



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

Summary
Investigation Report 304/10

Very Serious Marine Casualty

Collision about 25 nm east of Tianjin
between the CMV JULIA S
and the MV ZENITH WINNER on 24 July 2010

15 October 2011

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

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

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

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

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1 Summary

At 0554¹ on 24 July 2010, a collision occurred between the container vessel JULA S, which sails under the flag of Germany, and the coaster ZENITH WINNER, which is registered in the Republic of Korea², about 25 nm east of the Chinese port of Tianjin in fog. Visibility was considerably less than one nautical mile. The JULA S was on a westerly course towards the roads of Tianjin. The ZENITH WINNER left Tianjin at 0315 and steered continuously on a head-on course towards the open sea. In the (radar) view of the ship's command of the JULA S, up until about 2.5 minutes before the collision and at a distance of approximately 1 nm between the two vessels, everything pointed towards an uncomplicated 'green - green'³ passage with a passing distance of approximately 0.3 nm.⁴ However, as confirmed by the AIS recordings of Vessel Traffic Service (VTS)⁵ Tianjin, the ZENITH WINNER began to turn to starboard at this point for no apparent reason. At about 0553, this sudden and unpredictable change in course was noticed on the bridge of the JULA S, which responded with a hard to starboard course change and 'full astern' as a last moment action shortly after. However, at this point the distance between the two vessels was no longer great enough to avoid the collision. The bulbous bow of the JULA S ploughed into the port side of the ZENITH WINNER leaving an indentation some 3 metres deep in the area at which the superstructure and cargo hold meets and caused a massive inrush of water there. The ZENITH WINNER slowly began to founder about 15 minutes after the collision. All ten crew members abandoned the vessel and escaped in a liferaft. The JULA S only sustained minor damages to the bulbous bow and one of her lifeboats made for the liferaft and towed it to the JULA S. The survivors were taken on board the container vessel with no serious injuries.

¹ All times shown in this report are local = UTC + 8 hours.

² Non-official designation: South Korea.

³ 'Green - green' is a nautical euphemism for the passage of vessels to their respective starboard side based on the green navigational lights to starboard. In contrast, 'red on red' stands for the port side to port side passage of two vessels.

⁴ Source: radar recordings by the **Voyage Data Recorder (VDR)** of the JULA S.

⁵ VTS = **Vessel Traffic Service**.

2 SHIP PARTICULARS

2.1 Photo of the CMV JULA S



Figure 1: Photo of the JULA S⁶

2.2 Vessel particulars: CMV JULA S

Name of vessel:	JULA S (ex. CSAV TIANJIN)
Type of vessel:	Container vessel
Nationality/flag:	Germany
Port of registry:	Elsfleth
IMO number:	9299484
Call sign:	DDIU
Owner:	MS 'Jula S' H+H Schepers Reederei GmbH & Co. KG
Year built (keel laying/completion):	2004/2005
Shipyard/yard number:	Volkswerft Stralsund/454
Classification society:	Germanischer Lloyd
Length overall:	207.46 m
Breadth overall:	29.80 m
Gross tonnage:	25,414
Deadweight:	33,796 t
Draught (max.):	11.40 m
Engine rating:	20,930 kW
Main engine (type/manufacturer):	2-stroke diesel 7 L 70 MC/HSD Engine Co. Ltd.
(Service) speed (max.):	21 kts
Hull material:	Steel
Manning:	19

⁶ Source: owner's website (www.hschepers.de).

2.3 Voyage particulars: CMV JULA S

Port of departure:	Dammam (Saudi Arabia)
Port of call:	Tianjin (China)
Type of voyage:	Merchant shipping/international
Cargo information:	Empty containers
Draught at time of accident:	6.75 m
Manning:	19
Pilot on board:	No
Number of passengers:	None

2.4 Photo of the MV ZENITH WINNER



Figure 2: Photo of the ZENITH WINNER⁷

2.5 Vessel particulars: MV ZENITH WINNER

Name of vessel:	ZENITH WINNER
Type of vessel:	General cargo ship
Nationality/flag:	Republic of Korea
Port of registry:	Jeju
IMO number:	8844701
Call sign:	DSOG6
Owner:	DAE HO SHIPPING CO. LTD.
Year built:	1990
Shipyard/yard number:	YAMANAKA SHIPBUILDING CO. LTD./507
Classification society:	Korean Register of Shipping
Length overall:	69.77 m
Breadth overall:	11.70 m

⁷ Source: Korean Maritime Safety Tribunal (KMST) = maritime casualty investigation agency of the Republic of Korea.

Gross tonnage:	1,123
Deadweight:	2,680.9 t
Draught (max.):	7.20 m
Engine rating:	1,176 kW
Main engine (type/manufacturer):	HANSHIN 6LH31RG
(Service) speed (max.):	12 kts
Hull material:	Steel
Manning:	10

2.6 Voyage particulars: MV ZENITH WINNER

Port of departure:	Tianjin (CHINA)
Port of call:	Chungnam (Republic of Korea)
Type of voyage:	Merchant shipping/international
Cargo information:	No cargo on board
Draught at time of accident:	5.6 m
Manning:	10
Pilot on board:	No
Number of passengers:	None

2.7 Marine casualty information

Type of accident:	Very serious marine casualty, collision
Date, time:	24/07/2010, 0554
Location:	Approx. 25 nm east of Tianjin
Latitude/Longitude:	ϕ 38°52.8'N λ 118°14.5'E
Ship operation and voyage segment:	Approach to Tianjin
Consequences:	Foundering of a coaster; crew rescued

Section of nautical chart 2703 (great circle chart of the Northern Pacific Ocean), BSH⁸

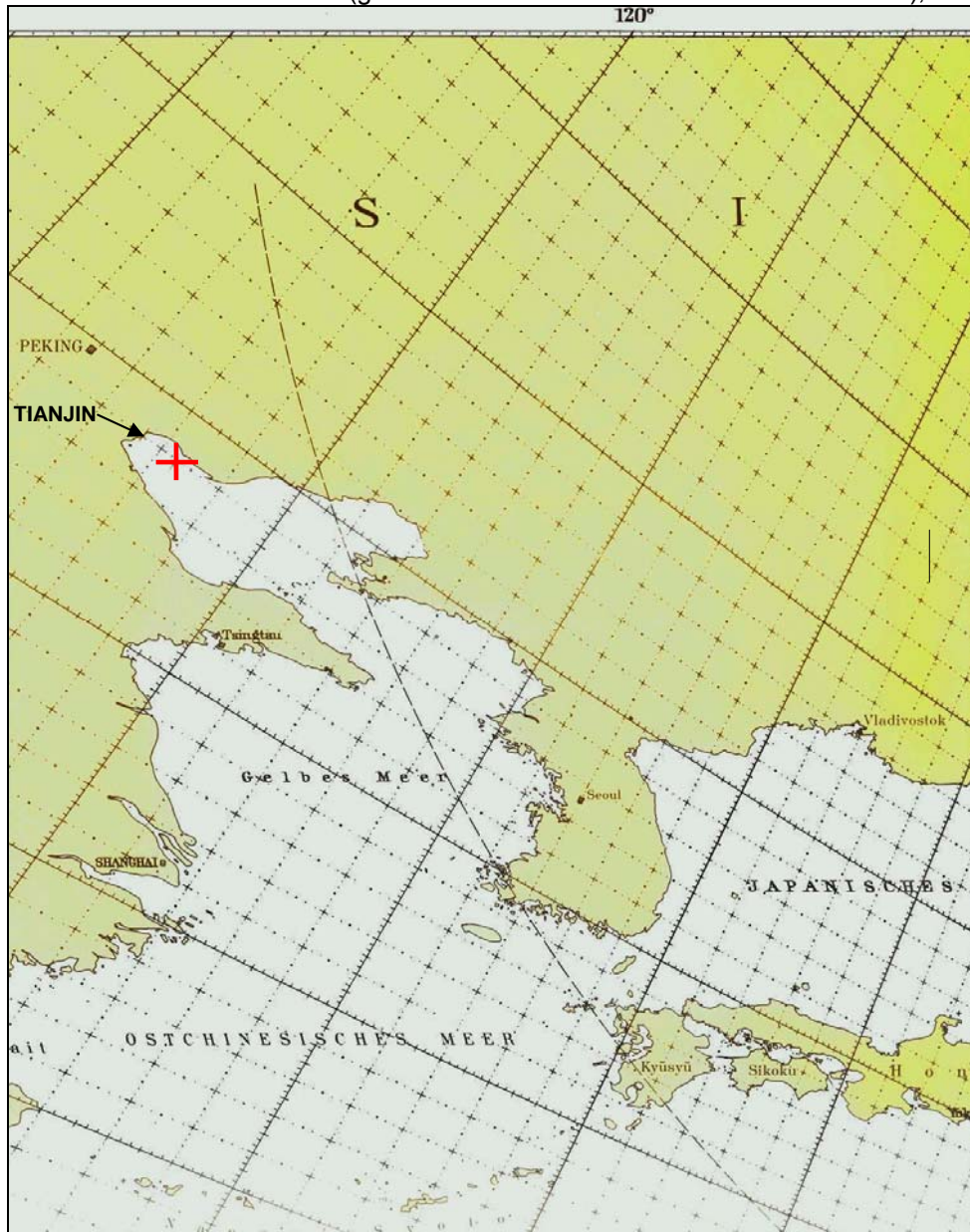


Figure 3: Scene of the accident

⁸ BSH = Federal Maritime and Hydrographic Agency

2.8 Shore authority involvement and emergency response

Agencies involved:	VTS Tianjin, VTS Caofeidian
Resources used:	Approximately 10 vessels located in the vicinity were ordered to proceed to the scene of the accident by the VTS
Actions taken:	Rescue the crew of the ZENITH WINNER from a liferaft by a lifeboat from the JULA S; survivors cared for on board the JULA S; disembarkation of the survivors in Tianjin
Results achieved:	One crew member suffered minor injuries; total loss of the MV ZENITH WINNER

3 COURSE OF THE ACCIDENT AND INVESTIGATION

3.1 Course of the accident

In the 30 minutes leading up to the collision, the JULA S, a 2,474 TEU⁹ full container vessel in regular service between the Persian Gulf and China, approached the roads of Tianjin on autopilot. Her course over ground was initially about 282 degrees (see **Fig. 4**) and finished at about 289 degrees (see **Fig. 5**). Her speed stood at a constant 14.7 kts.¹⁰ The sea in the congested area was calm and fog prevailed. Visibility was less than 0.5 nm at times. The vessel was navigated by the master, who was assisted by the chief officer (OOW). Aside from the master and OOW, a rating was also on watch on the bridge.

The ZENITH WINNER left the buoyed fairway of the approach to Tianjin at about **0535** on the day of the accident on its northern side and steered a course over ground of initially about 092 degrees (see **Fig. 4**) followed by about 098 degrees (see **Fig. 5**) up until some 4 minutes before the collision. The speed of the ZENITH WINNER, which was navigated by the chief officer, stood at a constant 11.6 kts.

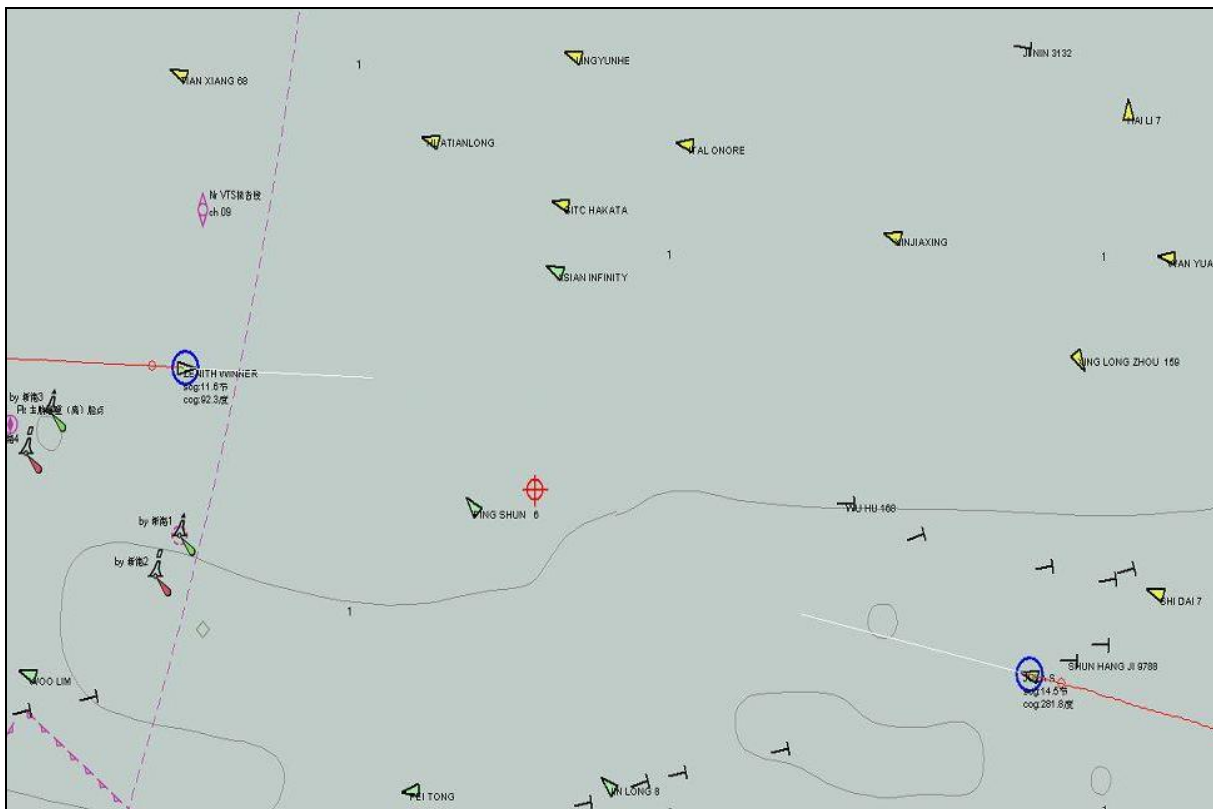


Figure 4: Traffic situation at 0541 (screenshot of the AIS recording of VTS Tianjin)¹¹

⁹ Container stowage capacity (Twenty-foot Equivalent Unit standard container) according to the owner.

¹⁰ Sources: VDR of the JULA S, Automatic Identification System recordings of VTS Tianjin.

¹¹ The subsequent scene of the accident is in the middle of the screenshot marked in red. The distance between the two vessels at the time in question stands at about 2 nm. See below in subpara. 3.3.2 f. for details of the AIS analysis.

At about **055030** at a distance of some 1 nm to the JULA S, the ZENITH WINNER suddenly began to alter her course to starboard without warning.



Figure 5: Traffic situation at 0551 (screenshot of the AIS recording of VTS Tianjin)

This course change becomes increasingly apparent on the radar of the JULA S between **055214** and **055229** (see Fig. 6; MV ZENITH WINNER highlighted in pink by the author of this report).¹²

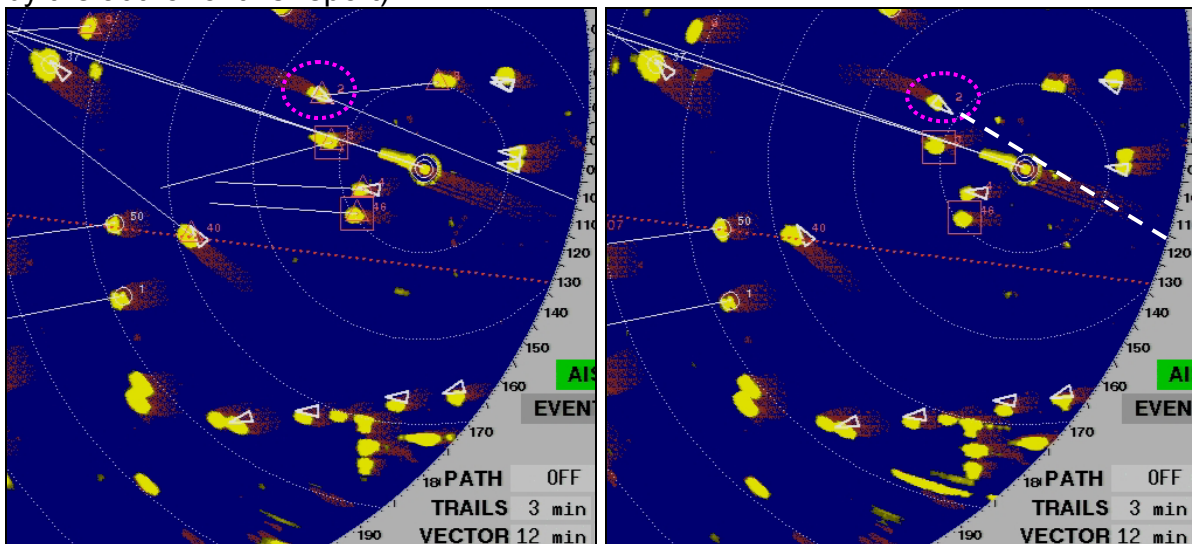


Figure 6: Screenshot of the radar recording of JULA S at 055214 and 055229¹³

¹² Source: VDR of the JULA S; see sub-para. 3.3.1.1 below for details of the radar image analysis.

¹³ In order to illustrate the development of the hazardous situation, the white dashed course line (vector) of the ZENITH WINNER (right image) was subsequently plotted in the figure by the author of this report (vectors of targets identified as hazardous by the ARPA radar flash when displayed on the radar screen. While the left screenshot (coincidentally) captured the flash of the vector, the flashing vector was hidden at the moment the right screenshot was captured).

The action taken to prevent the collision ('hard to starboard' course change, 'full astern' navigational manoeuvre) on the bridge of the JULA S shortly after **0553** did not prevent the two vessels from colliding at about **0554**. The bulbous bow of the JULA S ploughed into the port side of the ZENITH WINNER leaving an indentation some 3 metres deep in the area at which the superstructure and cargo hold meets.

General alarm was sounded on the bridge of the JULA S immediately afterwards.¹⁴ At this point, the chief officer went to the forecabin of the vessel and assessed the consequences of the accident from there. From about **0600** onwards, repeated attempts were made to establish contact with Vessel Traffic Service (VTS) Tianjin over VHF. The ZENITH WINNER was also called repeatedly after the name of the vessel was identified visually at **0615**. From about **0608** onwards, it was observed from the JULA S how the ZENITH WINNER slowly began to founder.

The ZENITH WINNER responded to the calls of the JULA S only on one occasion at **0616**. Due to the heavy damage to the vessel and the fact that she was foundering rapidly, her crew had apparently already made a decision to abandon her at this point. There was no further communication via VHF. It was not possible for the crew of the ZENITH WINNER to launch the lifeboat in an orderly manner due to technical problems in connection with the vessel's rapidly increasing list. The crew managed to lower only one liferaft and jump into it.

At **0616**, the JULA S lowered the starboard anchor. VTS Tianjin responded for the first time at **0619**. In the ensuing period, further action was coordinated with the VTS, which also managed the rescue operation. For about the next 90 minutes, those on board the JULA S were occupied with assessing the collision's impact on their own vessel.

At **0800** – visibility was still very poor – the anchor was weighed and they started to manoeuvre carefully towards the other vessel. At **0806**, a lifeboat was launched, which reached the liferaft containing the entire crew of the ZENITH WINNER at **0818**. The liferaft was taken in tow and all the persons rescued were on board the JULA S at **0906**.

After hauling in the lifeboat, the container vessel continued her voyage and made fast in the port of Tianjin at **1306**.

3.2 Consequences of the accident

The massive inrush of water after the collision resulted in the ZENITH WINNER foundering within about 2 hours. It was possible to rescue the crew, which was unscathed with the exception of one crew member who had a minor knee injury.

The side of the JULA S in the area of the forepeak and her bulbous bow were slightly damaged, respectively, deformed (see **Fig. 7 f.** below) due to the collision. No water ingress or damage to the tanks was found. There were no injuries on board the container vessel.

The BSU is not aware of the extent of the pollution associated with the foundering of the ZENITH WINNER after the collision.

¹⁴ Sources for this and the following information: VDR audio and log book recordings of the JULA S; information from the Chinese media.



Figure 7: Damage to the bulbous bow of the JULA S¹⁵



Figure 8: Damage to the forepeak of the JULA S¹⁶

¹⁵ Source: owner of the JULA S.

¹⁶ Source: owner of the JULA S.

3.3 Investigation

The analysis of the screenshots of the radar, which are saved at 15-second intervals in the VDR¹⁷ of the JULA S, was of fundamental importance to reconstructing the course of the accident. In addition, the AIS recording of Vessel Traffic Service Tianjin provided by the Chinese Maritime Administration delivered information on the development of the collision.

3.3.1 VDR recordings of the CMV JULA S

3.3.1.1 Radar

The ship's command used the S-band radar for navigation in the congested area. It was stated that the X-band radar, which is not connected to the VDR, was also in operation.¹⁸ The S-band system was operated at a range of 3 nm in the display mode north up, relative motion. The target vectors were set to 12 minutes. The display was off-centre, meaning the actual sector that could be observed was about 5 nm ahead. Frequency alignment ('TUNE') between the transmitter and receiver was automated ('AFC'). Anticlutler rain and sea ('RAIN' and 'SEA') was set to 0 and amplification ('GAIN') to about 3/4 of the maximum value. 'MEDIUM' was selected for the proprietary noise suppression ('CLEAN SWP'). The interference rejection ('IR') to suppress interference caused by the radar emissions of other vessels was enabled. Range markers ('RINGS') were displayed around the container vessel's own position at intervals of 0.5 nm. None of the settings discussed were changed subsequently.

An example of the traffic situation at **054659** (see **Fig. 9** below; oncoming ZENITH WINNER highlighted in pink here and below¹⁹) illustrates the high volume of traffic in the area of the scene of the subsequent accident. Most of the echoes can be attributed to fishing vessels; these are often found in large formations in the coastal regions of Southeast Asia, in particular. Passing through such formations calls for heightened awareness on the part of the ship's command, but also a degree of serenity. To that extent, the implementation of traditional evasion manoeuvres is hardly possible. Rather, in line with local practise, fishing vessels operate in the immediate vicinity of large merchant vessels, but regularly take timely action on their own initiative to ensure an unimpeded passage.

¹⁷ VDR = Voyage Data Recorder; carriage requirement on vessels of 3,000 GT and above; system for gathering data after an accident to make it possible to determine and analyse the causes thereof.

¹⁸ In addition to the S-band radar, the JULA S is equipped with an X-band radar (carriage requirement). X-band and S-band radar systems operate at different frequency ranges. X-band systems provide better resolution and detectability of small objects, but are susceptible to interference from rain and sea clutter. S-band systems have a longer range and are less susceptible to the above mentioned interference, but are less sensitive in terms of detecting small vessels.

¹⁹ Any pink highlighting in this and subsequent figures has been added by the author of this report.

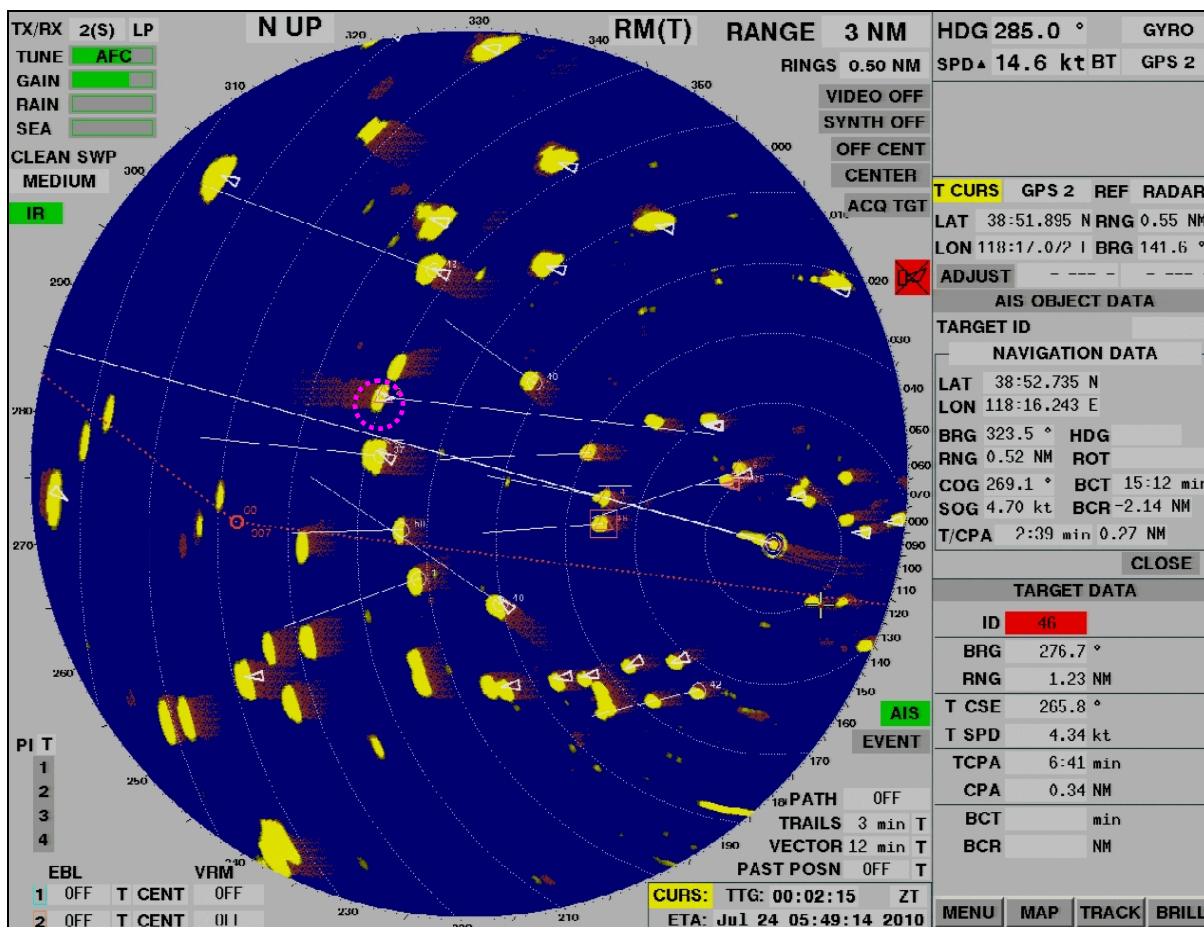


Figure 9: Radar image of the JULA S at 054659

In addition to a screenshot of the above radar image, **Figure 10** (see below) shows the ARPA²⁰ data of the ZENITH WINNER (= target 2; see pink highlighted area on the right side of the figure).²¹ Both the graphical representation of the vector ahead of the ZENITH WINNER and the numeric ARPA data (the CPA²² and the TCPA²³, in particular) show that the track of the other vessel involved in the subsequent collision did not indicate any potential danger about 7 minutes before the collision. The ZENITH WINNER, which was 3.1 nm away, was acquired²⁴ as an ARPA target and identified as dangerous by the radar because of the forthcoming close-quarters situation (see red triangle on the echo of the ZENITH WINNER).

²⁰ ARPA = **A**utomatic **R**adar **P**lotting **A**id.

²¹ A special filtering and display option of the replay software of the VDR has been used for the highlighted box containing the ARPA data of the ZENITH WINNER. This box is not part of the actual or available real-time radar image display on board.

²² CPA = **C**losest **p**oint of **a**pproach.

²³ TCPA = **T**ime to **c**losest **p**oint of **a**pproach.

²⁴ Acquisition means that a radar target has been added to the radar's automated plotting function by the user or automatically. The plotting of a target is represented graphically by a white circle over the echo and the display of a vector. Vessels which emit AIS signals are (possibly additionally) marked by a white triangle over the radar echo.

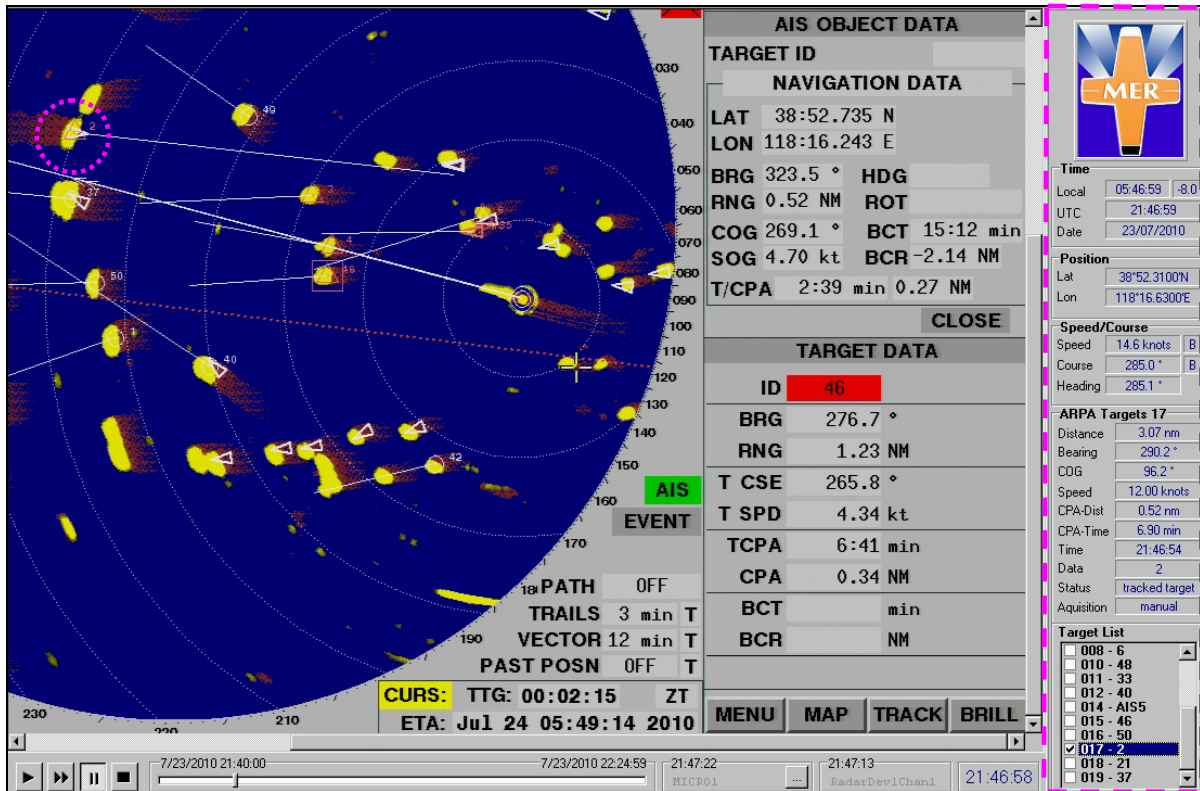


Figure 10: Screenshot of the radar image at 054659 plus VDR replay information window

Despite that, the radar user – most likely because of the bearing, which was initially clearly veering to starboard – saw no particular reason to view the ARPA data of the ZENITH WINNER on the radar screen.²⁵

With a CPA value of 0.52 nm and a TCPA value of 6.9 minutes, the ARPA data subsequently reproduced by the VDR's replay software in the course of the investigation confirm the harmless nature of the approach of the two vessels at the time in question.

The following 15-second interval radar image screenshots²⁶ (including the vessel's own ARPA data as well as that of the ZENITH WINNER displayed *subsequently* by the VDR's replay software)²⁷ illustrate the sequence of events during the final 3 minutes before the collision from the (radar) perspective of the ship's command of the JULA S; and consequently, the period in which an initially seemingly uncomplicated 'green - green' passage abruptly developed into a collision involving the two vessels.

²⁵ The radar is able to plot a multitude of objects internally and display those using vectors. However, the user can only display the ARPA data of a maximum of two targets graphically in the 'TARGET DATA' window set aside for that purpose. In Figure 9/10, this was target number 46 (targets whose data are currently displayed numerically are marked by the system with a square).

²⁶ See comment in footnote 19.

²⁷ To illustrate that the VDR replay window was not part of the radar screen on the bridge, the author of this report has separated it from the actual radar image in the following figures with an auxiliary line (see also footnote 21).

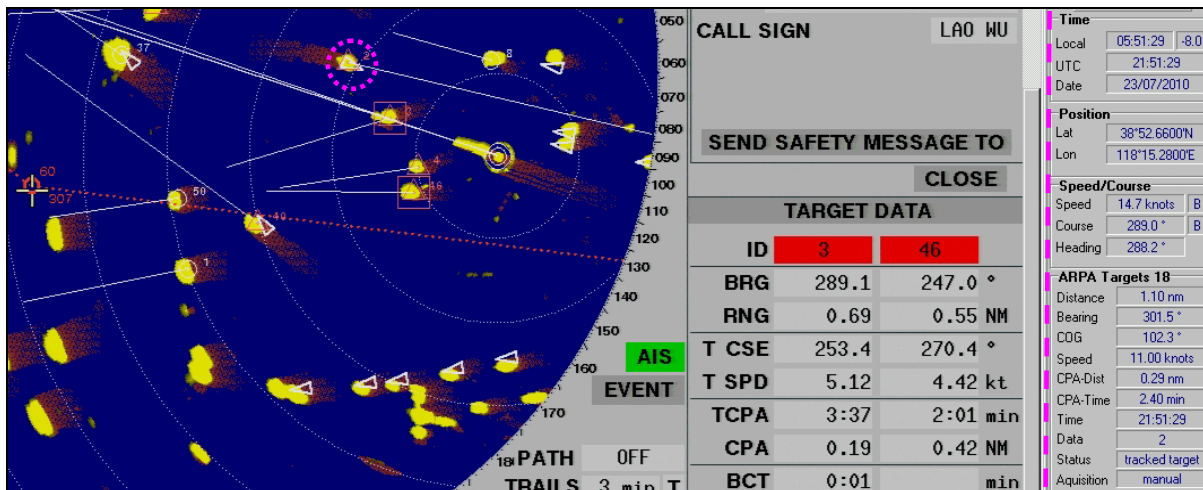


Figure 11: Screenshot of the radar image at 055129 plus VDR replay information window

The fact that the ZENITH WINNER is – as an acquired ARPA target – only shown sporadically with the corresponding symbols in the following screenshots (display of the vector ahead, red triangle to mark the echo identified by the system as being a dangerous target) should not give rise to confusion. The reason for this is that the manufacturer has configured the radar to display flashing symbols for dangerous targets. Accordingly, there is a 50 per cent chance that the vector ahead will be hidden in the respective screenshot when the VDR captures the radar images. Consideration of the following screenshots and the numeric ARPA data for the ZENITH WINNER permits a number of conclusions.

1. As a result of evaluating the radar information in the final minutes before the collision, it is very likely that the ship's command of the JULA S initially focused on the dangerous target (number 3) situated on the heading close to the course line.
2. Shortly after **055143**, the ZENITH WINNER had attained a course which crossed the course line of the JULA S and continued the course change to starboard, which had already been started a few minutes beforehand.
3. With respect to the echo of the ZENITH WINNER (target number 2), there was initially no heightened need for the JULA S to take action as a 'green - green' passage with a reasonable, albeit fluctuating CPA could be expected (see **Figs. 12 to 14** below).
4. From about **055230** onwards (see **Fig. 15 f.** below), the immediate risk of collision became apparent on the radar image due to the occurrence of the ZENITH WINNER's echo in the close quarters (approx. 0.5 nm), which was continuously converging with the JULA S on her lubber line.
5. In the period between **055329** and **055344** (see **Fig. 19 f.** below), the ship's command of the JULA S initiated a hard to starboard manoeuvre.

This is proven beyond doubt by the alteration in the course steered (heading) from 289.7 degrees to 299 degrees in just 15 seconds.

6. At best, the ZENITH WINNER's continuous turn towards the JULA S can be explained by the fact that the ZENITH WINNER intended to make room for four vessels (three with AIS signal; see green marking added by the author in **Fig. 13**) approaching her from the port side and possibly either

- interpreted target number 3 and the JULA S behind it as *one* vessel due to an unfavourable radar image resolution and/or making an incorrect visual assessment of the situation or
- assumed that the JULA S would, as a matter of course, immediately respond to the ZENITH WINNER's starboard course change with a starboard course change in order for the two vessels to pass 'red - red' instead of 'green - green'.

7. Communication and/or warning calls between the two vessels via VHF and/or light signals did not occur before the collision.

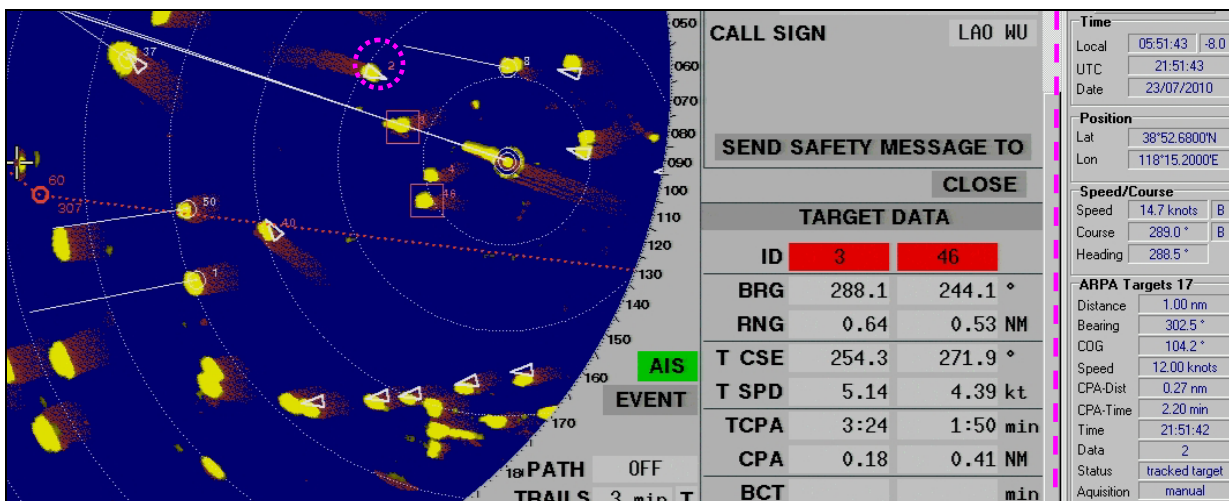


Figure 12: Screenshot of the radar image at 055143 plus VDR replay information window

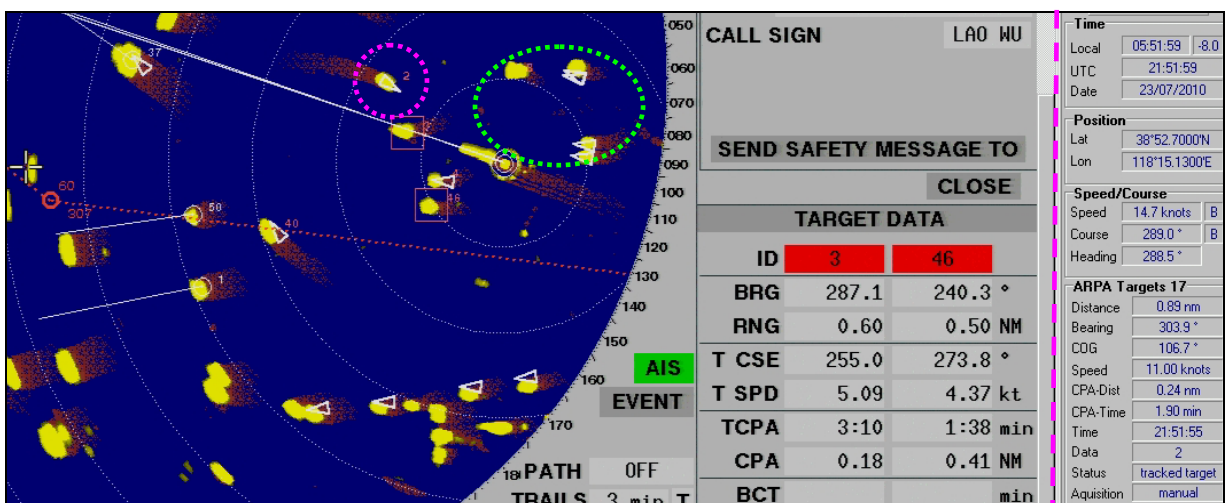


Figure 13: Screenshot of the radar image at 055159 plus VDR replay information window

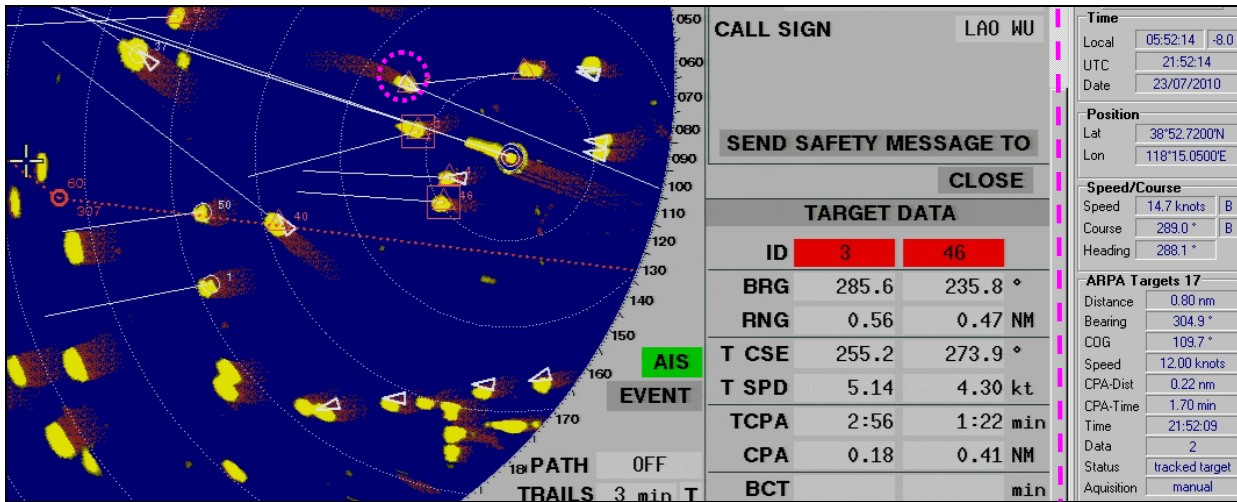


Figure 14: Screenshot of the radar image at 055214 plus VDR replay information window

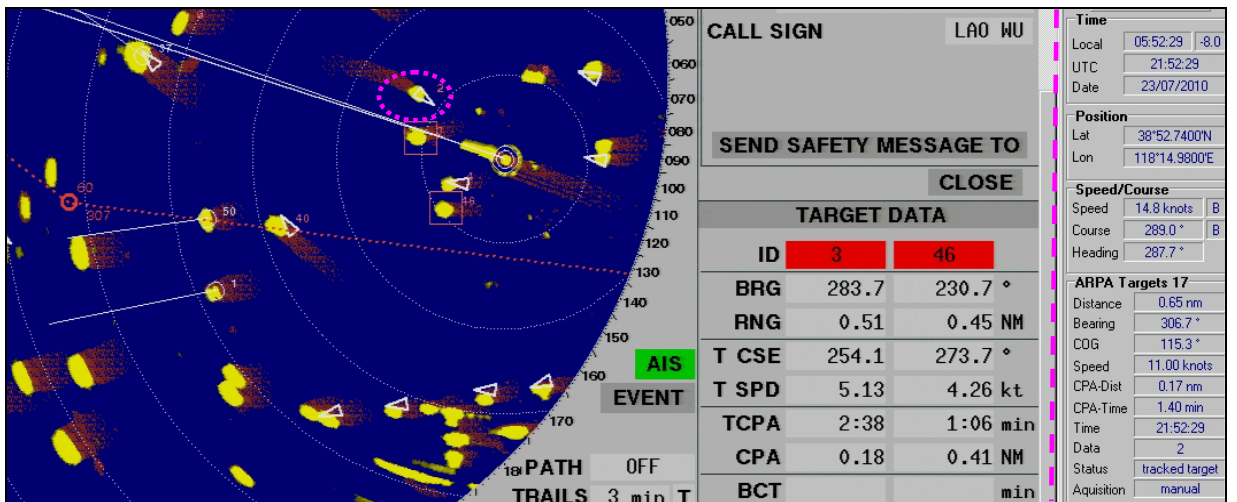


Figure 15: Screenshot of the radar image at 055229 plus VDR replay information window

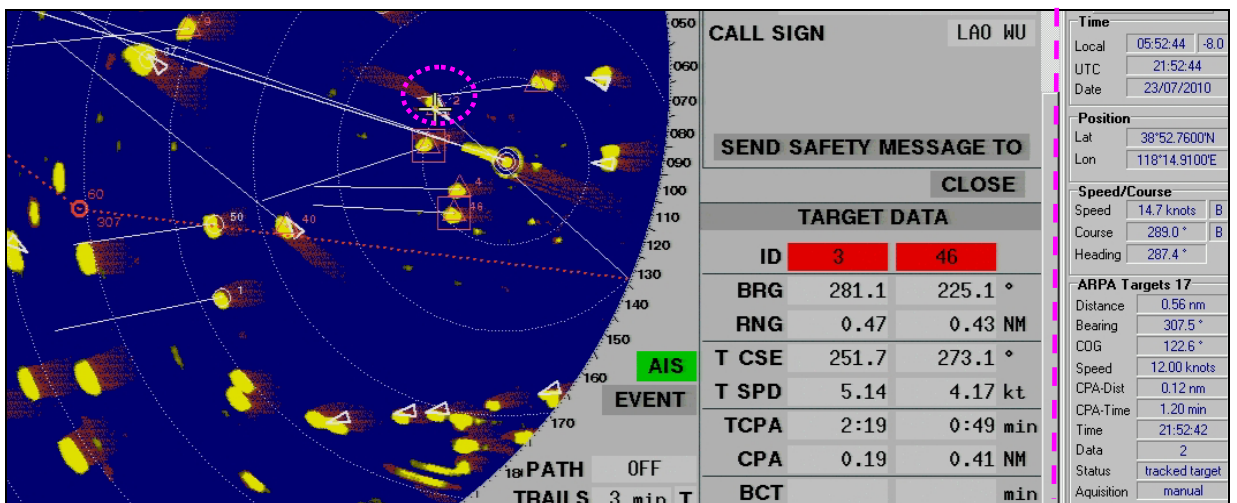


Figure 16: Screenshot of the radar image at 055244 plus VDR replay information window

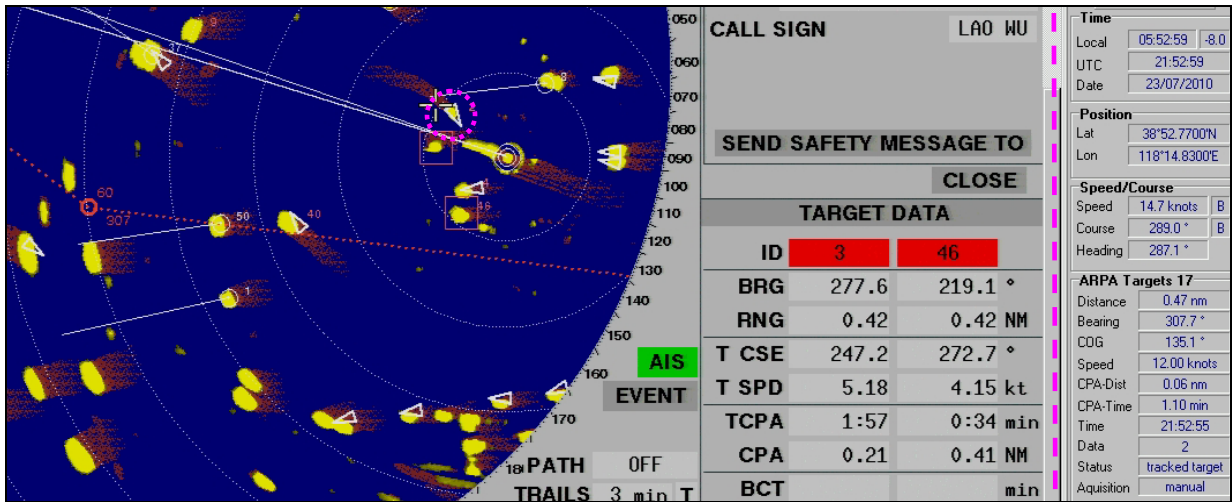


Figure 17: Screenshot of the radar image at 055259 plus VDR replay information window

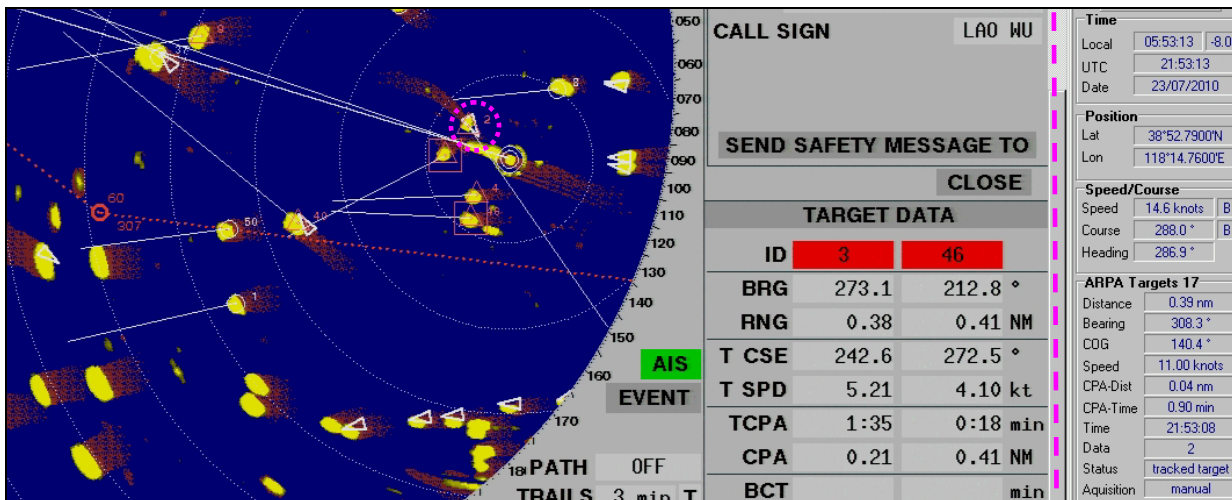


Figure 18: Screenshot of the radar image at 055313 plus VDR replay information window

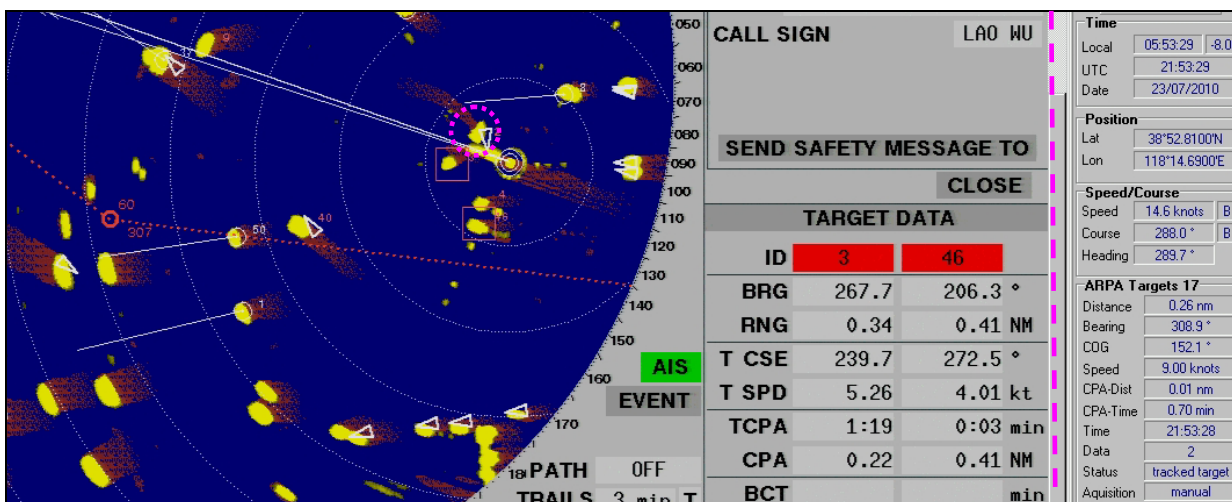


Figure 19: Screenshot of the radar image at 055329 plus VDR replay information window

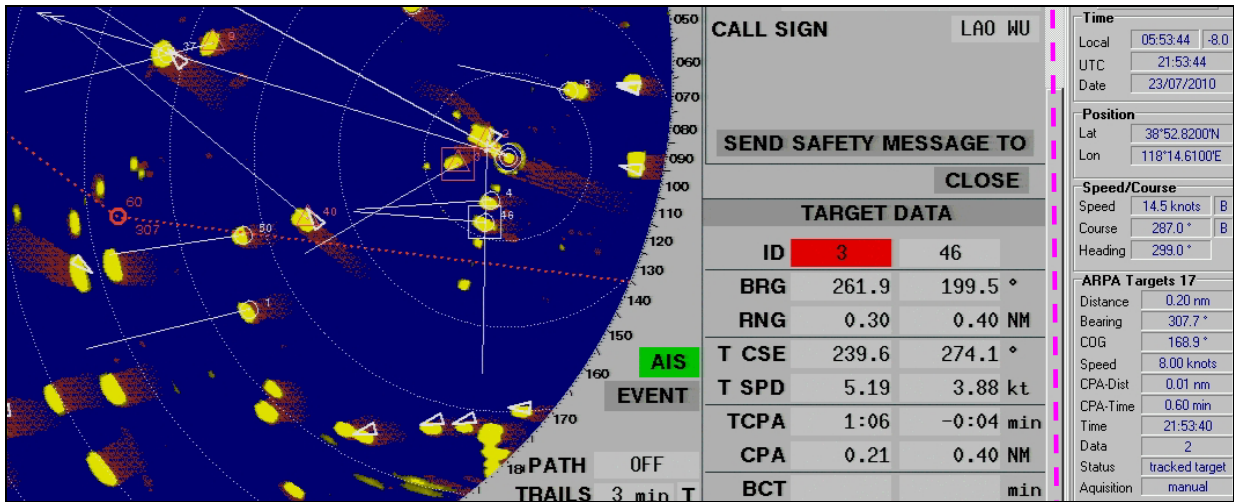


Figure 20: Screenshot of the radar image at 055344 plus VDR replay information window²⁸

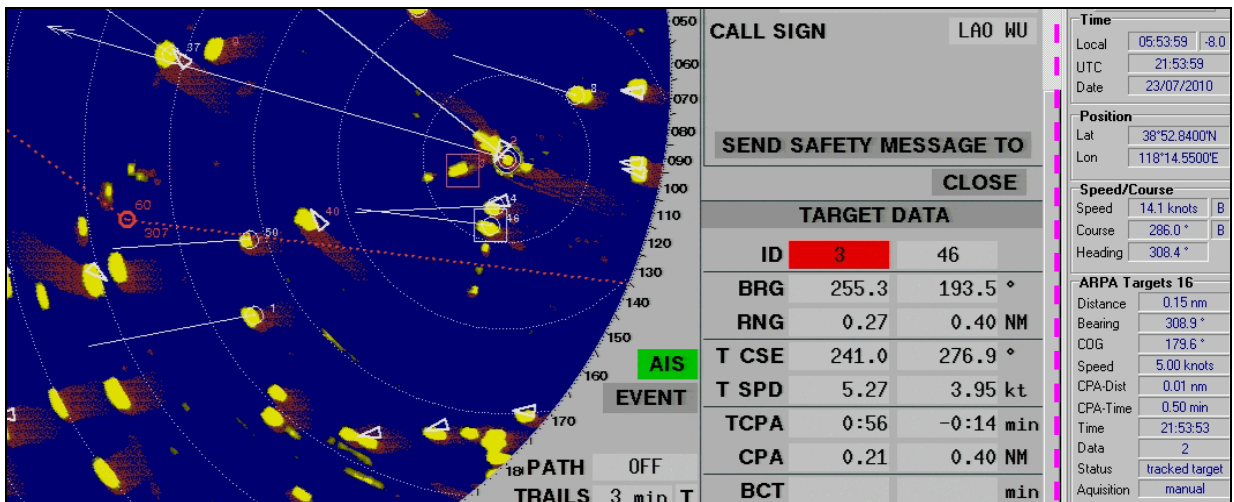


Figure 21: Screenshot of the radar image at 055359 plus VDR replay information window

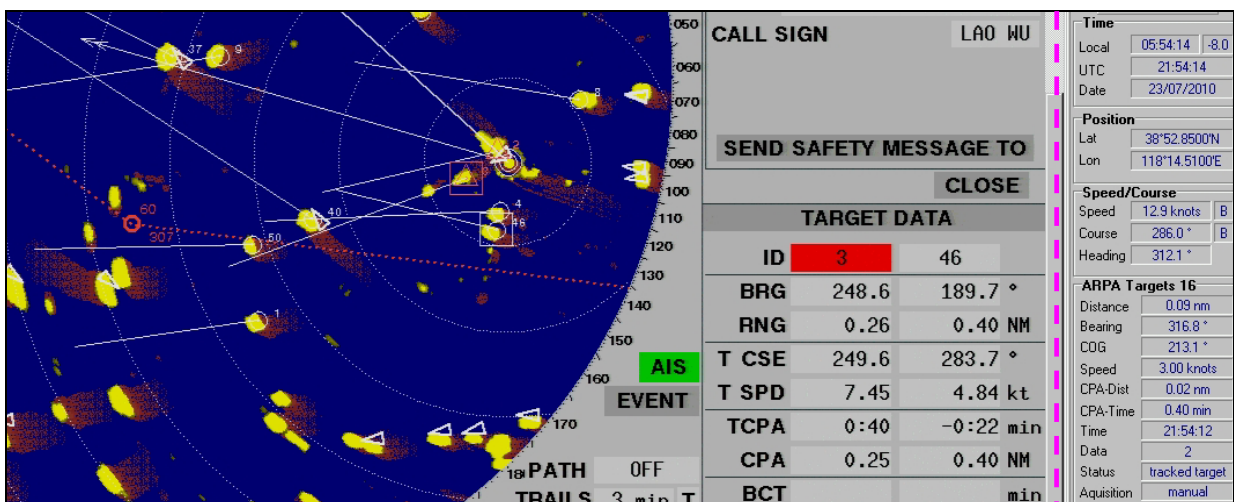


Figure 22: Screenshot of the radar image at 055414 plus VDR replay information window

²⁸ The ZENITH WINNER has not been marked on this and subsequent figures.

3.3.1.2 Audio recording

Contrary to past experience gained by the BSU, the quality of the VDR's audio recording of the bridge microphones of the JULA S was relatively good.

The analysis indicates that during the final 30 minutes before the collision under consideration, members of the ship's command of the container vessel communicated in an almost exemplary manner; in particular, they analysed the oncoming traffic and as a bridge team were adept in navigating the vessel through the busy coastal area of the port of destination, Tianjin.

However, the hitherto sole focus of the ship's command on the traffic was temporarily impeded at about **0552**. At this point, the chief officer called VTS Tianjin on VHF a number of times unsuccessfully in order to arrange the exact anchor position (Dagukou North or South) on the roadstead of Tianjin, which was about 40 minutes away, with the vessel traffic service.

Moreover, the audio analysis of the VDR shows that although the ship's command had already begun to call the vessel traffic service shortly after the collision, it took several attempts before contact was made with VTS Tianjin at **0619**.

Time/Period	<i>Audible</i> activity of significance to the accident ²⁹	Note
0530 to 0552	Conversations between the master and OOW regarding the actual traffic situation	
0534	Observation on the bridge that visibility is less than one mile	
0552 to 0553	Unsuccessful attempts of the OOW to call VTS Tianjin	The intention was to clarify the anchor position in the Tianjin roadstead.
055237	Statement: "She's turning!"	Presumably, this statement refers to the ZENITH WINNER. It is unclear whether the remark was based upon an observation made visually or on the radar.
0553 to 0554	Hazardous situation is recognised and avoiding action initiated	It quickly becomes apparent to the ship's command that a collision is unavoidable.
0554	Collision noises; general alarm is sounded; OOW is ordered to go to the forecastle	
0559	Message from the forecastle to the bridge that the JULA S has ploughed into the hull of another vessel with her bulbous bow.	

²⁹ The table shows only those activities that can be heard in the course of the analysis of the audio recording. It cannot be ruled out that communication existed over and above that.

Time/Period	<i>Audible</i> activity of significance to the accident	Note
0600	Attempt to make contact with VTS Tianjin	VTS Tianjin is subsequently called repeatedly without success.
0607	General alarm is sounded again	
0614	Bridge is informed of the name of the other vessel from the forecastle	
0615	Attempt to make contact with the ZENITH WINNER	
0616	ZENITH WINNER responds	Despite further calls by the JULA S to the ZENITH WINNER, no further communication can be heard between the two vessels; this is probably because the crew of the ZENITH WINNER abandoned the vessel shortly afterwards.
0616	Anchor manoeuvre	
0619	VTS Tianjin responds for the first time to calls made by the JULA S	
0625		Recording of the VDR finishes.

3.3.2 AIS recording of VTS Tianjin

Unlike ARPA technology, which is based on a computerised analysis of the movement of radar echoes, with AIS the tracks of vessels are calculated using voyage parameters. These are sent to AIS receiving stations in real-time on certain VHF frequencies by vessels equipped with the appropriate technology.

The BSU extracted the following screenshots from an AIS video file provided by the Chinese Maritime Administration. They show the final four minutes before the accident. The time interval corresponds to the alteration rate of the information in the video.³⁰

³⁰ All labelling and symbols in the figures are of Chinese origin.

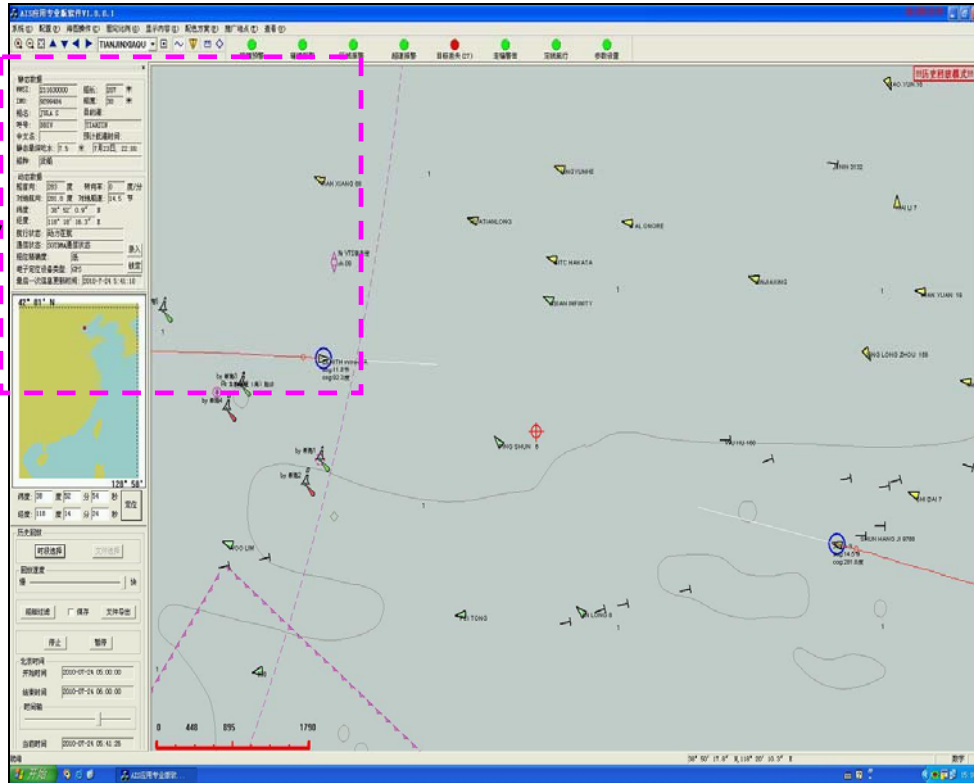
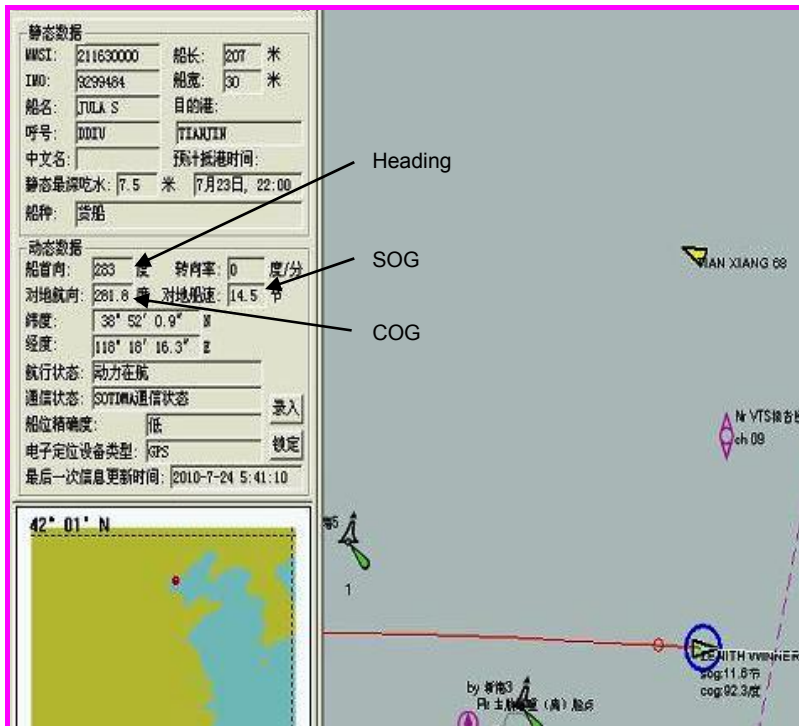


Figure 23: Screenshot of the AIS video file of VTS Tianjin



Note:

The AIS recording provided shows the tracks of the JULIA S and ZENITH WINNER. The course and speed over ground (COG and SOG) are shown below the symbol of each vessel.

The data window in the upper left corner of the screenshot contains additional information about the JULIA S (the BSU is not in possession of an alternative representation of the window with information about the ZENITH WINNER).

Figures 24 and 25 show that up until about 3.5 minutes before the accident, it was not possible to predict that the courses would cross.



Figure 24: AIS recording at 055010



Figure 25: AIS recording at 055041



Figure 26: AIS recording at 055052

Based on the AIS data, **Figures 26 and 27** show that the ZENITH WINNER switched to a course that crossed that of the JULA S at about **0551**.



Figure 27: AIS recording at 055128

Figures 28 and 29 show that in the period between **055152** and **055247**, the ZENITH WINNER steadily changed her course to starboard and at the same time the point of intersection with the course line of the JULA S veered from astern to ahead.



Figure 28: AIS recording at 055152



Figure 29: AIS recording at 055247



Figure 30: AIS recording at 055328

Based on the AIS data, the collision between the two vessels was imminent at **055343**.

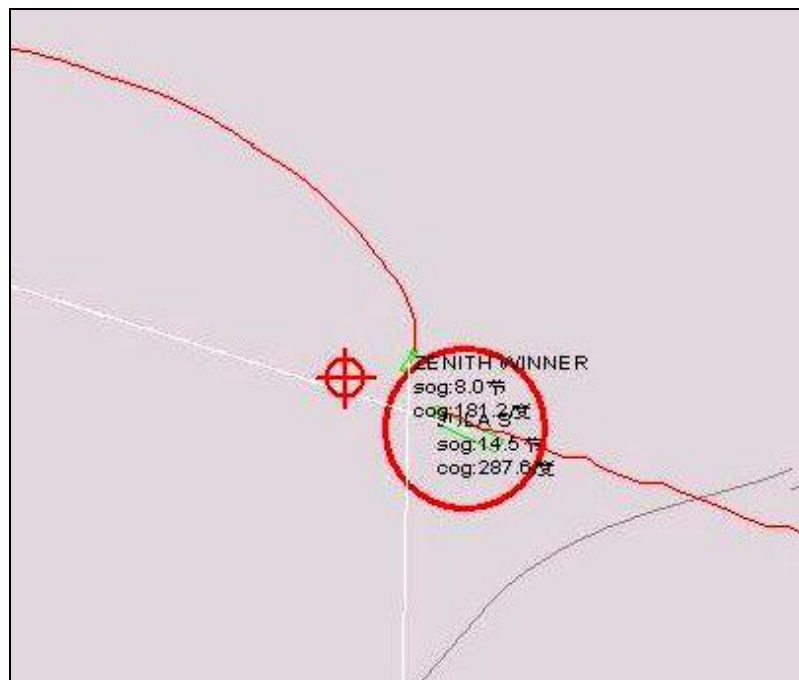


Figure 31: AIS recording at 055343

At about **0554** (see **Fig. 32** below), the AIS symbols of the two vessels merge and thus confirm the time of the accident.



Figure 32: AIS recording at 055351

3.3.3 Comparison of the AIS and VDR

The following table contains a comparison of the voyage parameters of the two vessels taken from the AIS video with the parameters saved, in each case at the same time, by the VDR of the JULA S.³¹

Time	JULA S						ZENITH WINNER				CPA (nm)	TCP A (min)
	VDR			AIS			VDR		AIS			
	SOG (kts)	COG (°)	HDG (°)	SOG (°)	COG (°)	HDG (°)	SOG (kts)	COG (°)	SOG (°)	COG (°)		
055010	14.7	289	288.7	14.7	289.3	289	11	97.8	11.9	98.2	0.37	0342
055041	14.7	290	287.5	14.7	290.3	288	11	97.8	11.8	103.8	0.35	0318
055052	14.7	290	287.3	14.7	289.7	287	11	98.1	11.9	108.7	0.34	0306
055128	14.7	289	288.1	14.7	289.1	288	11	101.0	11.8	110.6	0.31	0230
055152	14.7	288	288.5	14.7	289.3	289	11	105.2	11.7	122.1	0.26	0206
055247	14.7	289	287.3	14.7	288.5	287	12	122.6	11.6	137.4	0.12	0112
055328	14.6	288	289.7	14.7	288.7	288	9	152.1	8.4	170.2	0.01	0042
055343	14.5	287	299.0	14.5	287.6	296	8	168.9	8.0	181.2	0.01	0036
055351	14.3	286	304.5	14.4	287.0	303	8	175.4	./.	./.	0.01	0030

³¹ Source: VDR replay information window.

Since the ARPA-based VDR data and AIS work with entirely different – and in each case possibly erroneous – input information, absolute consistency between the respective target data and the tracks generated from that is hardly realistic. Nevertheless, it is clear from the comparison of the data that apart from the COG values of the ZENITH WINNER these are consistent, for the most part.

The beginning and the initial progress of the starboard course change of the ZENITH WINNER is displayed, respectively, calculated with a time lag of about one minute both by the radar display as well as by the numeric COG values calculated using ARPA as compared to the AIS recording.

The time delay is due to the different information bases and processing of both systems. While ARPA plots radar echoes and then uses past values to calculate a prediction of the future track, AIS maps the situation on the basis of the voyage parameters of the respective target, which are received in real-time.

The basic finding that the ZENITH WINNER began a sudden and abrupt turn to starboard a few minutes before the accident is not undermined by this discrepancy. Nevertheless, this time delay does explain why the ship's command of the JULA S no longer had any chance of avoiding the collision when the emerging risk was recognised on the radar.

3.3.4 Weather and visibility conditions³²

A strong high pressure system was situated to the south of Japan at about 30°N. This intensified during the period under consideration and formed a wedge over the Yellow Sea. Tianjin was situated on the north-western flank of the wedge and therefore in a south to south-westerly, yet very weak current with very low atmospheric pressure differences. On the day of the accident, the weather conditions were marked by only slight wind and a calm sea. The calm weather conditions are confirmed by the absence of any sea or rain clutter on the radar in spite of the anticlutter sea and rain being disabled.

A mist had formed in the marine area. Visibility was restricted by fog and stood at about 0.5 nm at the time of the accident.

Sunrise was at about 0504. At the time of the accident, the sun had reached a height of about 10° above the eastern horizon.

3.3.5 Witness accounts

With respect to the JULA S, the BSU is in possession of a master's report and a statement by the chief officer. The accounts of the course of the accident are fully consistent with the findings of the VDR and AIS analysis.

The BSU obtained a statement from the chief officer of the ZENITH WINNER, who was navigating the vessel at the time of the accident, via the Korean Maritime Safety Tribunal. The statement provides no information as to why the ZENITH WINNER altered her course to starboard a few minutes before the accident.

³² Sources: official report on the weather conditions at 2200 UTC on 23 July 2010 in the area of the approach to TIANJIN, China, by Germany's National Meteorological Service, Hamburg; testimonies

4 ANALYSIS

4.1 Actions taken on board the two vessels before the collision

The development of the collision could be traced beyond doubt by means of the radar images saved in the VDR of the JULA S and the AIS recording of the vessel traffic service, VTS Tianjin. The audio recording of the VDR on the JULA S also shows that the master and chief officer worked together closely and in a concentrated manner while navigating through the final voyage segment before reaching the roads of Tianjin, which was congested and marked by restricted visibility. The radar targets in the area ahead of the vessel were observed and evaluated jointly. Apart from being acquired as an ARPA target, no further attention was initially paid to the other vessel involved in the subsequent accident. This cannot be thrown into question. For several nautical miles, the ZENITH WINNER was on a reciprocal course, which neither crossed the vessel's own course line nor appeared to present a problem. Accordingly, the ARPA radar still pointed to an uncomplicated 'green - green' passage for both vessels at a reasonable distance of approximately 0.3 nm about 2.5 minutes before the accident. Following that, as the AIS recordings of Vessel Traffic Service Tianjin and the delayed radar images of the JULA S vividly demonstrate, the situation changed abruptly. The ZENITH WINNER began to steadily turn towards the JULA S, which was approaching her on a constant course.

The ZENITH WINNER is not required to carry a VDR; therefore, no such data are available. Apart from a statement by the officer on watch, which was generally very unhelpful, no other information is available to answer the all-important question as to why, at a distance of less than one nautical mile, the ZENITH WINNER suddenly switched to a course which crossed that of the JULA S.

It is conceivable that the ZENITH WINNER estimated the course of the oncoming JULA S totally incorrectly when she altered her course. However, it may also be the case that the possibly poorly configured radar image was misinterpreted. Moreover, the ship's command of the ZENITH WINNER may have believed – which is very difficult to comprehend – that in response to the ZENITH WINNER's change of course, the JULA S would also promptly change course to starboard.

4.2 Evaluation of the actions taken

The analysis of the VDR recording shows that approximately one minute passed between it becoming objectively possible to detect on the radar that at a distance of just 0.6 nm the ZENITH WINNER was in the process of moving onto a collision course (approx. **055230**), and the initiation of the hard to starboard manoeuvre (last-moment action; approx. **055330**) on the bridge of the JULA S. However, when evaluating this time span, which appears to be relatively long at first glance, it must be remembered that the ship's command was distracted due to attempting to make contact with VTS Tianjin at the precise moment that the course change of the ZENITH WINNER started to become threatening.

In this context, failing to monitor the radar for a short period – in particular, in favour of the efforts made on the bridge to locate vessels in close proximity to the container vessel through the dense fog using binoculars – was quite justifiable at this point. However, this is especially true because just a few seconds before it was objectively possible to detect that a collision was developing on the radar, the ship's command of the JULA S had been faced with what seemed to be an uncomplicated 'green - green' passage as regards the ZENITH WINNER.

Therefore, the time at which it was theoretically possible to detect the hazardous situation on the radar cannot be used as a basis for evaluating the activities on the bridge of the container vessel. The audio analysis of the VDR suggests that the course change of the ZENITH WINNER became more and more apparent on the bridge of the JULA S at about **055237** (statement on the bridge: "She's turning!"). The navigation lights of the ZENITH WINNER were probably sighted at this point or shortly after at a distance of about 0.6 nm.

It is quite understandable that the sudden and unexpected development of an immediate collision gave rise to confusion on the bridge of the JULA S for a certain period. To that extent, the ship's command of the container vessel cannot be reproached for not responding to the situation with the hard to starboard course change significantly earlier.

Finally, in the ex post evaluation of the activities on the bridge of the JULA S, it must be remembered that the ARPA information depicted the development of the hazardous situation with a time lag. In all likelihood, the two vessels were in such close proximity of each other when it became objectively possible to detect the acute threat of a collision on the radar that the last-minute avoiding action of the JULA S would presumably not have prevented the collision even if it had been taken a few seconds earlier.

This assessment is not opposed by the fact that it was basically possible to query the AIS data of the ZENITH WINNER³³ and in so doing identify the hazardous situation somewhat earlier. The approach of the JULA and ZENITH WINNER could, and rightly so, have been considered to be uncomplicated by the ship's command of the container vessel up until a few minutes before the accident. With that in mind, failing to query the AIS data of the oncoming vessel was quite acceptable.

It is open to debate whether the speed of the JULA S (14.7 kts) was fully consistent with the requirements of Rules 6³⁴ and 19³⁵ (b) of the international Regulations for Preventing Collisions at Sea (COLREGs) in view of the poor visibility in the congested voyage segment.

³³ On the JULA S, the AIS data of a selected target can be shown in a multifunctional display on the radar screen (see Fig. 9 on p. 17 on the middle right part of the screen 'AIS OBJECT DATA, NAVIGATION DATA' by way of example).

³⁴ See Rule 6 COLREGs (official title: 'Safe speed').

³⁵ See Rule 19 COLREGs (official title: 'Conduct of vessels in restricted visibility').

However, an allowance must be made for the fact that a reduction in speed would also entail a loss in manoeuvrability. Particularly relevant in the context of those made to prevent a potential collision is the fact that alterations in course are more time consuming at lower speeds; therefore, they need to be initiated earlier. However, in heavily congested voyage segments, this may lead to other dangerous approach. Therefore, in retrospect it is – providing the speed chosen remains within a reasonable range – difficult to make a reliable statement on the speed at which the JULA S should have proceeded in order to comply with the essence and purpose of the aforementioned rules to the fullest possible extent.

As already noted, the BSU is not in possession of information on the reasons behind the navigational activities on board the ZENITH WINNER. Therefore, in this summary investigation report by the BSU, it is only possible to analyse the quite incomprehensible course change to starboard a few minutes before the collision, which, viewed objectively, was the main cause of the accident, based on the external appearance of the development of the accident and in conjunction with the requirements of the COLREGs.

Rule 19 (d) of the latter requires that

- a vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and/or risk of collision exists and
- if so, she shall take avoiding action in ample time.

Moreover, in the course of such avoiding action, an alteration of course to port for a vessel forward of the beam shall be avoided if at all possible. Therefore, when viewed in isolation the starboard course change of the ZENITH WINNER in response to the development of the close-quarters situation can be regarded as being consistent with the regulations.

However, the approach of the ZENITH WINNER and JULA S was marked significantly by the fact that previously a constant 'green - green' passage with a CPA of between 0.5 nm and 0.3 nm was foreseeable for several nautical miles. With that in mind, breaking the confidence that had built up due to the preceding events in this – albeit tacitly made – 'agreement' by making a sudden alteration in course to starboard is difficult to justify with a reference to Rule 19 COLREGs.

The above comments on the speed of the JULA S apply analogously to that of the ZENITH WINNER. Furthermore, in retrospect it cannot be readily assumed that the ZENITH WINNER's speed of 11.6 kts contravened Rules 6 and 19 COLREGs.

4.3 Crisis management

The – as demonstrated by the audio recording of the VDR – activities on board the JULA S after the accident, which unfolded with calm and moderation, were appropriate to the requirements. General alarm was sounded without delay and an analysis of the damage initiated.

Establishing contact with VTS Tianjin and the other vessel involved proved to be difficult. With respect to the ZENITH WINNER, this can be attributed to the massive inrush of water.

In contrast, it is difficult to understand why VTS Tianjin did not respond to the clearly formulated attempt at making contact by the JULA S until some 20 minutes after the first call. However, in the course of analysing the radio traffic recorded by the VDR, it was noted that radio discipline among the vessels in the area of the accident was seriously flawed.

The ZENITH WINNER began to founder only minutes after the collision. Hence, the early decision by the ship's command to abandon the vessel was undoubtedly correct.

As the situation unfolded, it was possible for a lifeboat from the JULA S to rescue the entire crew of the ZENITH WINNER unscathed. This is an indication of a rescue operation conducted judiciously and in accordance with proper seamanship.

5 Actions taken

Two days after the accident, the owner of the JULA S informed the masters of its vessels about the accident in a circular and reminded them of the need to comply with the international rules and internal requirements for safe shipboard operation. Referring to the COLREGs, the circular points explicitly to need for a vessel to be slowed down and if necessary stopped in restricted visibility.

6 CONCLUSIONS

The investigation of the marine casualty had to be limited to the analysis of data and statements provided by the owner of the JULA S for lack of detailed information with respect to the Korean vessel. For the most part, the AIS data provided by the Chinese Maritime Administration confirm the findings. Nevertheless, publication of a full investigation report, which also includes the provision of safety recommendations, is opposed by a lack of available sources with respect to the ZENITH WINNER.

Shortly after the accident and again several weeks before the completion of this investigation report, the BSU was in contact with the Korean Maritime Safety Tribunal. Here, it was not possible to arrive at an agreement on a joint investigation. This is another reason for the BSU limiting itself to the publication of a summary investigation report.

It was not possible to clarify the reason for the alteration in course, which had a fundamental impact on the course of the accident, by the ZENITH WINNER a few minutes before the collision. Nevertheless, the account of the accident and analysis of the sources available deliver important and informative insights.

Firstly, it is clear that on no account must the risks inherent with any forthcoming close-quarters situation be underestimated, especially in restricted visibility. In less than 4 minutes, a situation that initially appeared to be entirely uncomplicated developed into a collision that resulted in the total loss of a vessel for no apparent reason. The second key finding arising from the events surrounding the accident concerns the compelling confirmation of the recognised fact that radar information, especially the ARPA data, which is so important in terms of collision avoidance, should be examined critically by the ship's command. A notional safety margin on the vectors shown by the ARPA radar and the CPA values produced as well as a comparison between the data and real-time AIS information is advisable because of the radar display's orientation on the past. This is relevant to targets at close quarters, in particular.

Noteworthy is the rapid and unconditional submission of data and documents relevant to the BSU's investigation by the owner of the JULA S.

7 SOURCES

- Written statements and documents
 - Ship's command of the CMV JULA S
 - Owner of the CMV JULA S
- VDR recordings of the CMV JULA S
- Contact with the Korean Maritime Safety Tribunal
- Contact with the Chinese Maritime Administration
- AIS data of the Chinese Maritime Administration
- Internet research (inter alia, analysis of Chinese newspaper articles about the marine casualty)
- Contact with SAM Electronics GmbH, Hamburg (radar manufacturer)
- Official report on the weather conditions at 2200 UTC on 23 July 2010 in the area of the approach to TIANJIN, China, by Germany's National Meteorological Service, Hamburg
- Nautical chart and vessel particulars, Federal Maritime and Hydrographic Agency (BSH)