure 15.

HENDRIK SENIOR

HENDRIK SENIOR usually operated from her home port of Harlingen on a 5-day cycle, fishing from Monday to Friday and returning to port for the weekend. She fished in the North Sea, with catches usually being landed in The Netherlands.

On Friday 5 December HENDRIK SENIOR landed the catch from her previous weeks fishing, at Harlingen. The crew arrived home in Urk late that evening, and the watchkeeper, who was subsequently conning HENDRIK SENIOR at the time of the accident, went to bed at about midnight.

On Sunday, the day before the accident, the watchkeeper attended church in both the morning and the late afternoon, with lunch followed by a short sleep in-between. During Sunday evening he attended a birthday party where he stated that he consumed a negligible amount of alcohol.

The watchkeeper was collected from his home by the vessel's crew bus at about midnight, other crew members were collected and they then drove for about one hour to reach HENDRIK SENIOR in Harlingen.

The crew worked together preparing the vessel for sea, making repairs and alterations to the fishing gear. In order to test the effectiveness of these changes, HENDRIK SENIOR was to be accompanied by her sister vessel, WILHELMINA, so as to undertake comparative fishing trials.

Events after sailing from Harlingen - the skipper's watch. HENDRIK SENIOR sailed from Harlingen for the fishing grounds at about 01:30 UTC (02:30 Local time) on Monday 8 December, accompanied by WILHELMINA.

Shortly after departure four of the crewmembers retired to their cabins to get some sleep. Before going to his cabin, the engineer/watchkeeper completed a check of the engine room, and then went to his cabin at about 02:30 UTC to sleep.

The skipper was on watch alone while HENDRIK SENIOR crossed the Waddenzee[7], heading seawards via the Vliestroom[8].

As is normal practice for beam trawlers when on passage, the derricks were lowered to about 30 degrees above the horizontal; the beam trawl gear remained on deck. This resulted in an effective breadth overall of approximately 33 m.

At 04:30 UTC, HENDRIK SENIOR had left the Vliestroom, and was in a position about 3 NM from the Vlieland traffic separation scheme (TSS). There was some traffic nearby, but BIRKA EXPORTER was not in the vicinity at that time.

The skipper went below and roused the watchkeeper; who collected a soft drink from the galley before going up to the wheelhouse. The watchkeeper was anticipating a duty of about 2 1/2 hours, taking HENDRIK SENIOR across the Vlieland TSS to their regular fishing grounds near the Netherlands gas fields. Once there he would wake the rest of the crew before they started fishing.

The wheelhouse equipment was set up as follows:

- One GPS unit on
- Port ARPA radar on, range 6 NM, Closest Point of Approach (CPA) alarm set at 2 cables. True motion, north up, display centred
- Starboard ARPA radar on, range 12 NM, CPA alarm 2 cables, True motion, north up, display centred
- Autopilot on, course 285 degrees
- Cruise control on, set at 11 knots (speed over ground)
- One VHF radio on channel 16, the other on channel 2. CB radio on
- Electronic chart plotter on, but track function not in use
- AIS receiver on
- Watch alarm on, set at 12 minute intervals; the control key was held by the skipper

After a brief handover to the lone watchkeeper, the skipper went to his cabin to sleep.

The voyage prior to the collision – watchkeeper on duty. The watchkeeper maintained a course of 285 degrees and a speed of 11 knots until buoy VL5, marking the eastern limit of the northbound lane of the Vlieland TSS. Using the autopilot, he then altered course to approximately 310 degrees. As he transited the northbound lane of the TSS, the vessel continued to maintain a steady course and speed.

[7] Waddenzee: A shallow inlet of the North Sea between the West Frisian Islands and the northern Netherlands mainland, it connects with the North Sea through inlets between the West Frisian Islands. The main ports are Den Helder and Harlingen. See British Admiralty chart number 2593.

[8] Vliestroom: The seaway between the Dutch islands of Vlieland and Terschelling. See British Admiralty chart number 2593.

WILHELMINA maintained a parallel course and speed, in position generally about 5 cables to the north, slightly ahead of HENDRIK SENIOR. There were no communications between these vessels until after the collision.

At about 05:10 UTC, HENDRIK SENIOR's watchkeeper first identified BIRKA EXPORTER at about six NM distant, on a south-south westerly heading, using the starboard radar and the AIS receiver. He acquired the target with the ARPA, which indicated a CPA of 3 cables astern of BIRKA EXPORTER; this CPA was acceptable to him. Only one white mast head light on BIRKA EXPORTER was visible at that time.

When the watchkeeper believed that BIRKA EXPORTER was about 8 cables distance, he made a single course alteration of 25 degrees to starboard using the autopilot, so as to pass clear astern of BIRKA EXPORTER. This course alteration was prompted by visual observation rather than information from the radar; however the radar confirmed what he could see outside. The watchkeeper had difficulty in recalling how or when the CPA changed, but he did recall clearly seeing one red port light and one white mast light from BIRKA EXPORTER.

As the vessel turned, the watchkeeper was standing at the front of the wheelhouse. He looked out of the window and saw what he believed to be BIRKA EXPORTER now altering course to port, and closing quickly on HENDRIK SENIOR. He was unable to later explain how he determined that BIRKA EXPORTER was altering to port. At some point he was alerted by the ARPA alarm, and he saw that the CPA had dropped to zero. The watchkeeper tried to turn further to starboard by using the autopilot controls, by simply throwing the control to starboard.

At about 05:29 UTC HENDRIK SENIOR collided with the bow of BIRKA EXPORTER; the aspect between the two ships was close to head on. HENDRIK SENIOR was rolled around the port bow of BIRKA EXPORTER, resulting in the two vessels lying parallel, and facing in the same direction. HENDRIK SENIOR then passed down the port side of BIRKA EXPORTER.

There was no communication between HENDRIK SENIOR and BIRKA EXPORTER until after the collision. No sound or light signals were made by either vessel. HENDRIK SENIOR did not alter speed until after the collision.

The watchkeeper stated that he did not leave the wheelhouse for any reason, and the watch alarm was not heard at any time by other crewmembers on board HENDRIK SENIOR.

Events immediately after the collision. The watchkeeper was thrown off his feet by the impact, and as a result he banged his head. However, he remained conscious throughout, and his injuries required no medical treatment. The watchkeeper put the propeller shaft to stop, but left the main engine running.

The skipper was woken by the collision, and within a few moments he was in the wheelhouse. He saw BIRKA EXPORTER's stern Ro-Ro door on the starboard side of

HENDRIK SENIOR. The other ship was moving away from them. The three remaining crewmembers were also woken by the collision and quickly made their way to the wheelhouse. No formal muster was undertaken, and lifejackets were not donned.

The skipper called WILHELMINA using the CB radio, requesting assistance. Having responded to HENDRIK SENIOR's call, WILHELMINA then contacted the Netherlands Coastguard to raise the alarm.

1.2.4 Injuries to persons

There were no injures to persons in the accident.

1.2.5 Damage to the ships

HENDRIK SENIOR

Afloat. Several surveyors and inspectors, including one from the MCA, boarded HENDRIK SENIOR in Harlingen. In addition to the obvious damage to the forward part of the vessel, extensive damage to the vessel's structure on the starboard side was noted. Frames and shell plating were set in, in way of the cabins, the engine room and the steering compartment.

Figure 16a and b Damages to HENDRIK SENIOR above waterline.

Out of the water

HENDRIK SENIOR was later placed on a ship lift. Very extensive underwater damages were found. As a result of damage sustained during the collision, HENDRIK SENIOR was sent to ship breakers on 10 February 2009.

a)

b)

Figure 17a and b. Underwater damages on HENDRIK SENIOR.

BIRKA EXPORTER

BIRKA EXPORTER suffered damages in the bow above the waterline with a 2m x 6m tear into the forecastle. The bulb had some scratches but no tears due to the ice strengthened bulb. 10 tons of steel plates were replaced in the bow.

a)

b)

Figures 18 a and b.Damages to BIRKA EXPORTER's bow.

1.2.6 Recorders

MAIB inspectors visited BIRKA EXPORTER on the afternoon of 11 December 2008, when she was berthed at Amsterdam for repairs. Data had already been extracted from the Simplified Voyage Data Recorder[9] (S-VDR) by manufacturer's representatives.

Information obtained

Data recorded by the S-VDR included ARPA radar pictures, GPS position, heading, course and speed, as well as audio from wheelhouse microphones and two VHF radio channels. The audio recordings confirm that no sound signals were made, and that there was no radio contact between HENDRIK SENIOR and BIRKA EXPORTER until after the collision.

Ship trajectories were constructed using two sources of information. BIRKA EXPORTER's S-VDR recording included her own position as well as a short period of ARPA target data for HENDRIK SENIOR and WILHELMINA.

The other source of data was the Dutch HITT system (chapter 1.2.7), which monitors and gathers data about vessel movements in Dutch coastal areas. HITT received position messages from BIRKA EXPORTER's AIS-transponder and HITT recording was created using solely that information. Fishing vessels HENDRIK SENIOR and WILHELMINA on the other hand did not have AIS-transponders, so their trajectories were monitored and constructed using ARPA-calculations by HITT.

BIRKA EXPORTER maintained a steady course and speed before the collision. This can be seen from 05:10 UTC onwards in figure 28 and from 05:24:00 UTC in table 2, where the BIRKA EXPORTER's S-VDR data (set course, set radius, heading, rate of turn/ROT, speed over ground/SOG and course over ground/COG) is shown.

Examination of the S-VDR radar recording also showed that HENDRIK SENIOR had two close encounters with other traffic heading south, on the eastern side of the southbound TSS lane, before she collided with BIRKA EXPORTER.

- 05:15:44 UTC HENDRIK SENIOR passed approximately 3 cables astern of a ship travelling in the southbound lane at about 7.5 knots. HENDRIK SENIOR was about 10 NM away from BIRKA EXPORTER at that time (figure 19).

- 05:25 UTC HENDRIK SENIOR passed approximately 3 cables astern of a ship travelling in the southbound lane at 7.5 knots. At that time HENDRIK SENIOR was about 1.6 NM from BIRKA EXPORTER, on a bearing of approximately 180°. HENDRIK SENIOR made no apparent course or speed alterations during these two encounters; no avoiding action appeared to have been taken by either of the two cargo ships, HENDRIK SENIOR just passed clear astern (figure 20).

[9] The S-VDR is fitted to existing cargo vessels according to the revision of SOLAS Chapter V. S-VDR records data and events occurred during navigation, which include: date and time, ship's position, speed, heading, bridge audio, communication audio, radar/ECDIS images and others.

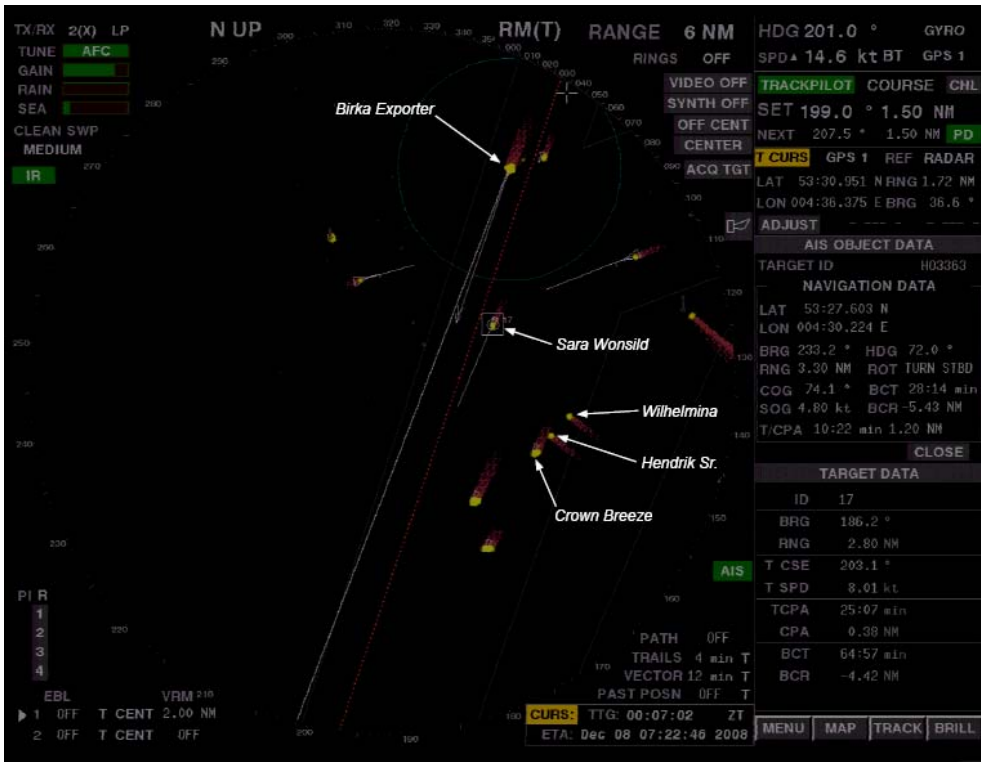


Figure 19. An extract from BIRKA EXPORTER's radar display at 05:15:44 UTC.

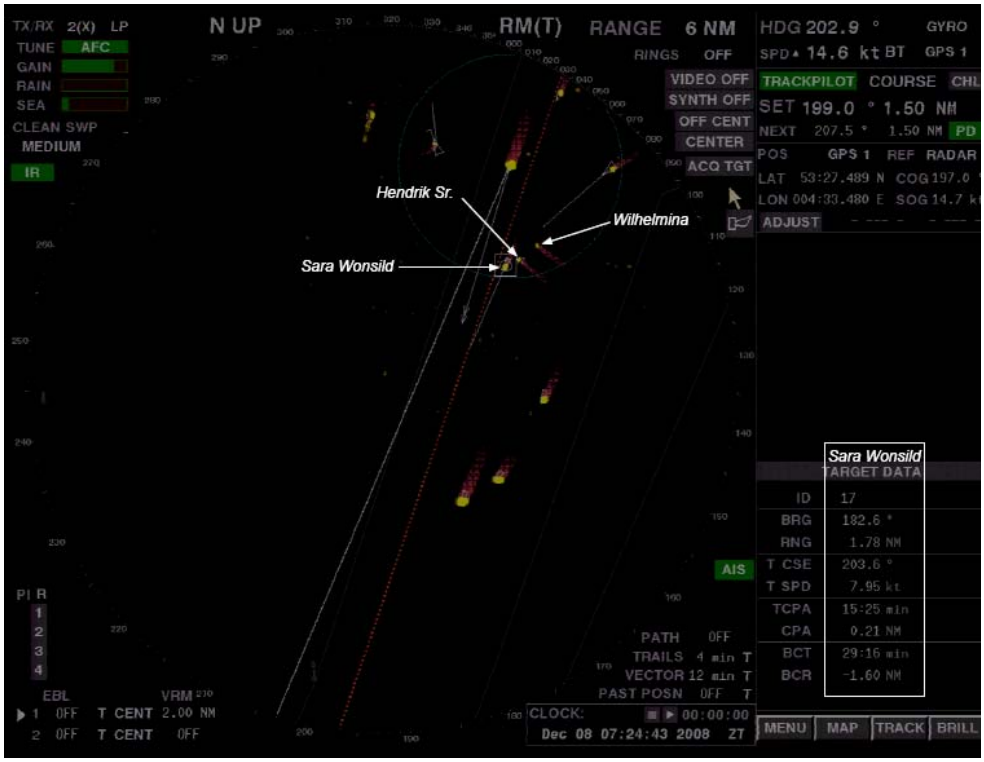


Figure 20. An extract from BIRKA EXPORTER's radar display at 05:24:44 UTC.

Table 2. BIRKA EXPORTER S-VDR data. Collision time based on the VDR Audio is in red.

Time (VDR)	Set Course (VDR Radar)	Set Radius (VDR Radar)	Heading (VDR Log)	ROT (VDR Log)	SOG (VDR/AIS)	COG (VDR/AIS)	HEADING (VDR/AIS)
5:24:00	199	1,5	200.83	-0009.1	14,8	201	201
5:24:30			201.66				
5:25:00	199	1,5	201.89	00015.8	14,5	199,8	201
5:25:30			202.37				
5:26:00	199	1,5	200.80	-0003.2	14,5	201,3	201
5:26:15			200.60				
5:26:30			201.59				
5:26:45			202.49				
5:27:00	199	1,5	199.62	-0029.7	14,8	199,8	201
5:27:15			199.85				
5:27:30			201.37				
5:27:45			201.81				
5:28:00	199	1,5	203.12	00005.0	14,6	199,8	203
5:28:05	199	1,5	202.28	-0011.9	14,6	200,2	203
5:28:10	199	1,5	202.63	-0005.3	14,6	201,4	203
5:28:15	199	1,5	201.44	-0018.1	14,6	200	202
5:28:20	199	1,5	201.54	00013.1	14,7	202,1	201
5:28:25	198,5	1,5	200.11	-0017.1	14,7	200,2	201
5:28:30	198,5	1,5	199.42	00001.4	14,9	201,6	199
5:28:35	198,5	1,5	199.37	00000.0	14,7	199,6	200
5:28:40	198,5	1,5	198.90	-0004.6	14,8	197,8	199
5:28:45	195	1,3	198.75	-0000.6	14,6	198,2	199
5:28:50	195	1,3	199.04	-0001.7	14,4	197,8	199
5:28:55	207	1,3	198.99	00014.9	14,5	196,8	198
5:29:00	207	1,3	198.80	00002.1	14,6	197,4	199
5:29:05	207	1,3	199.25	00013.3	14,6	197,4	199
5:29:10	207	1,3	198.58	-0021.2	14,1	197,2	200
5:29:15	207	1,3	197.35	-0004.9	13,4	195,6	197
5:29:20	207	1,3	197.12	-0001.1	10,7	196,5	198
5:29:25	207	1,3	199.70	00022.0	9,5	192,9	199
5:29:30	207	1,3	201.38	00015.3	8,5	190	201
5:29:35	207	1,3	202.72	00023.2	8,1	190,5	202
5:29:40	207	1,3	203.48	00025.7	7,6	187,9	202
5:29:45	207	1,3	204.78	00009.9	7,5	188,7	205
5:29:50	207	1,3	206.60	00030.3	7,2	188,5	206
5:29:55	207	1,3	207.71	00010.0	6,9	189,3	208
5:30:00	207	1,3	210.50	00034.3	6,5	189,4	209

According to table 2 the autopilot Set Course on BIRKA EXPORTER was 199 degrees until 35 seconds before the collision.

Further examination of the S-VDR also showed that at:

- 05:26:59 UTC WILHELMINA made a course alteration to starboard of about 10 degrees. This took her astern of BIRKA EXPORTER.
- 05:28:25 UTC BIRKA EXPORTER's autopilot Set Course was changed from 199 to 198,5 degrees.
- 05:28:29 UTC BIRKA EXPORTER's ARPA had been used to target HENDRIK SENIOR and WILHELMINA. The ARPA showed HENDRIK SENIOR bearing 191.5 degrees, range 0.33 NM, course 328.9 degrees, speed 11 knots, Time to Closest Point of Approach (TCPA) 0.50 minutes, CPA 0.07 NM. At about this time HENDRIK SENIOR had made or was making the first course alteration to starboard that is discernible when viewing BIRKA EXPORTER's radar replay.
- 05:28:44 UTC *BIRKA EXPORTER*'s ARPA shows HENDRIK SENIOR bearing 195.7 degrees, range 0.22 NM, course 335 degrees, speed 11.1 knots, TCPA 0.32 minutes, CPA 0.06 NM. BIRKA EXPORTER's autopilot Set Course was changed from 198,5 to 195 degrees.

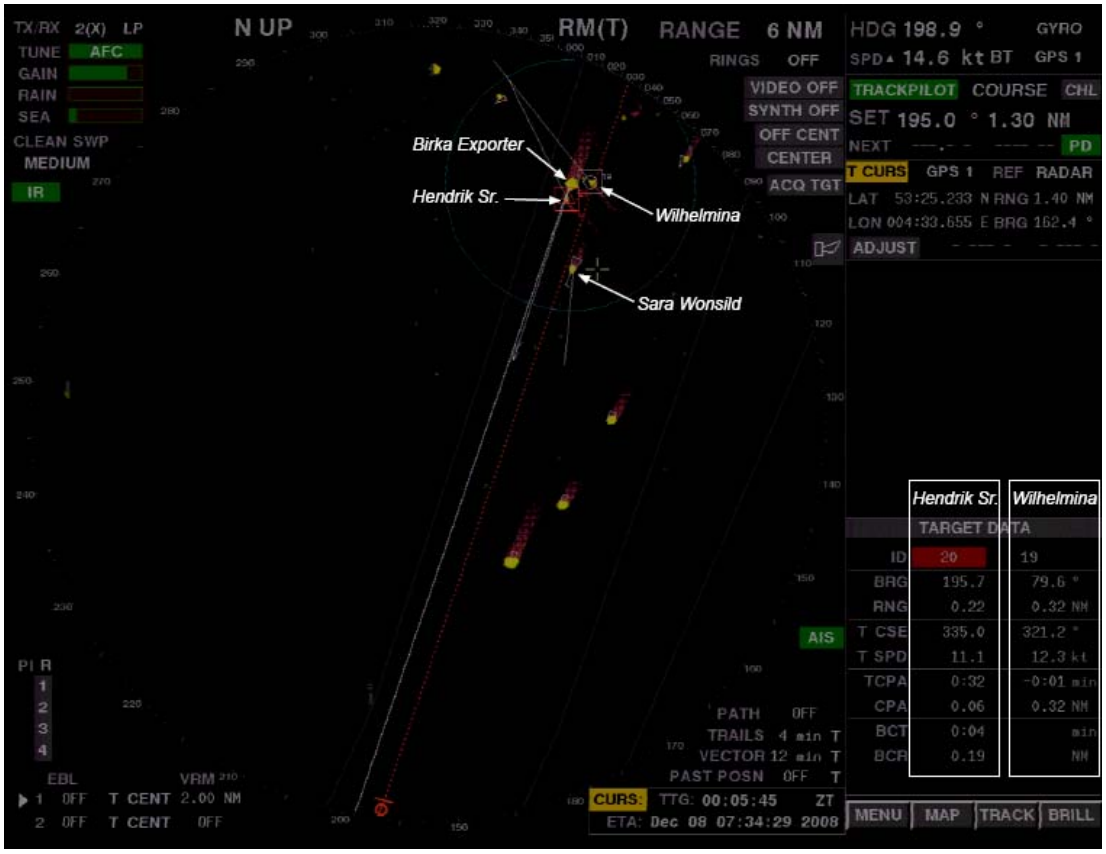


Figure 21. 05:28:44 UTC BIRKA EXPORTER's ARPA shows HENDRIK SENIOR target data.

The numerical values of HENDRIK SENIOR and WILHELMINA as ARPA targets in the radar pictures of BIRKA EXPORTER's VDR can first be seen at 05:28:29 UTC. Thus the ARPA calculation takes more than 15 seconds as the target acquisition had been started a little more than half a minute earlier before 05:28:00 UTC for both vessels (the VDR records only four pictures of the radar within a minute).

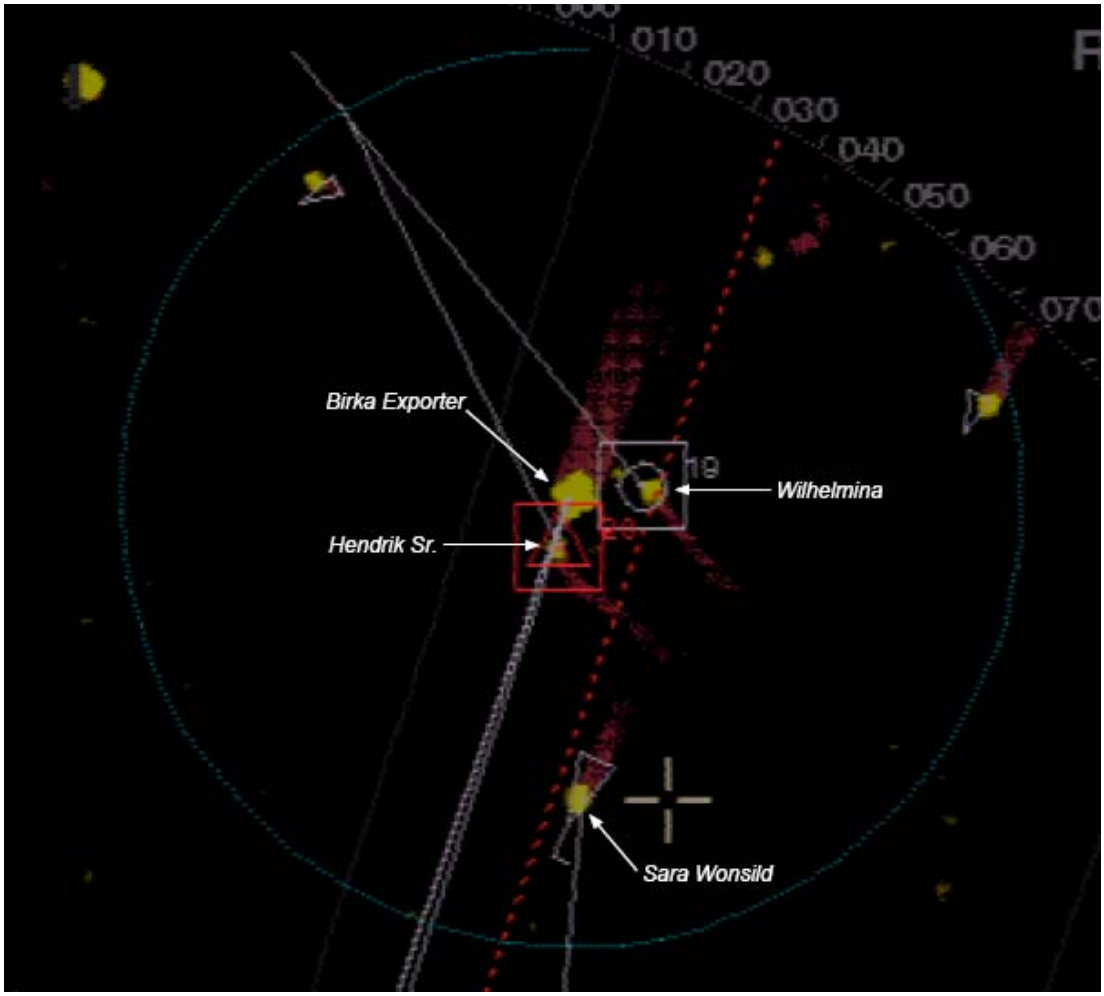


Figure 22. Close passing of BIRKA EXPORTER. Enlargement of figure 21 at 05:28:44.

- 05:28:44 UTC HENDRIK SENIOR can be seen crossing very close ahead of BIRKA EXPORTER, CPA shown as 0.06 NM. HENDRIK SENIOR was seen to be on BIRKA EXPORTER's ARPA vector (set at 12 minutes), resulting in a very small gap between the two vessels (figures 21 and 22). WILHELMINA passed approximately 3.2 cables astern of BIRKA EXPORTER.

- 05:28:55 UTC BIRKA EXPORTER's autopilot Set Course was changed from 195 to 207 degrees. Due to the two small Set Course changes since 05:28:29 the heading of the vessel had changed from 201 to 198,99 degrees.

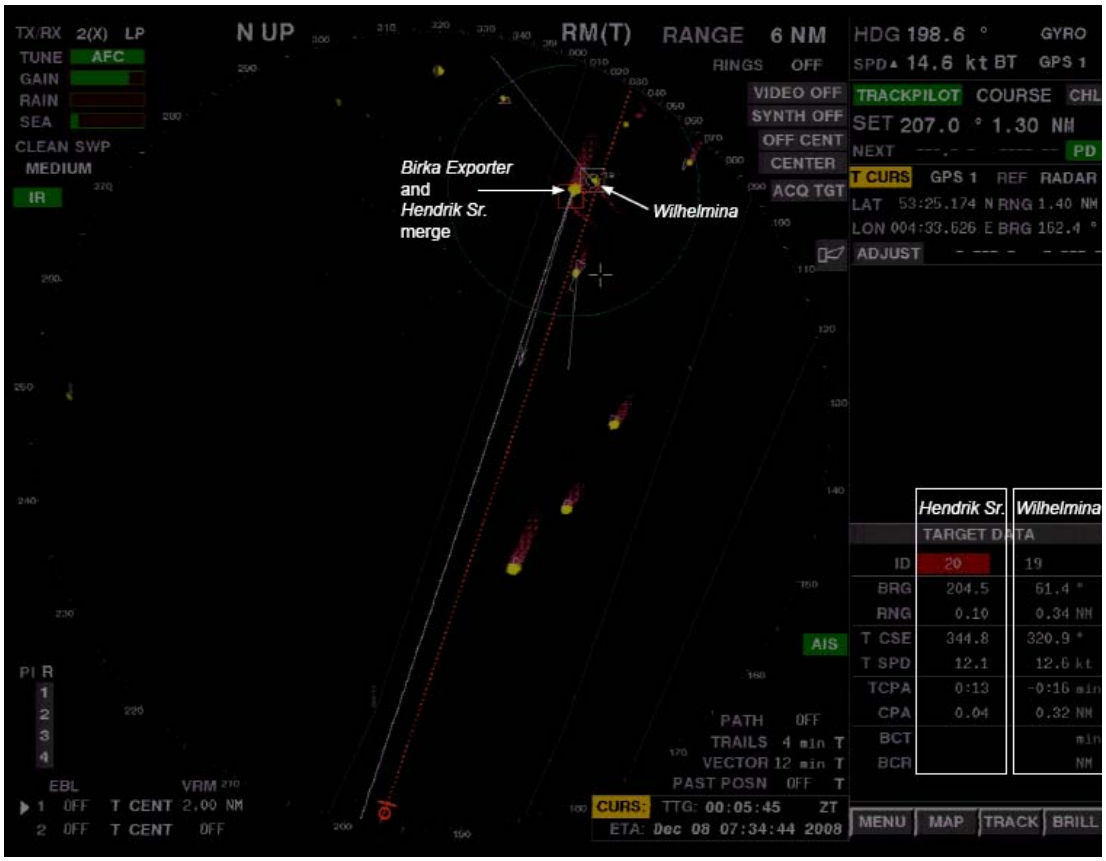


Figure 23. 05:28:59 UTC, at about this point the radar targets for HENDRIK SENIOR and BIRKA EXPORTER did merge.

- 05:28:59 UTC HENDRIK SENIOR can be seen in bearing 204.5 degrees, range 0.10 NM, course 345 degrees, speed 12.1 knots, TCPA 0.13 minutes, CPA 0.04 NM. At about this point the radar targets for HENDRIK SENIOR and BIRKA EXPORTER did merge (figure 23).

- 05:29:01 UTC BIRKA EXPORTER's VDR audio recorded the moment of impact.
- 05:29:05 UTC BIRKA EXPORTER's speed started to slow down from 14,6 knots and at 05:30 UTC it was 6,5 knots.
- 05:30:14 UTC WILHELMINA altered course, in order to return to assist HENDRIK SENIOR.
- 05:34 UTC The first VHF radio contact was recorded; from the master of BIRKA EXPORTER to the skipper of HENDRIK SENIOR.

WILHELMINA is also seen to maintain a generally parallel course and speed, in a position about 5 cables to the north of HENDRIK SENIOR throughout; this resulted in her passing clear of other vessels.

BIRKA EXPORTER did not alter course, either towards or away from HENDRIK SENIOR. During the last minute before the collision both the heading and COG changed from 203 to 199 degrees.

1.2.7 Functioning of the VTS and monitoring systems

The Vlieland TSS is not a Vessel Traffic Services[10] (VTS) area; it is under radar observation only.

MAIB inspectors visited The Netherland's Coastguard centre at Den Helder on 10 December 2008; this was after the inspectors had boarded HENDRIK SENIOR at Harlingen. After viewing a recording of the incident, target lists and incident plots were obtained from the coastguard computer system.

The information provided by the coastal radar station usually consisted of an electronically processed composite of both radar and AIS data. When no AIS information exists, as for HENDRIK SENIOR, the recording consists of radar information only. The MAIB was advised that it is possible that minor discrepancies in the relative positions between different vessels might exist. System time is taken from the GPS and it is possible that some minor delays can arise during signal processing.

Information obtained – Target lists

The MAIB was supplied with tables of target listings, for both HENDRIK SENIOR and BIRKA EXPORTER. These documents record the target's GPS position, course and speed, every three seconds.

From 05:10 UTC to 05:28 UTC HENDRIK SENIOR was consistently recorded as being on a course of between 307 degrees and 312 degrees, with a corresponding speed of between 10.5 and 11.5 knots. The first clear signs of a turn to starboard[11] are at 05:28:34 UTC, with 340 degrees achieved at 05:29:10 UTC. HENDRIK SENIOR's speed remained steady throughout the turn.

Over a similar time period according to the HITT recording BIRKA EXPORTER maintained steady course of 197 to 200 degrees and a speed of 14,5 knots until 05:29:40 UTC, when there was some indication of a course alteration to starboard and a reduction in speed [12] (see figure 28).

Information obtained – Incident plots

The radar station's graphical plots showed that HENDRIK SENIOR had two close encounters with other traffic heading south, on the eastern side of the south bound TSS lane, before she collided with BIRKA EXPORTER. The first close encounter was at approximately 05:16 UTC, when HENDRIK SENIOR passed less than 3 cables astern of a coaster[13] travelling in the southbound lane at 7.5 knots (figure 24).

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10 Vessel Traffic Services: a service implemented by a competent authority, designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area.

11 It was later confirmed that this turn commenced about 25 seconds before impact.

12 It was later confirmed that this alteration was after the impact (see 1.6.2 below)

13 Identified by AIS as MV *Crownbreeze,* 2600 GT, LOA 90m, Dutch flag.

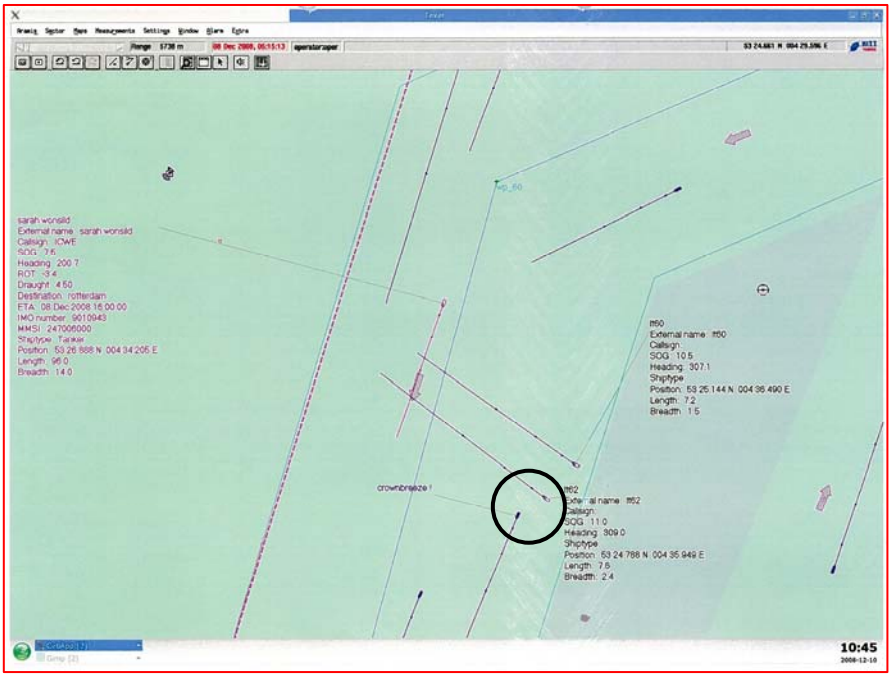

Figure 24. The first close encounter (within the circle) at approximately 05:16 UTC.

The second close encounter was at approximately 05:25 UTC, when HENDRIK SENIOR with a CPA of approximately 2.6 cables, passed astern of a chemical tanker[14] travelling in the south-bound lane at about 7.5 knots (figure 25).

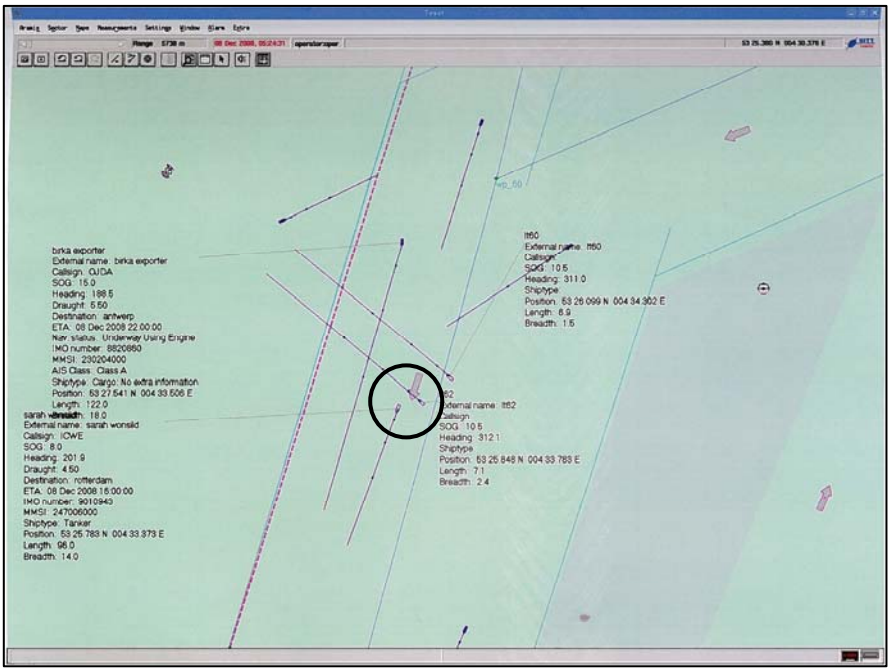

Figure 25. The second close encounter (within the circle) at approximately 05:25 UTC.

[14] Identified by AIS as MV *Sarah Wonsild,* 2349GT, LOA 96m Italian flag.

HENDRIK SENIOR made no discernible course or speed alterations during these two encounters. She continued on a steady course and speed throughout; course about 310 degrees and speed 11 knots (figure 26).

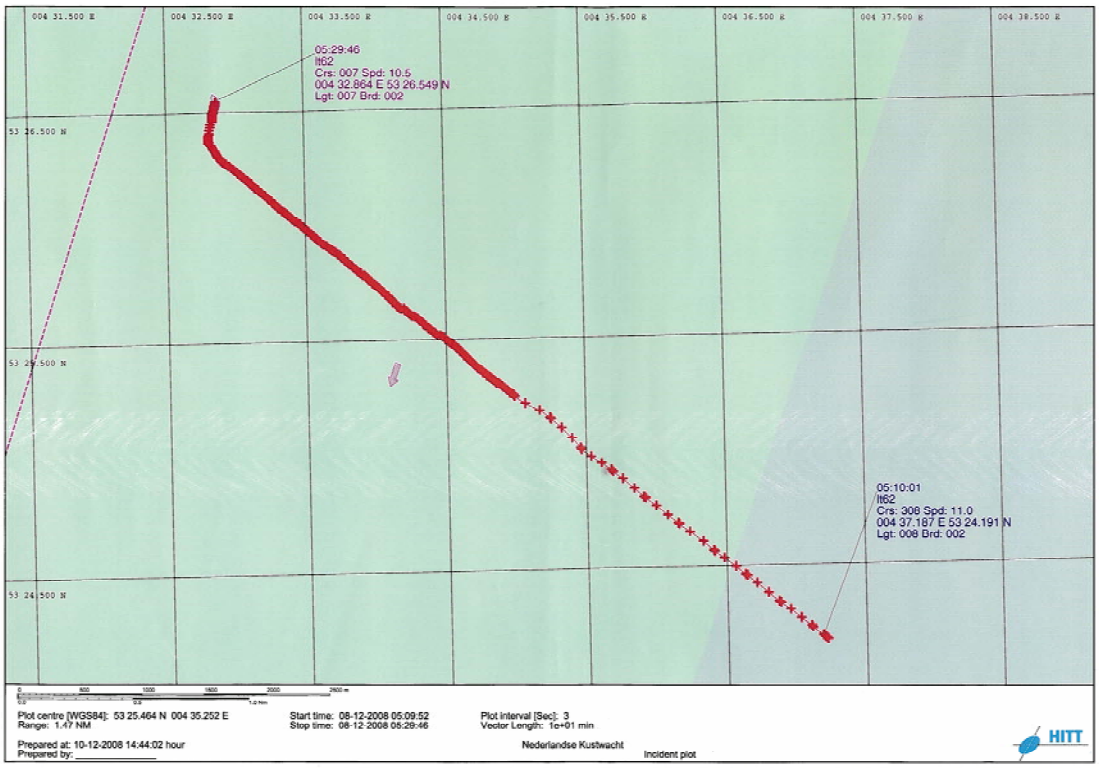

Figure 26. HENDRIK SENIOR made no discernible course or speed alterations during these two encounters.

A further series of plots shows that HENDRIK SENIOR was predicted to pass ahead of BIRKA EXPORTER at a CPA of about 1–1.4 cables; these plots cover a period of over 4 minutes before impact. However, perhaps due to the limitations described in point 1.2.7 this recording also appear to show HENDRIK SENIOR having passed clear ahead at a CPA of 0.2 cables. (The analysis of this is in 2.4.)

Between 05:28:40 and 05:28:49 UTC HENDRIK SENIOR had started a very late course alteration to starboard (figure 27). The relative positions of the vessels according to these recordings are perhaps debatable. However, the shore radar system clock indicates that this significant course alteration was within about 15 seconds of impact (which took place at 05:29:01 UTC).

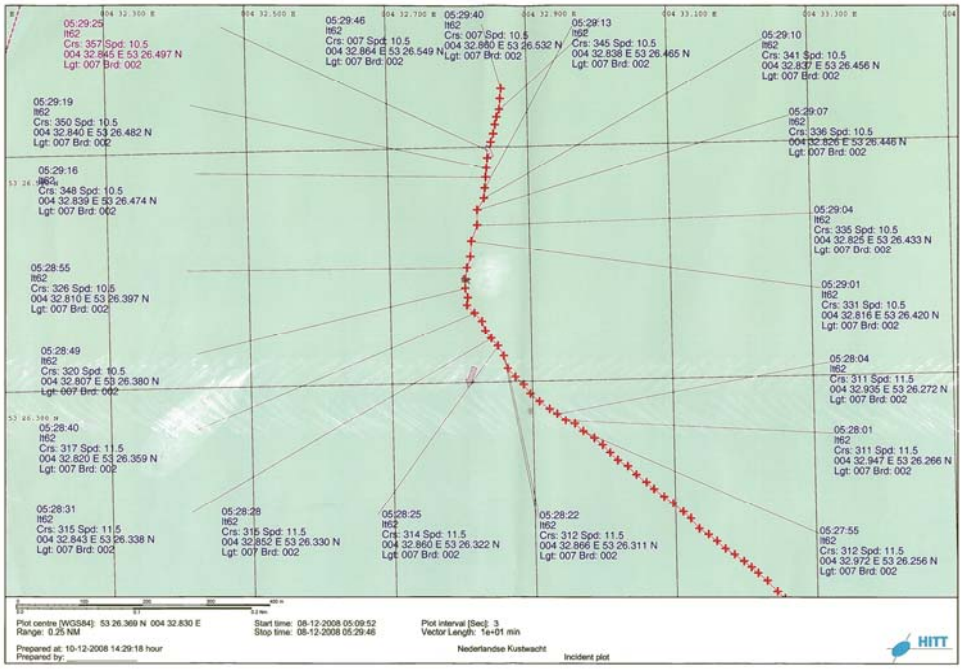

Figure 27. Alteration to starboard by HENDRIK SENIOR.

Coastal radar data shows BIRKA EXPORTER continuing on a steady course and speed until the impact; a slight deviation to starboard was then detected in the seconds immediately after the impact (figure 28).

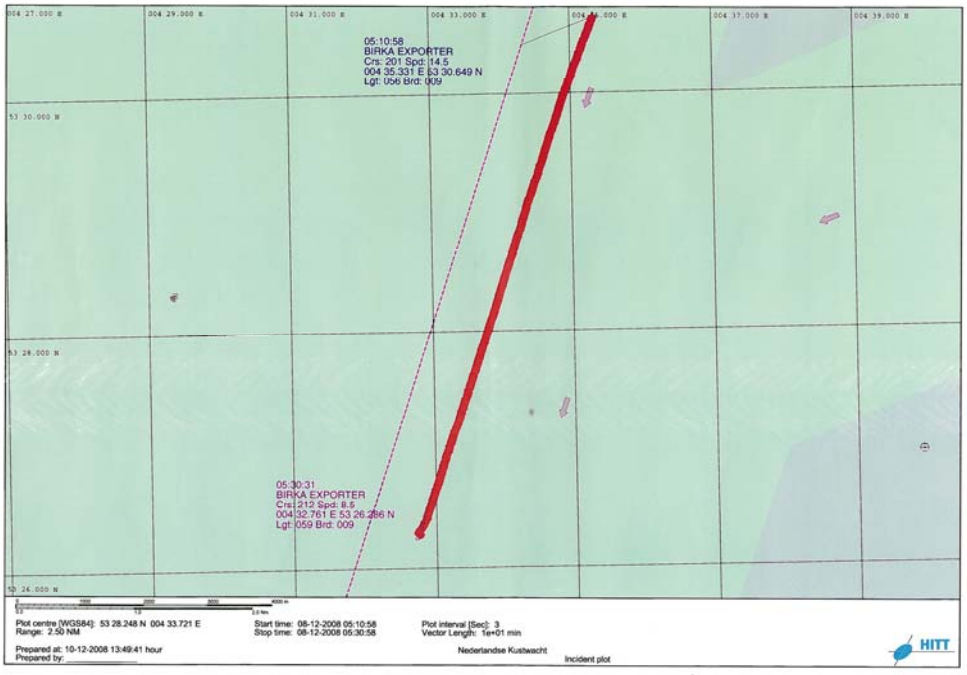

Figure 28. BIRKA EXPORTER keeping steady course and speed.

The same data shows WILHELMINA continuing on a generally steady course and speed, in a position 4–5 cables to the north of HENDRIK SENIOR. WILHELMINA passed about 3 cables astern of BIRKA EXPORTER.

1.3 Rescue operations

Both BIRKA EXPORTER and WILHELMINA stopped and stood by HENDRIK SENIOR after the collision. Both vessels called the Netherland Coastguard to report the collision and to seek assistance; two KNRM[15] lifeboats and a Netherlands Coastguard vessel attended.

On board HENDRIK SENIOR, it was quickly realised that she was very badly damaged, and in danger of sinking. Inspection showed that both the forward machinery room (FMR) and the fish hold were flooding. Material damage to the gantry, derrick and wheelhouse was evident

Figure 29 HENDRIK SENIOR followed by a lifeboat.

The flooding of the FMR was catastrophic, and the access hatch had been crushed by the impact. The crew had to cut a new access using an angle grinder; they eventually managed to rig salvage pumps supplied by the lifeboat, allowing them to control the

[15] The Royal Netherlands Sea Rescue Institution (Koninklijke Nederlandse Redding Maatschappij) was established in 1824 as a maritime life saving organisation, rendering its services free of charge. The Institution's 64 lifeboats are manned by professionally trained volunteers.

flooding. Water ingress to the fish hold was less serious and was contained using the vessel's bilge pumps.

No injuries were reported by any of the crew, and there was no significant pollution.

BIRKA EXPORTER was released by the coastguard and then continued to Amsterdam for repairs. One of the lifeboats, together with WILHELMINA initially accompanied HENDRIK SENIOR. Once released by the coastguard, WILHELMINA then continued on to the fishing grounds. The lifeboat continued to escort HENDRIK SENIOR until berthed in Harlingen.

1.4 Other investigation topics

1.4.1 Safety Management System on BIRKA EXPORTER

The Safety Management Certificate is valid from 8 May 2008 to 7 May 2013. Completion date of the survey on which this certificate is based on is 10 March 2008. The working language is Swedish onboard and all documentation regarding the Safety Management System is in Swedish.

Chapter 5 Ship administration / Routines in the deck department

Bridge Routines / At sea

- *OOW is responsible for the safety of the ship during his watch*
- *OOW shall be familiarized with the bridge equipments*
- *OOW shall be on the bridge at all time*
- *OOW shall follow existing rules and regulations, master's orders and the instructions for the OOW in the wheelhouse poster on the bridge.*
- *During darkness and in bad visibility one watchman/ lookout shall be posted on the bridge.*
- *OOW may not be doing things which may hazardous the safety of the ship.*
- *The planned route shall be followed*
- *At least one radar needs to be running*
- *Ships logbook and radio logbook shall be kept during the watch*

Masters night order book

Masters night order book shall be on the bridge and used by the OOW.
Masters night order book can consist:

- *Standing orders*
- *Instruction for the night*
- *Pilot ordering and details regarding it*
- *When the master shall be notified*
- *Ship at anchor and preparing of the main engine and if the ship is drifting*
- *Instructions regarding bad visibility*
- *Increasing or decreasing of the speed*
- *Other special circumstances and/or situations that can occur*

There were no remarks in the Masters night order book during the accident voyage.

Chapter 6 Safety system, Instructions and checklist
Accident to the ship / Collision / The ship

- *Sound the General alarm, muster all crewmembers*
- *Alarm the MRCC*
- *Consider the possibilities to abandon the ship*
- *Establish contact with the other vessel and exchange all important information*
- *Offer your help to the other ship if possible*
- *Collect all facts about the incident*
- *Update the position when needed and keep it beside the radio panel and other automatic transmitters.*
- *Evaluate the risk of pollution. In case of pollution check the SOPEP plan*
- *Check the stability*
- *Inform the company*
- *Be continuously in contact with MRCC and the company's emergency group*
- *Master of the ship is in charge of the operations onboard and makes the decisions together with the possible present authorities and executive group onboard.*
- *Inform if needed all the ships in vicinity*
- *If the ship is sinking send the distress message "Mayday" and activate the EPIRB and the SART.*
- *Master makes the decision of evacuation and arranges it together with the OSC and MRCC.*
- *In case of evacuation a list of evacuates shall be made and injured people's priority to be defined.*

Additionally items are listed under heading ***The Company*** about how to support the ship in case of a collision.

1.4.2 Skipper's standing orders on HENDRIK SENIOR

There were no written skipper's orders for the management and operation of HENDRIK SENIOR. However, the skipper had issued verbal instructions that if there was any problem or concern of any kind, and then he was to be called immediately. Various crewmembers had called out the skipper in the past, but no call was made during this voyage.

The skipper had set a CPA of 2 cables on the ARPA radars, primarily as he had found that this was an effective setting when fishing; he had found that any greater CPA resulted in very frequent alarms. However, the 2 cable setting was also used for the passage to and from the fishing grounds as the skipper had confidence in his watchkeepers, and allowed them to make their own judgment concerning safe passing distances.

1.4.3 Keeping a safe navigational watch - Guidance

UK. Several publications contain relevant advice for skippers and watchkeepers on the essentials of keeping a safe navigational watch; among these are:

- Marine Guidance Note[16] (MGN) 313 (F) – Keeping a safe navigational watch on fishing vessels
- MGN 137 (M+F) – Lookout during periods of darkness and reduced visibility

The above publications[17] emphasise the following points, inter alia:

- Watches must be kept by competent people
- A proper lookout should be kept at all times, especially during the hours of darkness
- The vessel's position should be checked by all available means
- The activities of all other vessels in the area should be monitored
- Sufficient rest should be taken before a watch,

Finland. At the time of the accident there were two regulations about watchkeeping in force in Finland. The Ministry of Traffic had given a Decision on the watchkeeping (19.12.1997/1257). This decision was based on a Degree on ship's manning, competence and watchkeeping (19.12.1997/1256) and according to it the principles of STCW Convention were to be followed. The contents of the decision of watchkeeping included same topics as in the UK publications referred to above.

The Finnish Maritime Administration (since 1 January 2010 Finnish Transport Safety Agency TraFi's Maritime Sector) is not issuing any further guidance regarding keeping a safe navigational watch interpreting the international regulations.

1.4.4 COLREGS

Background

Implementation in UK. The Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations 1996 (COLREGS) are published by the MCA as Merchant Shipping Notice 1781 (M+F)[18]. This Notice and the Rules referred to within it are an integral part of the Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations 1996. These Regulations implement the Convention on the International Regulations for Preventing Collisions at Sea, 1972, as amended. They enhance safe navigation, by prescribing the conduct of vessels underway, specifying the display of internationally-understood lights and sound signals, and set out collision avoidance actions in close-quarters situations.

[16] Marine Guidance Notes are published by the UK MCA, and give significant advice and guidance relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.

[17] MGN 313 is freely available from the MCA website, see http://www.mcga.gov.uk/c4mca/mcga07-home/shipsandcargoes/mcga-shipsregsandguidance/marinenotices.htm

[18] Freely available from the MCA website, see http://www.mcga.gov.uk/c4mca/msn_1781-2.pdf

Implementation in Finland. The International Regulations for Preventing Collisions at Sea, 1972, have been implemented in Finland by a degree (17.6.1977/538). The degree includes also the translation of the regulations into Finnish. The subsequent amendments to the convention have been ratified and implemented in due course. Also in the Decision on the watchkeeping (19.12.1997/1257) it is stated, that the OOW is responsible of the safe navigation and to abide by the COLREG rules.

Steering and sailing rules particularly relevant to this case

Section I – Conduct of vessels in any condition of visibility

- Rule 5 - duty to maintain a proper lookout
- Rule 7 - duty to assess risk of collision
- Rule 8 - actions to avoid collision
- Rule 10 - traffic separation schemes

Section II - Vessels in sight of one another

- Rule 15 - crossing situations
- Rule 16 - actions by give-way vessel
- Rule 17 - actions by stand-on vessel

1.4.5 Previous Incidents

MAIB Analysis of UK Fishing Vessel Safety - 2008[19]

The 2008 MAIB fishing vessel safety study reveals that, during the period 1992 – 2006, 12 fishermen lost their lives as a result of accidents involving collisions - 4.7 % of all fatalities as a result of accidents to fishermen during this period.

MAIB Bridge Watchkeeping Safety Study - 2004[20]

In 2004 the MAIB published a Bridge Watchkeeping Safety Study. The study reviewed 1,647 collisions, groundings, and contacts and near collisions involving merchant vessels over 500GT reported to the MAIB between 1994 and 2003.

In relation to collisions, the study found that:

- 65% of vessels involved in collisions were not keeping a proper lookout
- 73% of collisions involved improper or poor use of radar
- 33% of all accidents that occurred at night involved a sole watchkeeper on the bridge,

The study also concluded that there were 995 near collisions (hazardous incidents) voluntarily reported to the MAIB during this time, 342 of which were between fishing vessels and merchant vessels of over 500gt.

[19] All MAIB publications are freely available from our website. See MAIB report on the Analysis of UK Fishing Vessel Safety 1992 – 2006.
http://www.maib.gov.uk/publications/safety_studies/fishing_vessel_safety_study.cfm

[20] MAIB Bridge Watchkeeping Safety Study 1/2004,
http://www.maib.gov.uk/publications/safety_studies/bridge_watchkeeping_safety_study.cfm

MAIB Analysis of Fishing Vessel Accident Data - 2002[21]

The MAIB analysis of fishing vessel accident data published in 2002, noted that there were 264 UK fishing vessel collisions reported to the MAIB during the period 1992 to 2000. In those incidents investigated, over 90% of the contributory factors identified were human. Twenty-three of the fishing vessels involved in collisions did not comply with the regulations; the watchkeepers in nearly all of these had failed to keep a proper lookout.

Twenty-five of the identified human factors were associated with individual failings:

- The skippers or watchkeepers had failed to understand and allow for the risks involved in 25% of collisions,
- Recognised procedures or rules were intentionally violated by 20%,
- 28% involved a lack of competence, experience and/or training,
- 12% were associated with fatigue,

1.4.6 Fatigue - Hours of work and rest

Hours of work and rest were not required to be recorded on board HENDRIK SENIOR, and no records were available. However, the watchkeeper stated that having only recently put to sea, and having had more than seven hours rest in the previous 24 hours, he had felt well rested.

1.4.7 Simulation of the collision

A simulation was made at the Maritime Training centre Aboa Mare in Turku, Finland in a full mission ship-handling simulator. The intention with the simulation was to give as correct an impression as possible of how the situation was developing visually and in the radar for both BIRKA EXPORTER and HENDRIK SENIOR. It was also important for the investigators to get the right impression of the distances between the ships and time scale of the development of the situation.

A simulator ship model of BIRKA EXPORTER already existed in the simulator and a fishing boat with similar dimensions as HENDRIK SENIOR was used during the simulation. A scenario was built with all the surrounding ships and weather conditions as during the accident. Several simulations were made, both from the bridge on BIRKA EXPORTER and from the fishing vessel.

The observations made from the simulation were that there were no visual obstructions from either side at any time and the ships could be clearly seen on the radar at all time. Secondly the passing distances were too close with no safe margins left.

[21] MAIB Report on the Analysis of Fishing Vessel Accident Data 1992 - 2000. See http://www.maib.gov.uk/cms_resources/analysis_of_fishing_vessel_accident_data.pdf

2 ANALYSIS

2.1 Aim

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future

2.2 Environment

Environmental conditions were benign, and are not considered to have contributed to this accident.

2.3 Corroboration and interpretation of voyage data

Corroboration of data

HENDRIK SENIOR was not required at the time of the accident to be fitted with a VDR or AIS and she did not carry either. Data from BIRKA EXPORTER's VDR was limited due to its simplified type, but that which was recorded was of good quality and the audio recordings were clear.

There is generally good corroboration with a few exceptions between the Terschelling coastal radar station data and that from BIRKA EXPORTER*'s* VDR. HENDRIK SENIOR's close encounters with other traffic are very similar on both recordings.

The apparent discrepancies in HENDRIK SENIOR's course, as recorded by the coast radar station and the ARPA recording from BIRKA EXPORTER*'s* VDR, have been attributed to lack of AIS information for HENDRIK SENIOR, and the short time elapsed since she was acquired and followed by BIRKA EXPORTER*'s* ARPA.

Interpretation and findings

Radar resolution and accuracy (HITT). Radar ARPA functionality is based on consequent radar echo measurements, instantaneous distance and bearing to the target is calculated using several reflections from the target, one measured value on each antenna revolution. HITT radar system used by the Dutch coastal radars most likely uses regular sea traffic radars, which have an antenna rotation speed of about 0.5 Hz, one revolution every two seconds. Reasonable ARPA calculation accuracy is usually achieved after eight consequent reflections, resulting in minimum time gap of 16 seconds, before a decent approximation of the target motion becomes available. Depending on system performance the time may be much longer, older radar systems could have this lag up to one minute. The overall performance of ARPA tracking is depending, not only on radar transmitter-receiver unit, but also on digitalisation of the received raw information and on actual target motion calculation.

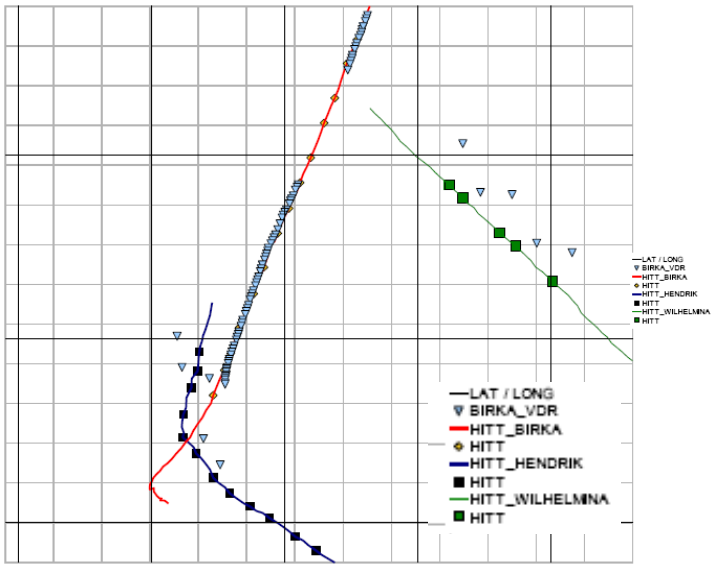

Figure 30a. Ship trajectories and positions derived from BIRKA EXPORTER's S-VDR and HITT coastal station. Small grid squares are 100 x 100 metres. (See also the original HITT recordings in figures 27 and 28.)

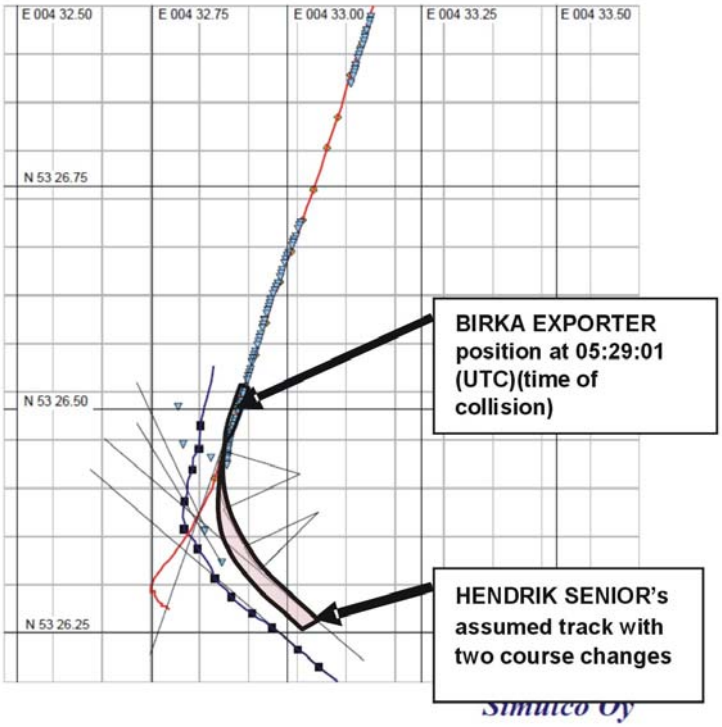

Figure 30b. The track of BIRKA EXPORTER with its position at the time of collision 05:29:01 (marked with ship shape in scale) and HENDRIK SENIOR's assumed track with two course changes to starboard drawn with the turning radius of one cable lengths. The uncertainties in the reconstructed positions of HENDRIK SENIOR are shown as a light grey area of its possible approach tracks.

One possible source of inaccuracy is related to coordinate conversion. The rotating radar antenna receives target echo in polar coordinate system and this position information is then converted to Mercator coordinate system for latitude and longitude. The conversion error is dependent on the distance between the antenna and the target. On the other hand, if the ARPA target is located very close to the radar antenna, internal delay of the system plays greater part in time critical pulse triggering and will defect accuracy. In this study it is assumed that HITT tracking is less accurate due to the coordinate conversion error and other factors than BIRKA EXPORTER's ARPA-measurements of the fishing vessels.

In figure 30a the relative accuracies of the GPS positions (BIRKA EXPORTER AIS and VDR data) and the shore radars (HITT recordings) are shown. The assumed track of HENDRIK SENIOR, which is analysed later in the text, is also shown in the figure 30b. As the accuracy of the recorded data for HENDRIK SENIOR is not as good as BIRKA EXPORTER's, there are also uncertainties in its reconstructed track. These uncertainties in the reconstructed positions of HENDRIK SENIOR are shown in the figure as a light grey area of its possible approach tracks.

Combining the recorded S-VDR and shore-based data. When the most probable tracks of BIRKA EXPORTER and HENDRIK SENIOR are reconstructed for the last minute before the collision five assumptions have been made:

- the time and the position of the collision was at 05:29:01 UTC on the GPS position according to the BIRKA EXPORTER's VDR audio recording,
- there is a need to adjust the relatively less accurate radar plotted track of HENDRIK SR to achieve a fit with the GPS positions of BIRKA EXPORTER (the original tracks are shown in figures 27 and 28 respectively),
- HENDRIK SENIOR maintained its speed of 11,0 knots before the collision (in HITT recording 11,5 knots and 10,5 knots at the approach and in the turn respectively; in BIRKA EXPORTER's ARPA plotting HENDRIK SENIOR's speed was 12,1 and 11,1 knots), the trawler's speed determines thus also the distance travelled and the time taken by the last-minute manoeuvres (i.e. also their execution times),
- HENDRIK SR made two consecutive turns before the collision as its watchkeeper has stated and
- the angle of collision at the impact was about 10 degrees.

These assumptions are elaborated in the analysis in the following pages.

BIRKA EXPORTER's GPS position recorded by its S-VDR and by HITT via AIS transmission is considered to be most accurate. The exact collision time according to BIRKA EXPORTER's S-VDR audio recording was at 05:29:01 UTC and the GPS position of the vessel at that time is shown in figure 30b. The collision noise recorded on the bridge in-

dicates items dropping from tables, so it is assumed that this event originated from a collision affecting BIRKA EXPORTER's longitudinal velocity, not from HENDRIK SENIOR scratching BIRKA EXPORTER's side plating.

HITT ARPA tracking of the fishing vessels was compared also to BIRKA EXPORTER's ARPA plotting. The OOW of BIRKA EXPORTER did plot HENDRIK SENIOR and WILHELMINA just before the accident and a few reference plots were available in BIRKA EXPORTER's S-VDR recording for comparison. There is a pattern of differences between BIRKA EXPORTER's ARPA calculation and HITT recording. If HENDRIK SENIOR's ARPA position relative to BIRKA EXPORTER's own DGPS position at a certain moment is compared to the respective HITT recording, we learn that HITT ARPA is about 80 metres off in SW direction. BIRKA EXPORTER's ARPA calculation for WILHELMINA gives the same result (figure 30a).

It is assumed, based on the discussion above, that HENDRIK SENIOR's track was somewhat closer to BIRKA EXPORTER than shown in HITT recordings (figure 30b). The analysis of the tracks is also elaborated in later sections of the report.

Course alterations made by HENDRIK SENIOR. Both BIRKA EXPORTER's and HITT's ARPAs show that shortly before the accident HENDRIK SENIOR changed its course from about 310 degrees to starboard. Recordings and collision damages also show, that this manoeuvre turned HENDRIK SENIOR into a nearly opposite course with BIRKA EXPORTER.

It is assumed further, according to the following analysis, that HENDRIK SENIOR made two course alternations as her watchkeeper has stated (see figure 30b). The approximate turning radius was about 160 metres (0,9 cables) which led just ahead of BIRKA EXPORTER, which held her course steady at 198 degrees. One constant radius turn of about 65 - 70 degrees ending up to a head-on collision course with BIRKA EXPORTER has not been the case.

There are uncertainties both about the turns of HENDRIK SENIOR (magnitudes of heading changes and execution times) and about its recorded positions. These uncertainties are discussed in the analysis as well as shown as a light grey area of its possible approach tracks in the figures in the analysis.

2.4 Manoeuvres before the collision

The observations by the OOWs

When the OOW on **BIRKA EXPORTER** actually noticed the approach of HENDRIK SENIOR is not clear. His spontaneous first words to the captain in the VDR recording were that HENDRIK SENIOR could not be seen on radar and she put her navigation lights on just before the collision. The same statement, that he suddenly could see the navigation lights of the fishing boats and that they surprised him as they were switched on, was given by OOW in an interview. Later on, in the AIBF interview in Finland, OOW stated that he saw the fishing vessels when they entered the 2 NM VRM area on BIRKA EXPORTER's radar.

In all his statements the OOW is consistent that he noticed the trawler's green light on the starboard side of the BIRKA EXPORTER's foremast and after that HENDRIK SENIOR turned towards his vessel. According to the analysis of the vessels' tracks before the collision and the damages on both vessels it is unlikely that the OOW could have seen the trawler wholly on the starboard (right) side of the foremast and especially before HENDRIK SENIOR's turn. But, it is possible that due to small yawing of BIRKA EXPORTER and the rolling of the fishing vessel, the OOW could have seen the green navigational light to right of the foremast immediately before the collision.

A chemical tanker[22] was heading in the same direction 1.9 NM ahead of BIRKA EXPORTER. HENDRIK SENIOR and this vessel were in almost the same bearing from BIRKA EXPORTER several minutes before the collision, which can have caused confusion regarding navigation lights (figures 20 and 21).

HENDRIK SENIOR's watchkeeper was only able to recall some of the events before the collision. He could offer no reason for standing into danger, and could not explain why the collision had happened. It is considered, therefore, that the following factors, or a combination of them, may have been prevalent:

- The watchkeeper was complacent in his watchkeeping duties, or lost situational awareness, becoming confused as to the range, bearing and relative speeds of the two vessels.
- The watchkeeper was distracted in some way (e.g. a mobile telephone call or computer); meaning that he stood on in to danger without realising it.
- The watchkeeper became drowsy, and not fully alert, at some point after cancelling the watch alarm for the last time before the collision, waking in the moments just before impact.

Comparison of the narratives provided by those on board HENDRIK SENIOR with the electronic evidence available could provide supporting evidence for any of the above scenarios. The watchkeeper's belief that BIRKA EXPORTER altered towards HENDRIK SENIOR, when it did not, together with strong evidence of a lack of any effective avoiding action taken by the watchkeeper until about 20–25 seconds before the impact, also supports these scenarios.

Alternatively, given the evidence of complacency as demonstrated, it is possible that the two fishing vessels intended to pass either side of BIRKA EXPORTER; WILHELMINA intending to pass close astern, HENDRIK SENIOR close ahead. WILHELMINA did pass close astern, and without altering sufficiently to allow HENDRIK SENIOR to pass between WILHELMINA and BIRKA EXPORTER. It appears that HENDRIK SENIOR might just have passed very close ahead had the watchkeeper maintained course and speed, and not turned towards BIRKA EXPORTER for a reason that remains unknown.

[22] MV *Sarah Wonsild,* 2349 GT, LOA 96m, Italian flag (figure 25).

Initial course of HENDRIK SENIOR

The trawler approached BIRKA EXPORTER from the southeast on a steady course and speed. Initially, HENDRIK SENIOR appeared to be going to cross very close ahead of BIRKA EXPORTER. The bow crossing without HENDRIK SENIOR's course alterations would have taken place at about 05:28:33 UTC. The bow crossing distance in this case would have been about 0,2 nautical miles (370 metres). This situation is shown in figure 31. Depending on the assumed approach track the distance is between 355 metres (0,19 NM) and 440 metres (0,24 NM).

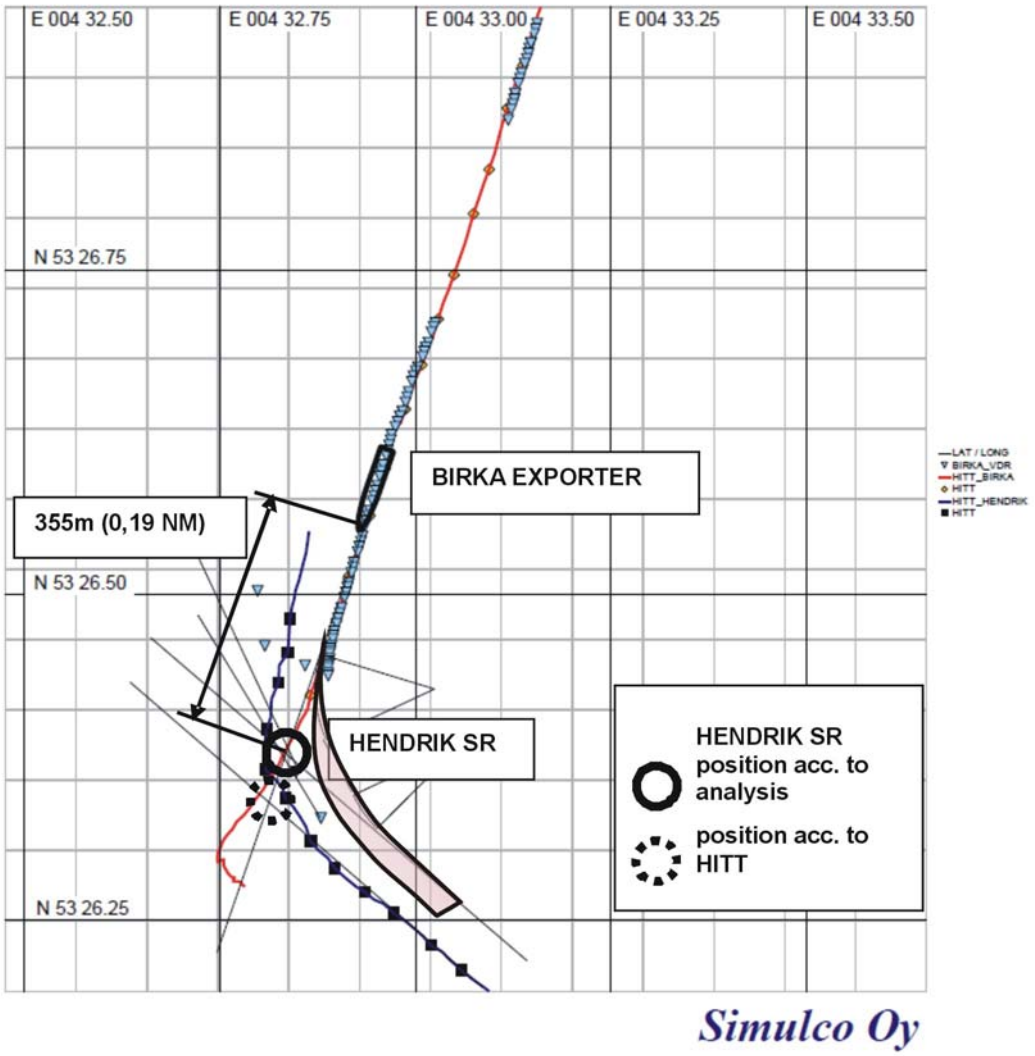

Figure 31 Time 05:28:33 UTC. The moment when HENDRIK SENIOR would have crossed the path of BIRKA EXPORTER if the trawler had continued straight ahead. The distance between the vessels measured from BIRKA EXPORTER's bow would have been at its shortest 355 m (0.192 NM). The corresponding distance to HITT track extension is about 440 m (0.24 NM).

The starboard turns of HENDRIK SENIOR

The reconstructions of the turns of HENDRIK SENIOR presented below are the most probable ones based on the facts and narratives available for the analysis. The exact positions of the trawler relative to BIRKA EXPORTER are not known and the execution timing of the two turns as well as their magnitudes could have had many variations. This uncertainty is included in the analysis as a couple of the possible scenarios presented, which, although, are not necessarily the only possibility. The uncertainty is shown in the figures from 30b to 35 as a light grey area, where the tracks are with high probability located, and all of which also converge to the actual impact position. With small variations in initial course, the magnitude of turns, their execution times and the straight legs a great number of turn sequences are possible within the limits of the light grey area.

There are some facts on which the reconstruction is based. HENDRIK SENIOR's watchkeeper remembered that he executed, using the autopilot, two avoidance turns, the first of 25 degrees and the second, the emergency one, after having heard the radar's ARPA alarm set at two cables (370 metres).

For the reconstruction it is assumed that the initial course (heading) of HENDRIK SENIOR was about 310 degrees and the heading of BIRKA EXPORTER at the time of impact was 198 degrees. As it is analysed in the following section, the angle of impact was about 10 degrees. The final course of the trawler at the time of impact is about 010 degrees also in the HITT recording (figure 27). It follows that HENDRIK SENIOR made a course change of about 58 degrees before the collision. It is further assumed that the track of HENDRIK SENIOR recorded by HITT can be used to give corroborative but also to some extent slightly different information about the courses and timings of the trawler's manoeuvres.

Important for the analysis of the turns is the calculation of the travelled distances and the heading changes made in the defined time slots. The speeds of the vessels are assumed 11,0 knots (5,5 m/s) for HENDRIK SENIOR and 14,6 knots (7,3 m/s) for BIRKA EXPORTER. The rate of turn of 120 degrees/minute (2 degrees/s) for HENDRIK SENIOR follows from the autopilot settings explained later in the text.

Use of the autopilot. According to HENDRIK SENIOR‘s watchkeeper, he was viewing the sea by the window and making estimates about the traffic situation by sight. After evaluating the distance to BIRKA EXPORTER he began the manoeuvre. HENDRIK SENIOR had a Robertson AP-45 autopilot. The easiest way to activate a turn with the autopilot is to first to press and release the course dial of the control unit (Figure 32) and then turn the dial for an immediate turn. The dial will change the course setting by 60 degrees with a full turn. The autopilot user interface is most likely designed to perform a 30 degree turn with a half a turn of the dial. The ergonomics of a human hand allows a 180 degree twist (half a turn of the dial) with an ease. The course change of 30 degrees is normally used when avoiding other vessels. This kind of manoeuvre will give a clear indication to other vessels about ones intentions and is usually sufficient when executed in good time. If the watchkeeper estimated BIRKA EXPORTER's position as safe dis-

tance away, he may have executed the turn with the pre-set radius setting. The watchkeeper could have twisted the dial about half a turn in order to commence a turn of approximately 25 degrees to starboard, which for him could have been a normal avoidance manoeuvre. After that he walked back to his lookout position by the window.

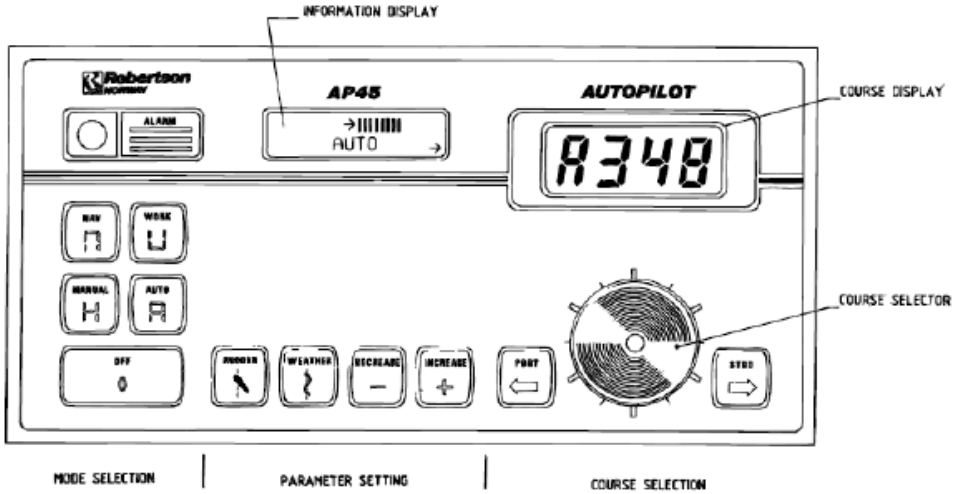

Figure 32. Robertson AP 45 Autopilot control unit.

Turning parameters. Both vessels maintained constant speed before the accident and there is no indication of any alteration of the autopilot steering parameters by HENDRIK SENIOR's watchkeeper.

In its Parameter Settings Robertson autopilot has a set of default rate of turn values for turning manoeuvres. The actual pre-set value is dependent of ship dimensions and if actual dimensions were saved in the system, HENDRIK SENIOR's autopilot would use as the limiting turning rate parameter the value of 120 degrees per minute (2 degrees per second). This will lead to turning radius of about 0,9 cable lengths when sailing at the speed of 11 knots (5,5 m/s)[23].

Course alterations. The reconstruction of the two turns, their trajectories and initialisation times, can be done with analysing backwards from the collision place and time. In this study it is assumed that the collision time is 05:29:01 UTC and that BIRKA EXPORTER's GPS-position at that moment is the actual collision place. Damages on both ships indicate that in the impact HENDRIK SENIOR's heading was about 10 degrees to port of BIRKA EXPORTER's heading (see section 2.5). Thus the impact headings of the ships are assumed to have been: BIRKA EXPORTER 198 degrees and HENDRIK SENIOR about 008 degrees.

HENDRIK SENIOR's original course was around 310 degrees before the watchkeeper first time turned autopilot dial in order to avoid BIRKA EXPORTER, which was closing at

[23] The instantaneous turning radius of a vessel can be calculated by R = v/ω, where the turning radius R is in metres, v is ship speed in m/s and ω is rate of turn radians/s.
In this case R = 5,5/(2/57,3) = 158 m = 0.085NM or 0,85 cable lengths.

a steady course of 198 degrees. So the vessels were approaching each other in a 68 degree angle. HENDRIK SENIOR's first deviation from the original course, here called *the first turning manoeuvre, was according to the watchkeeper's statement 25 degrees.* If the first turning manoeuvre was completed before the second one was initialised, HENDRIK SENIOR was then sailing at a straight course of about 335 degrees. This means, that *the second turning manoeuvre would have been about 33 degrees*. With the steady rate of turn of two degrees per second (120 degs/min) the time taken by the turn of 33 degrees is 17 seconds.

First turning manoeuvre is assumed to be started at 05:28:05 UTC and the vessel positions are shown in figure 33. The distance to the BIRKA EXPORTER was between 610 and 640 metres (0.33 – 0,35 NM). HENDRIK SENIOR turned about 25 degrees to starboard and the autopilot terminated the turn.

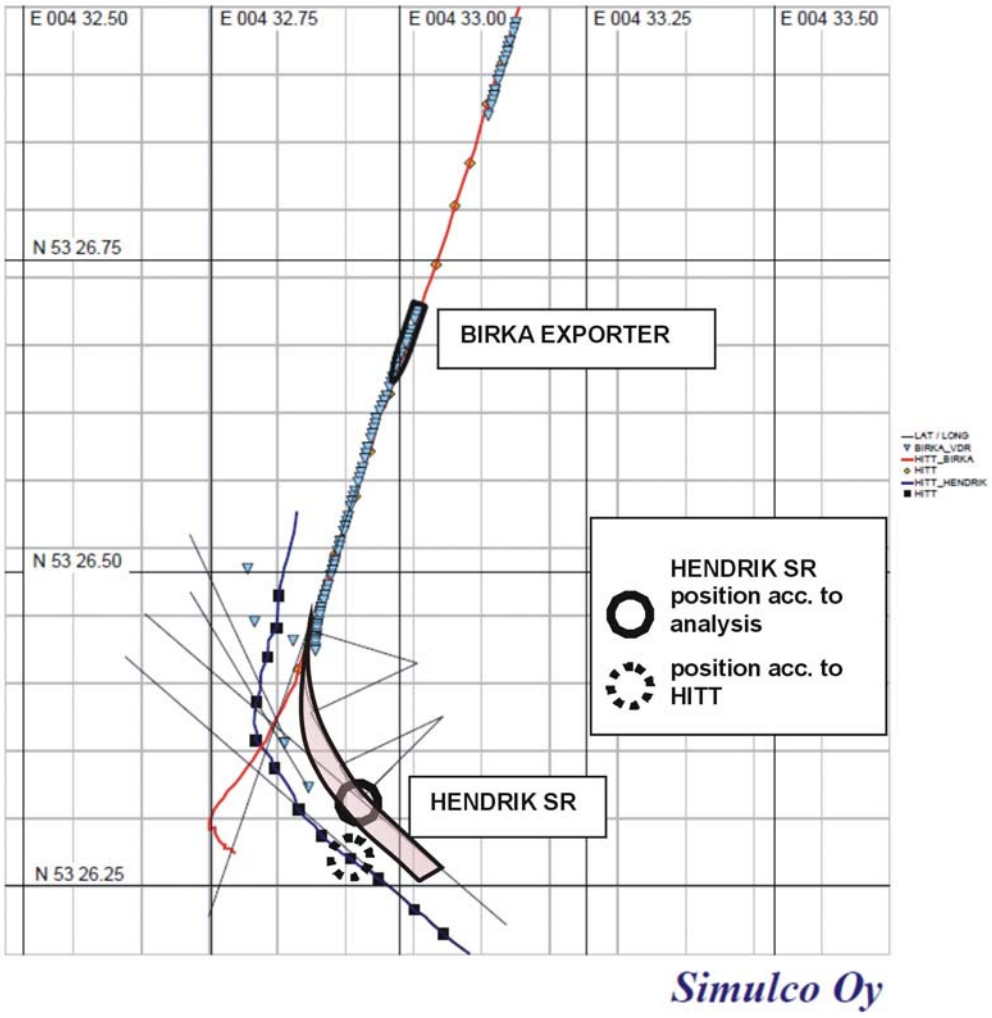

Figure 33. Time 05:28:05 UTC. The first turning manoeuvre of HENDRIK SENIOR starts, the distance between HENDRIK SENIOR and BIRKA EXPORTER was between 610 and 640 metres (0.33 – 0,35 NM). From HITT registered position the distance was 710 metres (0,38 NM).

The watchkeeper stated to have started this turn at distance of eight cable lengths from BIRKA EXPORTER. The visual estimation of distances is difficult and it can explain the difference of his estimate to the actual distance of less than four cable lengths.

Weather conditions were moderate, however the vessel was now sailing in quartering seas. This condition must have made it difficult for the watchkeeper to observe and evaluate autopilot performance, its ability to finish the turn and follow the course command in ambient wave pattern.

Robertson autopilot manual mentions following sea condition as challenging for the control system and advice readjustment of the control parameters for adequate control. Obviously, this adjustment procedure was not feasible at that moment. It may have taken several seconds before the watch keeper realised that the turning manoeuvre was completed and that the turning motion of the vessel was due to the wave conditions around the ship. Or he may have not realised the termination of the turn at all if he was preoccupied.

Referencing to BIRKA EXPORTER‘s first recorded ARPA plot of HENDRIK SENIOR at 05:28:29 UTC (with plotted course of 328,9 degrees) indicates that the first turning manoeuvre of HENDRIK SENIOR was actually almost, if not already completed. This suggests that HENDRIK SENIOR was sailing straight ahead before the ARPA-alarm took place. The time delay in the ARPA calculations has also been taken into account here[24].

Second turning manoeuvre. After hearing the ARPA alarm, checking the CPA and finding BIRKA EXPORTER still on the starboard side of the fishing vessel, the watchkeeper walked back to the autopilot control panel and twisting autopilot control to starboard executed another turn. It may be assumed that he still estimated sufficient clearance to BIRKA EXPORTER for an autopilot-controlled turn.

This gives the initialisation time of what we call here as *the second turning manoeuvre*. According to watchkeeper’s statement he was standing by the window when the ARPA-alarm was activated and the vessels were two cables away from each other. The ARPA alarm limit was set to two cables (370 metres). According to BIRKA EXPORTER‘s GPS track and HITTs ARPA-recording for HENDRIK SENIOR the distance between the vessels was two cables at about 05:28:30 UTC. It must have taken several seconds as the watchkeeper walked to the radar, acknowledged the alarm, checked the CPA value and walked to the autopilot for initialising the turn. The 33 degrees steady turn takes as previously noted 17 seconds and the initialisation of the second turning manoeuvre was committed a few seconds earlier. So the initialisation of the second turning manoeuvre can be assumed taken place at 05:28:40 UTC (21 seconds before collision).

[24] The last recorded ARPA plot of HENDRIK SENIOR in the VDR data is at 05:28:59 UTC (about two seconds before collision). In this recording the trawler’s plotted course of 344,8 degrees is 25 degrees less than the estimated heading of 009 degrees at the impact (see section 2.5). The time needed for a turn of 25 degrees is about 12,5 seconds, which is a rough estimate of the ARPA time delay.

At about 20 seconds before impact, HENDRIK SENIOR's more discernible alteration to starboard began; in figure 34 the time is assumed to be 05:28:40 UTC. The distance to the BIRKA EXPORTER was 290 m (0.157 NM). This very late action can be identified in both data sets.

The watchkeeper may not have had serious doubts about the safety of the vessel and the crew, because he did not switch to manual steering. Execution of another automated manoeuvre command indicates that no immediate danger was assumed.

Whilst turning starboard to following seas, the autopilot had increasing difficulty to hold a steady course. HENDRIK SENIOR's oscillating heading as well as BIRKA EXPORTER's slight yawing in waves may onboard HENDRIK SENIOR have been interpreted as BIRKA EXPORTER's manoeuvre to its port, straight on to collision course.

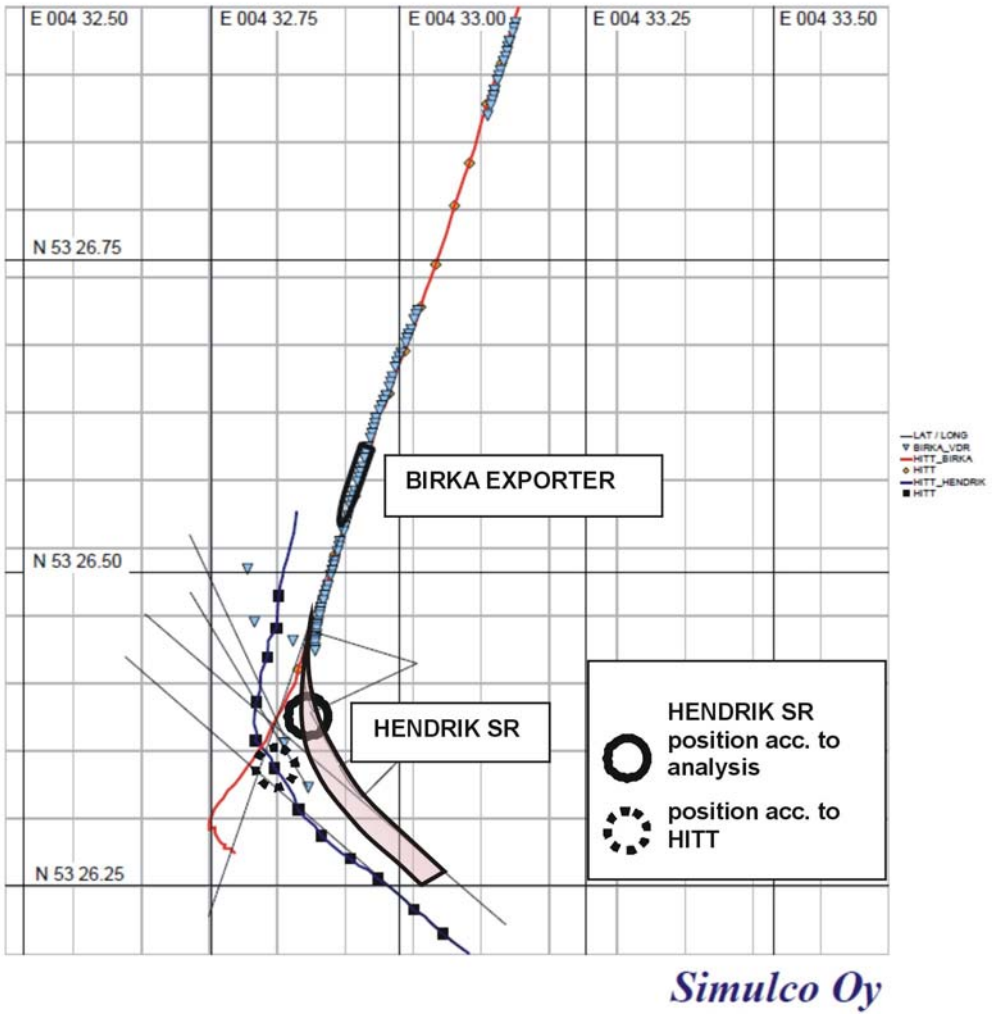

Figure 34 *Time 05:28:30 - 05:28:40 UTC. As the second turning manoeuvre of HENDRIK SENIOR started the distance between HENDRIK SENIOR and BIRKA EXPORTER was between 267 and 377 metres (0.14–0,20 NM). From HITT registered position the distance was 367 metres (0,20 NM).*

When the second turning manoeuvre completed or became almost complete, there was very little time left before the collision. Robertson autopilot is deactivated by pressing and holding down the OFF button for two seconds. This period is too long if an immediate use of the stand-by mode of the autopilot is required.

The possible turn sequences. In the grey uncertainty area of HENDRIK SENIOR's turns in the figures from 30 to 35, the upper black track depicts a first turn of 25 degrees followed by a straight leg of 100 metres and a second turn of 33 degrees ending at the impact. This sequence of manoeuvres follows from the watchkeeper's recollection of a 25 degree turn as the initiation of the evasive manoeuvre.

The lower limiting track is of a 20 degree first turn followed by a short straight leg of less 50 metres and a second turn of 38 degrees followed also by a straight leg of les than 50 metres ending at the impact. In this sequence of manoeuvres the first turn is assumed to be about 20 degrees based on the course change shown by the HITT recording (figure 27). The second turn is initiated in this reconstruction very soon after the ARPA alarm of two cable length distance. It is also assumed that the larger second turn is completed and HENDRIK SENIOR is steadying to its new course of about 008 degrees.

In both of the presented sequences the time spent on the whole manoeuvre is about 46 seconds for the steady sections plus some five seconds in the initiation and checking of the turns. This analysis leads in both cases to the execution time of the first evasive turn at about 05:28:10 UTC.

The first turn is assumed to have been smaller than the second one because both as HENDRIK SENIOR's watchkeeper recalls it being smaller and as it was considered to have been for him a normal evasion according to COLREGs and not yet any emergency manoeuvre. The second turn in both presented sequences could have been slightly different about its timing and whether the turn was still continuing or not at the impact, but in both cases the emergency action carried out using the autopilot led to the collision.

If immediately before the collision HENDRIK SENIOR was steadying on a new course, which had a small angle with the steady course of BIRKA EXPORTER, it also explains the observation of the watchkeeper of the trawler about BIRKA EXPORTER turning to port.

The analysis shows that the evasive manoeuvre carried out by HENDRIK SENIOR was commenced too late and with too small a course change in respect to the approach course chosen by the trawlers. An important observation from this accident is that if proper safety margins are not maintained a close-quarters situation can develop very quickly into an extremely serious one with possible catastrophic consequences.

2.5 The collision and assessment of damage caused to both vessels

The course and position of BIRKA EXPORTER

Both data sets (HITT and VDR) confirm that BIRKA EXPORTER maintained **a steady course** and speed throughout, and did not alter course to port, towards HENDRIK SENIOR.

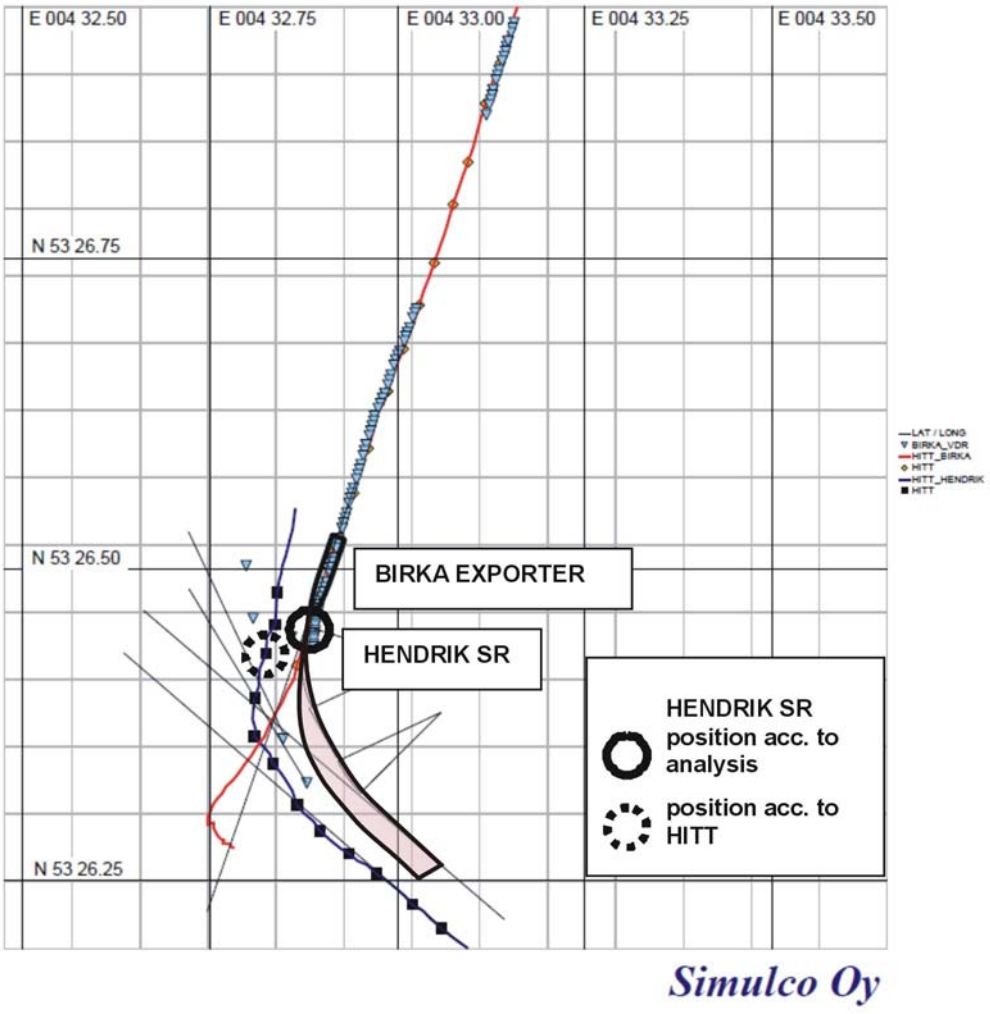

Figure 35 Time 05:29:01 UTC. The time and position of the collision. Note the difference of about 80 metres to southwest in the HITT position when compared to the GPS position.

According to the VDR data the autopilot Set Course on BIRKA EXPORTER was 199 degrees until 36 seconds before the collision. After which the changes in the autopilot Set Course were from 199 to 198,5 degrees (36 seconds to collision), from 198,5 to 195 degrees (17 seconds to collision) and from 195 to 207 degrees (6 seconds to collision). Due to these small Set Course changes the heading of the vessel changed from 200,1 to 198,8 degrees between 05:28:25 and 05:29:01 and the COG from 200,2 to 197,4.

BIRKA EXPORTER's GPS **position** recorded by its S-VDR is considered to be most accurate source. The exact collision time according to the VDR audio recording was at 05:29:01 UTC and the GPS position of the vessel at that time is shown in figure 35.

HENDRIK SENIOR's approach and positions relative to BIRKA EXPORTER's has been analysed in the previous chapters. It was assumed that HENDRIK SENIOR's track was somewhat closer to BIRKA EXPORTER than shown in HITT recordings, which is about 80 metres off in SW direction at the time of impact. (BIRKA EXPORTER's ARPA calculation for WILHELMINA gives the same result, figure 30a).

Assessment of damage caused to both vessels

Limitations of the assessment. There were significant differences in both the displacement and sea keeping characteristics of the two vessels. Their respective relative motions[25] at the time of the accident were not predictable for the purposes of this investigation. Therefore, it was not possible to accurately reconstruct their aspects at the moment of impact based only on the recordings available (VDR and HITT recording). However, the damages sustained provided indicative evidence.

Damages above the waterline. The damage to HENDRIK SENIOR's whaleback shelter indicated that her starboard bow made heavy contact with the upper hull plating of BIRKA EXPORTER. The way in which HENDRIK SENIOR's whaleback structure had been distorted aft, and to port, provided evidence of the relative aspects at impact. The "goalpost" gantry and starboard derrick were also damaged on the starboard side. The structural distortion to the frames and shell plating over most of the length of HENDRIK SENIOR's starboard side, together with paint traces, confirmed that the contact continued as the fishing vessel rolled around the bow of BIRKA EXPORTER and passed down her port side. Also, paint traces found on the tip of HENDRIK SENIOR's starboard derrick confirmed that the extended derrick was in contact with the white paint of BIRKA EXPORTER's hull.

HENDRIK SENIOR was relatively undamaged on her port bow, with no damage down her port side.

The damage to BIRKA EXPORTER's shell plating extended over an area covering both sides of the centre line. The damage sustained to her starboard side extended as far as the hawse pipe, slightly further aft, and was more extensive than that seen on her port side. This indicates that the initial impact was probably directed towards her starboard side of the bow.

Evidence therefore suggested that HENDRIK SENIOR's bow was across the bow (centerline) of BIRKA EXPORTER, and had turned towards BIRKA EXPORTER very shortly before impact.

[25] Including roll, heave, pitch etc as a result of the sea conditions, as well as motion due to speed over the ground.

Damages below the waterline. BIRKA EXPORTER is an ice strengthened ship, meaning that her bulbous bow is particularly strong. Below the waterline the indentation to the shell plating on the starboard bow (well aft of the forward extremity) of HENDRIK SENIOR is similar to the profile of BIRKA EXPORTER's bulbous bow (Figure 17a). This also indicates that HENDRIK SENIOR's bow was across the bow of BIRKA EXPORTER when the ships struck one another. It is likely that the relative movements of the two ships then caused BIRKA EXPORTER's bulbous bow to pass aft down the starboard side of HENDRIK SENIOR, until sufficient purchase allowed the bulb to dig hard into the side of HENDRIK SENIOR in way of the fish hold, close to amidships (Figure 17b). HENDRIK SENIOR then rotated about this point, landing heavily on her starboard mid and aft mid sections. This secondary impact caused the setting in of the frames and plating in that area.

The ice strengthened bulb of the BIRKA EXPORTER had the potential to cause severe damages on HENDRIK SENIOR with possibly catastrophic results. This could have been the result, if the impact angle and its position had been only slightly different.

The impact

The relative positions of the vessels at the moment of impact can be analysed based to the extent and location of damages of both vessels and the analysis of the collision angle is based both on the damages and the tracks of the vessels.

At the time of impact HENDRIK SENIOR was either still continuing its turn or the vessel was steadying on its new course. In both cases the colliding vessels were not on exactly opposing courses. It is assumed that BIRKA EXPORTER approaching with the heading of 199 degrees hit HENDRIK SENIOR in an angle of impact of about 10 degrees from starboard. The assumed angle of impact and its place is shown in figure 36. Thus the trawler's heading at the impact was about 009 degrees. This can be deduced from the damages on both vessels, the angle between the recorded tracks and how HENDRIK SENIOR turned 180 degrees to BIRKA EXPORTER's port side after the impact.

The impact damages on the bows of both vessels were unsymmetrical about the centerline. On BIRKA EXPORTER the damages are slightly on the starboard side on its bow (figures 18 a and b). On HENDRIK SENIOR's bow the damages are mainly on the starboard side as can be seen from figures 16 and 29. To explain the damages on both vessels' a parallel assessment is needed. This indicates that at the time of the impact the vessels had an angle of about 10 degrees. The first contact according this scenario is by the flares of the forecastles. This is shown in figure 36.

Another indication of the collision angle is the recorded HITT track of HENDRIK SENIOR, which has a small angle with the track of BIRKA EXPORTER (see for example figure 35).

On both sides of the bulb of BIRKA EXPORTER there were minor indentations and some paint, which seemed to originate from HENDRIK SENIOR. The bow of the trawler

below waterline was rather narrow with sharp lateral sections (waterlines) in the area of the bulb. This can explain the indentation caused obviously by the bulb of the BIRKA EXPORTER as a second contact between the vessels.

Both the actual position of the first contacts and the small angle of impact contributed to the relatively restricted damages without any large holes below the waterline on the hull of HENDRIK SENIOR. The trawler could thus stay afloat using its own pumps and those from the KNRM lifeboat.

The damages on the trawler were mainly on the starboard side of its bow. That combined with the collision angle of about 10 degrees i.e. the angle of the impact force, as shown in figure 36, could produce the moment on HENDRIK SENIOR resulting it almost instantly turning 180 degrees. Some of the indentations below the waterline on the forward starboard part of the trawler (figure 17b) could be caused by BIRKA EXPORTER's bulb when the other vessel was leaning on the bulb while making the 180 degree turn after the impact.

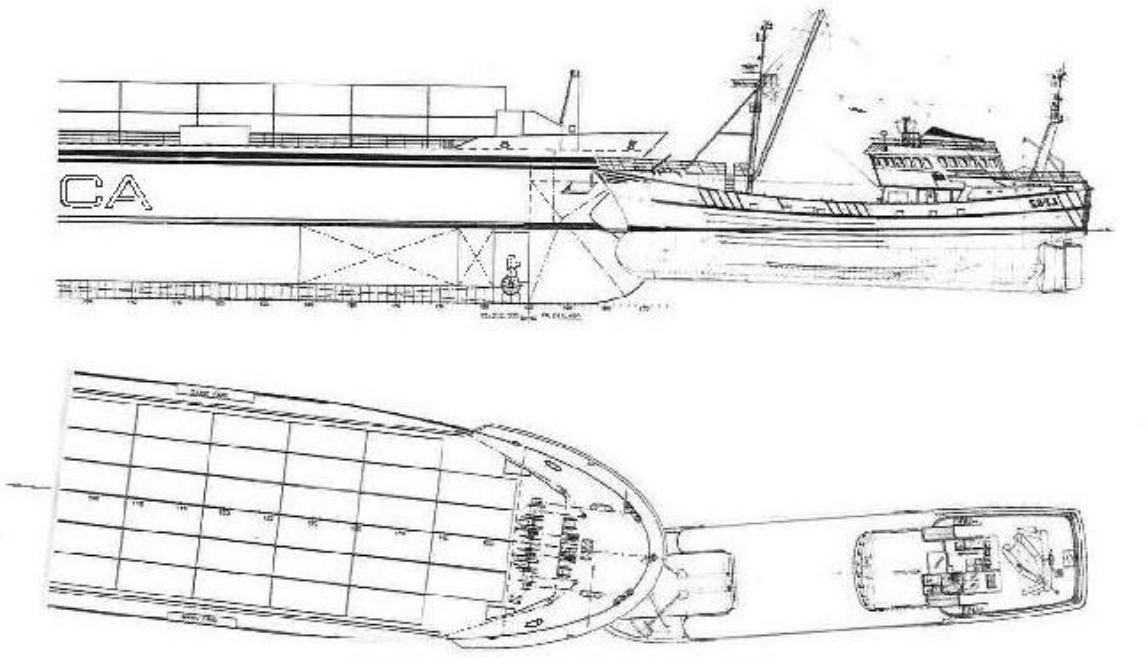

Figure 36 The positions of the vessels at the impact according to the extent and location of damages of both vessels. The collision angle is assumed to be about 10 degrees. The analysis of the collision angle is based both on the damages and the tracks of the vessels.

2.6 Keeping a safe navigational watch

2.6.1 Guidance on keeping a safe navigational watch

MGN 313 states

Investigations into collisions, groundings and near misses involving fishing vessels have continued to show that poor watchkeeping is a major cause. And *It is absolutely essential that a proper look-out is kept at all times. Casualties to fishing vessels, resulting in loss of life, continue to occur because of the lack of a look-out.*

2.6.2 Lookout

BIRKA EXPORTER During the accident there was no lookout posted on the bridge except for the OOW. The custom onboard was to send down the lookout at 06:00 ship time (UTC+2). Boatswain would have been the lookout in the next watch from 06:00 to 10:00 but he usually started to work at 08:00 ship time. This left the ship without a watchman for 2 hours. The sunrise that day was 06:45 UTC and the lookout was sent down at 04:00 UTC. Lookout was requested according to:

> ***BIRKA EXPORTER SMS 5.3.1 Bridge Routines*** *"During darkness and in bad visibility one watchman/ lookout shall be on the bridge"*
>
> ***STCW Section A-VIII/2 part 3-1****"15 The Officer in charge of the watch may be the sole look-out in daylight provided that on each such occasion".*
>
> ***COLREGS Part B Rule 5*** *Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.*

If the ship is manned according to the minimum safe manning certificate, watch-keeping customs like on BIRKA EXPORTER will be created due to lack of deckhands. The working hours act puts pressure on the masters to solve how the maintenance work is done onboard as well as the work in port on a trade with loading and discharging every second day.

The easiest option is to take away the lookout because no incidents are expected to happen under normal circumstances. It can also be considered that violating the working hour act is worse than violating the regulations regarding lookout. Several accidents investigations show lack of lookout on the ships bridges.

The status of the lookout has changed during past years. To have a lookout to watch for ships in the horizon seems to be depreciated today because of the navigational equipments available. When the lookout has observations to inform the officer about, it is usually old information for the officer and therefore the exchange of information will decrease in a while. If the lookout would have an own radar picture to interpret the visually observations with, it would increase the safety and the status of the lookout.

2.6.3 Watch alarm

HENDRIK SENIOR was fitted with a watch alarm, and it was in use at the time of the accident. However, MGN 313 states that a watch alarm should not be relied upon exclusively to alert a lone watchkeeper or other member(s) of the crew.

BIRKA EXPORTER was fitted with a watch alarm but it was not in use at the time of the accident.

2.6.4 Navigational duties and responsibilities

The vessel's position was not plotted onto a chart on HENDRIK SENIOR. The chart plotter display was monitored to ensure the vessel followed the track displayed on screen. This was poor navigational practice, as reference to a chart would have helped to maintain situational awareness. Regular use of a chart provides the watchkeeper with a stimulus and provides essential information to assist the conduct of a safe passage.

2.6.5 Experience and qualifications

Even when there is no statutory requirement for the watch to be kept by a certificated officer (as in this case), it is still essential that watchkeepers are always experienced and capable. This is especially important when navigating in areas where there is dense traffic or when in a TSS.

HENDRIK SENIOR's watchkeeper was sailing in his home waters, on a route that he had plied regularly over a period of several years. He was in control of his family boat, a class of vessel that he had known for many years. As a college educated, fisherman who held a Dutch COC, he was well qualified to act as watchkeeper. The collision did not occur as a result of an inexperienced or under qualified watchkeeper.

2.6.6 Fatigue

Analysis of the work/sleep patterns of HENDRIK SENIOR s watchkeeper indicated a possible risk of a slight to moderate fatigue problem, when analysed using the MAIB Fatigue Investigation Tool[26] (FIT).

The watchkeeper's inability to offer any explanation as to why he stood on into danger, and why he then made a very late turn towards the bow of the oncoming BIRKA EXPORTER, indicates that he was not alert at the time of the collision.

Fatigue or sleep deprivation is endemic. It is widely accepted by the industry, and is either the main cause of many accidents or is judged to be a strong underlying factor.

[26] Software developed for MAIB, used to help determine the likelihood of fatigue-induced mistakes causing an accident.

Many collisions, and a number of groundings, can be attributed to watchkeepers falling asleep when outward bound having sailed at around midnight…[27]

Whilst the watchkeeper claimed to be well rested, with the risk of moderate fatigue, it is possible that he became drowsy and not fully alert at the time of, or shortly before, the accident. It is worthy of consideration that the accident took place immediately after a busy weekend ashore and at a time of day that is recognised to be a low point in the circadian rhythm. Research has shown that alertness and performance tend to be at their lowest during the early hours of the morning[28].

2.6.7 Wheelhouse equipment

HENDRIK SENIOR

HENDRIK SENIOR was fitted with a wide range of equipment, provided to assist the watchkeeper in making a full appraisal of the situation, and of the risk of collision.

The watchkeeper was sitting in front of ARPA equipped radar, but this facility was not used effectively to acquire and plot radar targets. If used correctly, and monitored regularly, the equipment available would have allowed an early determination of the risk of collision to be made. The information displayed on the AIS receiver was also not used to best advantage.

Watchkeepers must make proper use of all available equipment when undertaking their duties; this was not done on board HENDRIK SENIOR.

BIRKA EXPORTER

Analyse of how OOW on BIRKA EXPORTER uses the radar onboard can be divided into two categories, the range and the plotting.

The radar range. How OOW used the radar was analysed throughout his watch of the accident. In the first part of the watch the range was set to 12 NM and during the accident the range was 6 NM.

At 04:29 UTC BIRKA EXPORTER passes a vessel with CPA of 0.64 NM. The range on the radar is 12 NM. The area is heavily trafficked at that time. 34 minutes before the accident the range scale is changed to 6 NM and will remain until the collision. Even when there were close-quarters situations, the OOW did not change the range on the radar. This can indicate that there was a need to use even the second radar with a different range, for the OOW to get clear situational awareness.

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[27] MAIB Report on the Analysis of Fishing Vessel accident Data 2002. Chief Inspector's foreword, at page3. http://www.maib.gov.uk/cms_resources/analysis_of_fishing_vessel_accident_data.pdf

[28] MAIB Bridge Watchkeeping Safety Study 1/2004, manning levels and fatigue, at page 10. http://www.maib.gov.uk/publications/safety_studies/bridge_watchkeeping_safety_study.cfm

Plotting/determine if risk of collision exists for BIRKA EXPORTER. OOW used AIS, ARPA, EBL, trails and visual observations to determine if there was a risk for collision with other ships during his watch on the night of the accident. When there was a close situation at 03:22 UTC the OOW uses AIS data to make his decision to keep clear of the ship, he even uses the EBL to check the compass bearing to the target.

When the two fishing vessels are approaching BIRKA EXPORTER, the OOW uses visual observations and trails of the target on the radar screen to determine if there is risk for collision.

When the fishing vessels are 0.5 NM away, the OOW is plotting them by ARPA radar. This gives him CPA and TCPA to the fishing vessels in less than 1 minute. According to the OOW he is plotting them to get their heading and speed to be able to contact them after the situation, to ask them if it was necessary to come so close.

According to the OOW it is almost impossible to keep away from all the fishing boats in congested waters and it is common that they are coming very close to cargo ships. Since there are two ships approaching without AIS information at the same speed the OOW can assume it is fishing vessels. They are going close astern of the ship ahead of BIRKA EXPORTER and OOW can assume they will do the same when passing BIRKA EXPORTER. There are no attempts to contact the fishing vessels by VHF or to wake up their attentions by ALDIS lamp, whistle or searchlight.

According to STCW and COLREGS, OOW shall ensure that plotting is commenced in ample time and all available means to determine if risk of collision exists shall be used. But assumptions shall not be made on the basis of scanty information, especially scanty radar information. Trails of the targets can be considered as scanty information since the OOW can only assume approximate movements of the other ships.

STCW Section A-VIII/2 part 3-1

"39 Whenever radar is in use, the officer in charge of the navigational watch shall select an appropriate range scale and observe the display carefully, and shall ensure that plotting or systematic analysis is commenced in ample time"

Watch keeping under different conditions and in different areas

Clear weather "43 The officer in charge of the navigational watch shall take frequent and accurate compass bearings of approaching ships as a means of early detection of risk of collision and bear in mind that such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large ship or a tow or when approaching a ship at close range."

COLREGS Rule 7 - Risk of collision *a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist.*

(b) Proper use shall be made of radar equipment if fitted and operational, including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

(c) Assumptions shall not be made on the basis of scanty information, especially scanty radar information.

(d) In determining if risk of collision exists the following considerations shall be among those taken into account:

(i) such risk shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change;

(ii) such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large vessel or a tow or when approaching a vessel at close range.

2.7 Collision avoidance rules

Collisions should be prevented if every vessel complied with the COLREGS.

HENDRIK SENIOR did not keep a proper lookout, did not accurately assess the risk of collision and took insufficient action to avoid a collision. In a simple crossing situation, she was the “give way” vessel and she did not take early action to keep well clear. The course set to cross the TSS was not at right angles to the general direction of traffic flow.

BIRKA EXPORTER expected to stand on, she maintained her course and speed in accordance with the regulation but, when collision could not be avoided by action of the give way vessel alone, she did not take sufficient action to avoid a collision.

From the evidence available it is clear that neither watchkeeper applied the COLREGS correctly.

Following rules from Part B – Steering and sailing rules in the International regulations for preventing collisions at sea needs to be used for analysing this accident.

Rule 8 - Action to avoid collision

(a) Any action taken to avoid collision shall be taken in accordance with the Rules of this Part and shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

(c) If there is sufficient sea room, alteration of course alone may be the most effective action to avoid a close-quarters situation provided that it is made in good time, is substantial and does not result in another close-quarters situation.

(d) Action taken to avoid collision with another vessel shall be such as to result in passing at a safe distance. The effectiveness of the action shall be carefully checked until the other vessel is finally past and clear.

(e) If necessary to avoid collision or allow more time to assess the situation, a vessel shall slacken her speed or take all way off by stopping or reversing her means of propulsion.

By analysing the collision avoidance rules we can notice that they are complicated and do not give the OOW a direct guidance for his decisions, because ample time, safe passing distance or close-quarters situations are not quantified. Their application is left to the OOW to do during the watch.

Safe passing distance

The safe passing distance is not defined because it depends on number of factors. A safe passing distance is not the same if the other vessel is passing ahead or if it is passing astern.

A close-quarters situation

The distance at which the close-quarters situation first applies has not been defined in NM. It has been considered but decided that the distance could not be quantified because it depends on number of factors. In restricted visibility a close-quarters situation can be considered to apply at a distance of 2-3 NM[29].

Rule 10 - Traffic separation schemes

(c) A vessel shall, so far as practicable, avoid crossing traffic lanes but if obliged to do so shall cross on a heading as nearly as practicable at right angles to the general direction of traffic flow.

On HENDRIK SENIOR the course alteration made by the watchkeeper from 285 degrees to 310 degrees meant that HENDRIK SENIOR did not comply with this regulation.

(e) A vessel other than a crossing vessel or a vessel joining or leaving a lane shall not normally enter a separation zone or cross a separation line except:

(i) in cases of emergency to avoid immediate danger;

OOW on BIRKA EXPORTER considered himself to be obliged to keep his course and speed because he is in the separation zone and HENDRIK SENIOR is approaching from his port side.

Rule 15 - Crossing situation

When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

[29] *A Guide to Collision Avoidance Rules*, Cockcroft, A.N. and Lameijer J.N.F., Burlington, Cornwall 2004

Rule 16 - Action by give-way vessel

Every vessel, which is directed to keep out of the way of, another vessel shall, so far as possible, take early and substantial action to keep well clear.

It can be considered that HENDRIK SENIOR is not following Rule 15 and 16

Rule 17 - Action by stand-on vessel

(a) (i) Where one of two vessels is to keep out of the way the other shall keep her course and speed.

(ii) The latter vessel may however take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these Rules.

(b) When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.

Give-way vessel is required to take action in good time, which will result in passing at a safe distance. Stand-on vessel is required to keep her course and speed until it becomes apparent that the give-away vessel is failing to take action in ample time.

In open sea a give-away vessel which approaches within two NM in a crossing situation, can usually be considered to have waited too long to take action and therefore it is important for the stand-on vessel to get the give-away vessel's attention by the VHF or five short rapid blasts of the whistle.

2.8 Complacency and risk perception

HENDRIK SENIOR was habitually operated at night, in busy coastal waters, with one man in the wheelhouse while the remaining crew slept. The skipper did not provide written instructions to his crew, preferring to rely on verbal instructions to "call him if there was a problem". He allowed an ARPA CPA alarm setting of 2 cables to be used at all times, even when crossing a TSS at night, with a lone watchkeeper in control of his vessel. Despite his qualifications and experience, with respect to watchkeeping, this was too low leading to the suspicion that the skipper had become complacent.

The evidence shows that the watchkeeper applied the skipper's minimum CPA, and passed two other vessels at about this distance, before apparently attempting to pass very close ahead of BIRKA EXPORTER. The watchkeeper also altered course so as to minimise passage time to the fishing grounds, and in so doing placed his vessel in greater danger by not crossing the TSS at right-angles.

If HENDRIK SENIOR's watchkeeper was not asleep, absent from the wheelhouse, or otherwise distracted, his behaviour leading up to the collision suggests his risk perception was seriously flawed. There was little evidence of positive actions taken to acquire information and reduce uncertainty. This behaviour can arise for a number of reasons, including the failure to remain situational aware, due to poor perception of potential risk and a failure to think ahead. This prevented him from recognising the clear signals indicating that a dangerous situation was developing until it was too late to take effective ac-

tion to prevent the collision. This suggests a complacent attitude towards his navigational responsibilities.

Complacency continues to be a recurring safety issue in accidents investigated by the MAIB. Vessel owners should recognise the risks posed by complacency and ensure that their vessels always operate with effective and efficient personnel[30].

2.9 Observations from previous incidents

Previous safety studies conducted by the MAIB have shown:

MAIB Analysis of UK Fishing Vessel Safety 1992–2006

The record of fatalities as a result of collisions was almost three times the fatality rate from fires and explosion over the same period, and included a predominance of >24m vessel deaths.

This analysis showed that it is not unusual for serious collisions involving fishing vessels to result in human tragedy; not just damaged vessels.

MAIB Bridge Watchkeeping Safety Study 1994–2003

Twenty-two people lost their lives in collisions involving merchant vessels during the period covered by this study, and many of the issues identified in merchant shipping, and highlighted in section 1.4.5 of this report, also apply to the fishing industry.

MAIB Analysis of Fishing Vessel Accident Data 1992–2000

The analysis found that during the period under examination:

- Poor lookout contributed to the majority of fishing vessel collisions
- Passing distances (including CPA) were too small
- Procedures and regulations were sometimes intentionally violated.
- The facts of this case support this analysis, which was written in 2002.

[30] MAIB safety flyer arising from Scot Isles v Wadi Halfa 2009. See http://www.maib.gov.uk/cms_resources/Scot_Isles_Wadi_Halfa_Flyer.pdf

3 CONCLUSIONS

HENDRIK SENIOR was the give way vessel; the watchkeeper saw BIRKA EXPORTER but did not take early and substantial action to keep clear. Instead HENDRIK SENIOR executed two consecutive starboard turns with a total heading change of 60 degrees towards the incoming vessel. BIRKA EXPORTER was the stand on vessel, and this she did. However, she did not subsequently take appropriate avoiding action before the vessels had a head-on collision.

The routines regarding the lookout onboard on BIRKA EXPORTER was not working even if it was in the Ship management system. Because the time onboard was not shifted to the time zone of the position, there was a bridge without a lookout for several hours before sunrise. The minimum safe manning certificate onboard did not either support proper watch keeping routines since the manning on deck is only 3 persons especially during darkness in the winter time. [1.2.3, 2.6.2]

To use 6–12 NM range continuously on the radar in congested waters cannot be considered to be correct. Before the collision there were several close-quarters situations with other vessels without the change of range on the radar. The requirement in the standing orders on BIRKA EXPORTER to use the second radar with a smaller range during night time and/or reduced visibility could have been the proper procedure. [1.2.3, 2.6.7]

GOLREGS do not always support the decision making for the OOW and terms like ample time, safe passing distance and close-quarters situation are not quantified. Authorities are not able to do this because it depends on number of factors, from ship to ship. Therefore it would be necessary for the master and the officers onboard to define guidelines regarding ample time, safe passing distance and close-quarters situation for their ship and traffic area. [1.4.4, 2.7]

While no evidence was found that the watchkeeper was asleep, HENDRIK SENIOR*'s* watchkeeper was not alert immediately prior to the collision. [2.4, 2.6.6, 2.8]

HENDRIK SENIOR and BIRKA EXPORTER were in sight of one another; each ship was also provided with a range of modern navigational aids. However, neither vessel maintained a proper lookout, in accordance with the COLREGS, by using all available means, to assess that a risk of collision was developing. [2.4, 2.6, 2.7]

BIRKA EXPORTER did not alter course towards HENDRIK SENIOR, as alleged by HENDRIK SENIOR*'s* watchkeeper. BIRKA EXPORTER maintained a steady course and speed until a collision became unavoidable, and she was not then able to take effective avoiding action, in accordance with the COLREGS. [2.4, 2.7]

HENDRIK SENIOR*'s* watchkeeper demonstrated a complacent attitude to his bridge watchkeeping responsibilities, and he also could have made better use of available resources. [2.6, 2.8]

The evasive manoeuvre carried out by HENDRIK SENIOR was commenced too late and with too small a course change in respect to the approach course chosen by the trawlers. An important observation from this accident is that if proper safety margins are not maintained a close-quarters situation can develop very quickly into an extremely serious one with possible catastrophic consequences. [2.4]

The ice strengthened bulb of the BIRKA EXPORTER had the potential to cause severe damages on HENDRIK SENIOR. This could have been the result, if the impact angle and its position had been only slightly different. [2.5].

Both the actual position of the first contacts and the small angle of impact contributed to the relatively restricted damages without any large holes below the waterline on the hull of HENDRIK SENIOR. The trawler could thus stay afloat using its own pumps and those from the KNRM lifeboat.

The minimum CPA set by the HENDRIK SENIOR*'s* skipper was too small. [2.7]

Previous safety studies conducted by the MAIB have shown that poor lookout contributed to the majority of fishing vessel collisions, passing distances (including CPA) were too small and procedures and regulations were sometimes intentionally violated. The issue has also been raised that it is difficult to keep away from all the fishing boats in congested waters and it's common that they are coming very close to cargo ships. Additionally fishing vessels often have no AIS transmitter[31]. [1.4.5, 2.8, 2.9]

[31] An improvement to the recognition of fishing vessels on electronic navigation systems is coming with the new *DIRECTIVE 2009/17/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 amending Directive 2002/59/EC establishing a Community vessel traffic monitoring and information system* which requires that progressively all fishing vessels over 15 metres long shall be equipped with automatic identification systems (AIS).

4 ACTIONS TAKEN

Skipper of HENDRIK SENIOR

The skipper of HENDRIK SENIOR has amended his standing orders so that when on passage in the future the minimum CPA will be 5 cables; the ARPA CPA alarms will be adjusted to reflect this.

Watchkeeper of HENDRIK SENIOR

- Has applied for a UK CEC.
- Is studying to gain a Merchant Navy (STCW) qualification.

Owner of HENDRIK SENIOR

Has purchased a replacement beam trawler.

the UK Maritime and Coastguard Agency

- HENDRIK SENIOR's International Fishing Vessel Certificate was withdrawn following an inspection of the vessel at Harlingen.
- The vessel was subsequently de-registered.

Birka Cargo Ab Ltd

The company processed the accident in the management review according to the safety management system. They found no defects in the safety management system. Bridge routines are described in the SMS manual chapter 5.3.1 and also that COLREGS must be followed. Even instructions that the lookout shall be on the bridge during darkness are in the SMS. The management review decided to wait for the investigation report before further action is taken.

5 SAFETY RECOMMENDATIONS

Previous safety studies have shown that poor lookout, too small passing distances and sometimes intentionally violated procedures and regulations contributed to collisions.

Both vessels failed in this case to comply with the COLREGS, and as a result of complacency, two well equipped and modern ships collided in conditions of good visibility, even though each knew a risk of collision existed. Bridge equipment was not used effectively and no lookout was present in either wheelhouse at the time.

The Investigators give recommendations[32] to the owners of the two vessels:

1) Birka Cargo as the owner of BIRKA EXPORTER ensures that

a. the custom regarding lookout on the bridge onboard their vessels complies with the Safety Management System and

b. the guidance regarding safe navigational watchkeeping for the OOW is improved in the fleet, including the use of navigational equipment and the interpretation of COLREGS.

2) The owner of HENDRIK SENIOR ensures that

a. the use of the lookout on the bridge onboard their trawlers complies with the COLREGS and

b. the guidance regarding safe navigational watchkeeping for the OOW is improved on their trawlers, including the use of navigational equipment and the interpretation of COLREGS.

Helsinki, 16 November 2010

Martti Heikkilä Micael Vuorio

[32] Safety recommendations shall in no case create a presumption of blame or liability.

Appendix 1

BIRKA CARGO

SAAPUNUT
02 -11- 2010
494/5M

ACCIDENT INVESTIGATION BOARD
Sörnäisten rantatie 33 C
00500 Helsinki
FINLAND

28.10.2010

Your letter 271/5M dd.24 September 2010

HENDRIK SENIOR (UK) V BIRKA EXPORTER (FIN), COLLISION IN INTERNATIONAL WATERS 17 NM OFF THE NETHERLANDS, ON 8.12.2008

Dear Sirs,

With reference to the final draft of the investigation C5/2008M, HENRIK SENIOR (UK) v BIRKA EXPORTER (FIN), Collision in the International Waters 17 NM off the Netherlands, on 8.12.2008, we have the following statement.

We have studied the report which we consider to be thorough and accurate. However, the report should stress the fact that had HENRIK SENIOR followed the basic rule for avoiding collision the accident would not have in first hand occurred.

Yours sincerely,

Birka Cargo Ab Ltd

Stefan Axberg
Managing Director

Kim Heiniö
Safety Manager

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