Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Ministry
of Transport and Digital Infrastructure

Investigation Report 241/18

Serious Marine Casualty

Grounding of the motor tanker PAZIFIK off Indonesia on 9 July 2018

23 January 2020

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1 SUMMARY

At about 1110[1] local time on 9 July 2018, the German motor tanker PAZIFIK ran aground on a shoal between the islands of Komodo and Banta at φ 08°29.21'S and λ 119°20.31'E. The ship was loaded with 18,000 t of ammonia. Since only the forepeak and ballast water tanks were damaged, no cargo escaped. Transferring cargo and ballast water enabled the PAZIFIK to refloat at 0850 local time on 14 July 2018. She then proceeded to a shipyard in Singapore under her own steam escorted by a tug which had arrived in the meantime.

During the repair, about 50 m of the double bottom was renewed and the rudder was repaired. The latter was damaged when the ship refloated from the rocks during a minor collision with the tug.

[1] All times shown in this report are ship's time = UTC + 8 hours.

2 FACTUAL INFORMATION

2.1 Photograph of the PAZIFIK

Source: Owner

Figure 1: Photograph of the ship

2.2 Ship particulars

Name of ship:	PAZIFIK
Type of ship:	Liquefied gas carrier
Flag:	Germany
Port of registry:	Rostock
IMO number:	9293430
Call sign:	DBIP
Owner (according to Equasis):	MS "PolarPacific" GmbH & Co. KG
Owner:	F. Laeisz G.m.b.H.
Year built:	2005
Shipyard:	Hyundai Heavy Ind. Korea
Classification society:	DNV GL
Length overall:	204.98 m
Breadth overall:	32.23 m
Draught (max.):	11.90 m
Gross tonnage:	38,853
Deadweight:	42,937 t
Engine rating:	11,300 kW
Main engine:	Hyundai-MAN/B&W 5S60MC-C
(Service) Speed:	15.2 kts
Hull material:	Steel
Hull design:	Double bottom, independent type A cargo tanks
Minimum safe manning:	15

2.3 Voyage particulars

Port of departure:	Luwuk, Indonesia
Port of call:	Kwinana, Australia
Type of voyage:	Merchant shipping/international
Cargo information:	Dangerous goods, liquified gas
Manning:	21
Draught at time of accident:	Df = 7.73 m, Da = 8.03 m
Pilot on board:	No
Number of passengers:	None

2.4 Marine casualty or incident information

Type of marine casualty:	SMC (ground contact)
Date, time:	09/07/2018, 1110 local time
Location:	Between the islands of Komodo and Banta
Latitude/Longitude:	Φ 08°29.213'S λ 119°20.305'E
Ship operation and voyage segment:	High seas
Consequences:	Grounded on a reef; unseaworthy due to severe damage to the bottom of the ship

Extract from the Pulau Jailamu to Pulau Serbete navigational chart, BA 2910

Figure 2: Navigational chart

2.5 Shore authority involvement and emergency response

Agencies involved:	Federal Bureau of Maritime Casualty Investigation (BSU)
Resources used:	Tug on standby
Actions taken:	Transferring cargo and ballast water enabled the ship to refloat

3 COURSE OF THE ACCIDENT AND INVESTIGATION

3.1 Course of the accident

About 18,000 t of ammonia were loaded into the PAZIFIK's cargo tanks 1 and 3 in the Indonesian port of Luwuk on 5-7 July 2018. The ship left the port of Kwinana in Australia at about 2036 on 7 July 2018 in a seaworthy condition. Her port of destination/discharge was Kwinana in Australia. She sailed on the planned route in accordance with the passage plan. Full speed was maintained throughout the entire voyage in accordance with the charter contract with the main engine at about 90 revolutions, corresponding to an average speed of about 15 kts. It was decided that the ship should sail from the Flores Sea to the Sumba Strait via the Selat Sape between the islands of Banta and Komodo.

The master assumed command at about 1018 local time on the morning of 9 July 2018. The third officer, who had been on watch prior to that, was to attend a Videotel training course in the conference room. A crew member assigned as lookout had been on the bridge for the whole time. At 1024 the system was switched from automatic to manual control due to approaching fishing vessels. When the ship entered the Selat Sape at about 1042 she deviated from the originally planned route to the south, sailing parallel to the route at a distance of about 0.25 nm, because of those vessels. The third officer was back on the bridge at about 1100 but the master retained command. At about 1111 the ship sailed over a submerged object at a speed over ground of about 18.1 kts and grounded at the position φ 08°29.213'S λ 119°20.305'E.

3.1.1 Actions taken after the grounding

After strong vibrations were detected, the main engine was stopped manually from the bridge. The master sounded the general alarm after the grounding and instructed the crew to assemble. All crew members were accounted for and nobody was injured. Since only the forepeak and ballast water tanks were damaged, no cargo escaped. Transferring cargo and ballast water enabled the PAZIFIK to refloat at 0850 local time on 14 July 2018. She then proceeded to a shipyard in Singapore under her own steam.

3.2 Investigation

The owner notified the BSU about the accident promptly on 9 July 2018 and the latter began an immediate investigation. The ship was surveyed on 4 July 2019 at Taichung Port in Taiwan.

3.2.1 Ship

The PAZIFIK is a liquefied gas carrier with four cargo tanks. She has a double bottom and was delivered by Hyundai Heavy Industries Shipyard in Ulsan on 3 January 2005. The ship has been managed by the owner, F. Laeisz G.m.b.H., Rostock, Germany, since her commissioning. The PAZIFIK sailed under the flags of Gibraltar prior to March 2018 and Germany since March 2018. She is equipped with a Transas ECDIS (electronic chart display and information system) for navigation.

3.2.2 Crew

The master and the officers possess the necessary qualifications. The master boarded the ship in Singapore on 20 May 2018 and assumed command on 21 May 2018 at Nipah Anchorage. He has been employed by the owner for 20 years and was promoted to master in 2014. He had already completed five voyages as chief officer and four voyages as master of the PAZIFIK or her sister ship.

The second officer has worked for the owner since 2010. He has served on gas carriers since 2015 and has sailed on the PAZIFIK four times.

The third officer has served as a navigational officer since 2011. It was his first contract with the owner.

3.2.3 Watchkeeping

In accordance with the watchkeeping plan and common practice, watchkeeping on the bridge is carried out in three watches. The master does not perform a sea watch.

Chief officer	0400-0800 and 1600-2000
Second officer	2400-0400 and 1200-1600
Third officer	0800-1200 and 2000-2400

There were no unusual events before the accident. The master and all officers were rested. Hours of watchkeeping and rest were observed.

3.2.4 Voyage planning

The second officer planned the voyage on board the PAZIFIK using the PassageManager program from ChartCo. To assist with planning the ship is equipped with electronic navigational charts (ENCs) and electronic sailing directions.

The Transas ECDIS on board acts as a primary and backup navigation system. ChartCo provided the ENCs used. An ENC flat rate is available and there are no restrictions in respect of requesting navigational charts. The ENCs are ordered via an online system, received by email and transferred to the ECDIS manually. The navigational charts for the planned voyage were ordered and installed on 5 July 2018; the last updates were transferred on 8 July 2018.

The master approved the passage plan on 6 July 2018. The master briefed all the deck officers on the same day and this was entered in the logbook.

Figure 3: Voyage planned using ChartCo

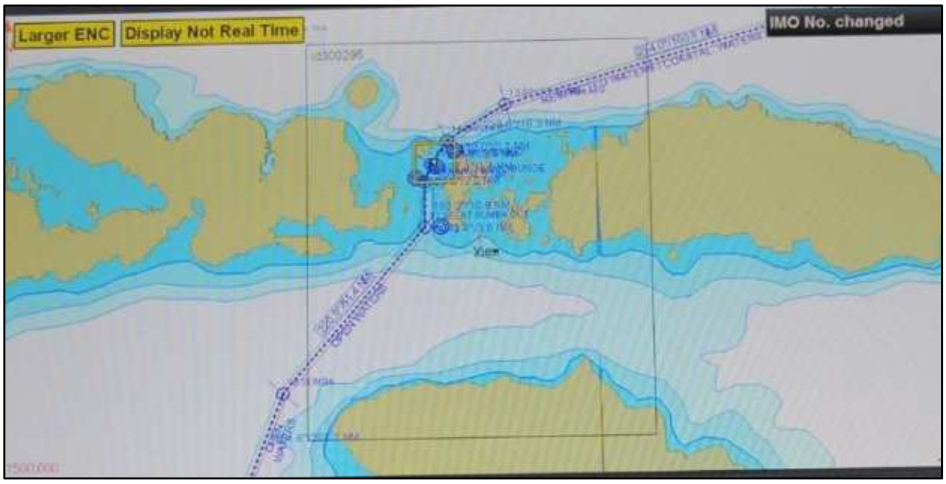


Figure 4: Passage planned using ChartCo

3.2.5 Environmental conditions and weather reports

The BonVoyage weather routing software was used on board for voyage planning. A safe passage was not restricted by environmental conditions on the day of the accident. There were no restrictions in visibility recorded. The wind force stood at 4 Bft and the swell had a value of 2 on the Douglas scale. An aft current prevailed and was setting in a southerly direction at about 2.6 kts according to the tide table.

3.2.6 Place of grounding

The position at which the ship grounded is in Indonesian waters between the main islands of Banta and Komodo. The seabed and islands in this region were produced by volcanic activity. Several smaller islands are situated between the two main islands. The passage between the islands is called the Selat Sape.

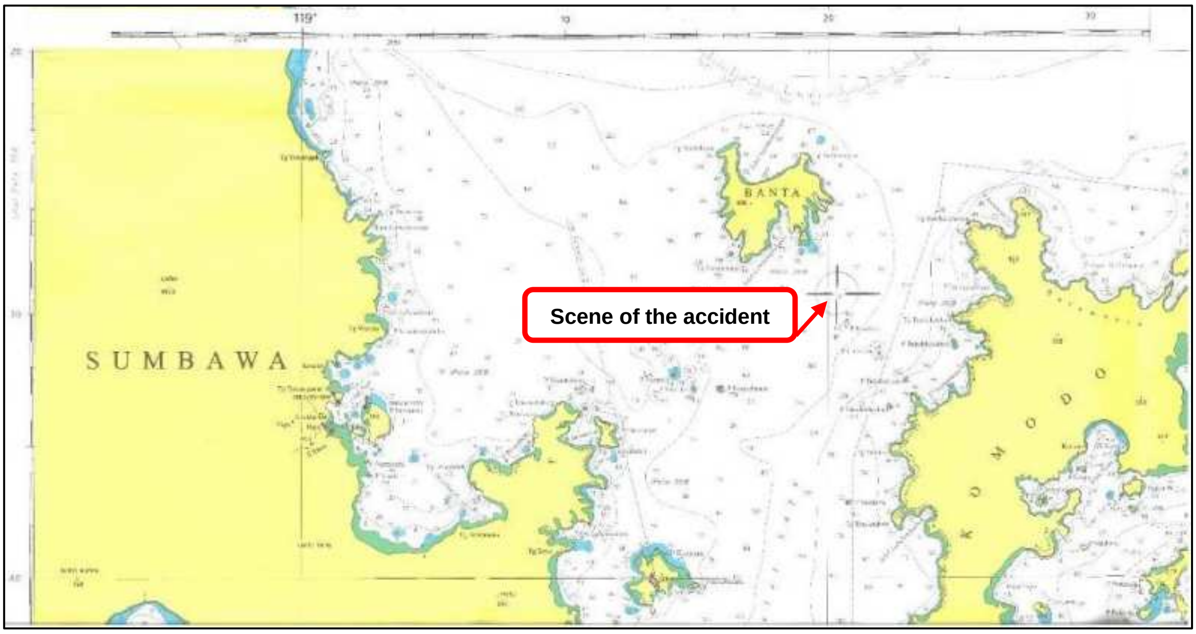


Figure 5: Indonesian Navigational Chart ID 295; scale: 1:200,000

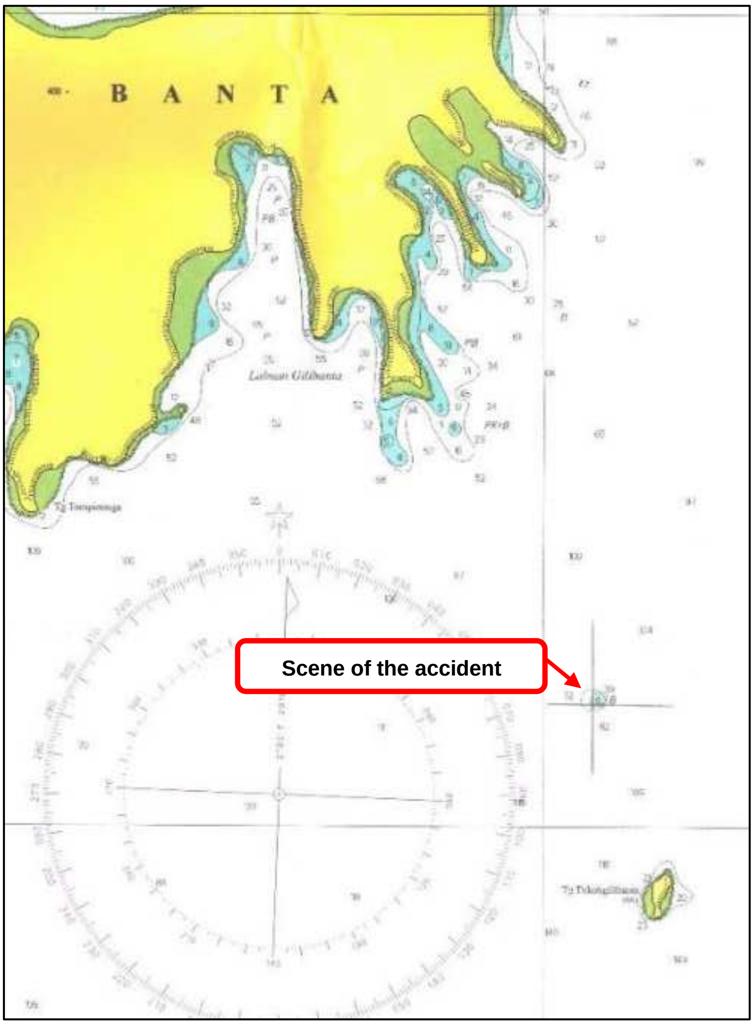


Figure 6: Navigational Chart ID 268-2; scale: 1:50,000

4 ANALYSIS

4.1 Ship and crew

The ship and her equipment were in good, seaworthy condition. Technical defects were not found during the investigation.

The MT PAZIFIK was sufficiently manned with qualified crew members. Hours of work and rest intervals were observed. Human error or misconduct was not found.

4.2 Weather report by Germany's National Meteorological Service (DWD)

The Maritime Division of the DWD was requested to prepare an official report on the weather and sea conditions in the sea area for the period of the accident.

The DWD has at its disposal measurements and observations from the surrounding stations for the sea area around Indonesia. Analysts of Australia's national Weather Service (Bureau of Meteorology), the American Global Forecast System (GFS), and satellite imagery were used for the account of the weather conditions. Forecasts of the global weather and wave forecast model of the ECMWF (European Centre for Medium-Range Weather Forecasts) were included in the assessment, as were findings of the ICON (Icosahedral Nonhydrostatic) global weather forecast model and the GWAM (Global Wave Model) wave forecast model of the DWD.

4.2.1 Weather situation

On 9 July 2018 the Selat Sape sea area between the islands of Komodo, Banta and Sumbawa lay on the northern edge of an extensive high pressure zone, which centred on southern Australia. A reasonably steady southeasterly equatorial current prevailed within the sea area. However, this was subject to isolated minor disturbances due to the influence of the islands mentioned above.

4.2.2 Wind

It is reasonable to assume that easterly to southerly winds with speeds of 5-15 kts (2-4 Bft) initially and 10-20 kts (3-5 Bft) later prevailed in the sea area under consideration during the relevant period.

4.2.3 Weather – precipitation and visibility

Analyses of the satellite imagery indicate cloudiness around the Selat Sape with upper limits in the lower or middle troposphere. Ground-based cloud observations confirm this statement. In all likelihood there was no precipitation in the area under consideration. This can be deduced from the observation of clouds and meteorological phenomena, as well as from precipitation measurements.

Measurements of visibility, the relative humidity and the temperature at the surrounding stations indicate that visibility in the relevant sea area was 10-20 km.

4.2.4 Sea state

No sea state data were available for the sea area around the Selat Sape. To permit a statement on the sea state nevertheless, the findings of assimilation runs of the GWAM were considered. These indicate significant wave heights of 1-2 m. Due to the complex topographical conditions, crossing seas cannot be excluded in certain areas, either.

The weather forecast recorded on board is consistent with the DWD's report.

4.3 Voyage planning

4.3.1 ChartCo PassageManager

ChartCo PassageManager is a voyage planning software application from ChartCo Ltd in Great Britain. It is used for passage planning and the management of charts and publications. PassageManager proposes a route based on the ports of departure and destination, the ship's particulars and any restrictions or requirements entered by the user. The software is installed on all the ships belonging to the owner.

4.3.2 Route selection

The ChartCo software proposed a route via Selat Sape, passing between the islands of Banta and Komodo. The master and the second officer discussed this route. The route that the master is familiar with, through the more westerly Lombok Strait, was not chosen because it entailed an additional distance of more than 200 nm.

The master and the second officer agreed to follow the Selat Sape route proposed by the system with one modification. The route proposed by the PassageManager passed between the islands of Nisabedi and Lubuhtare. The distance between the two islands is only about 1.5 nm. The passage between the islands of Nisabedi and Banta, which was then used, is about 2.5 nm.

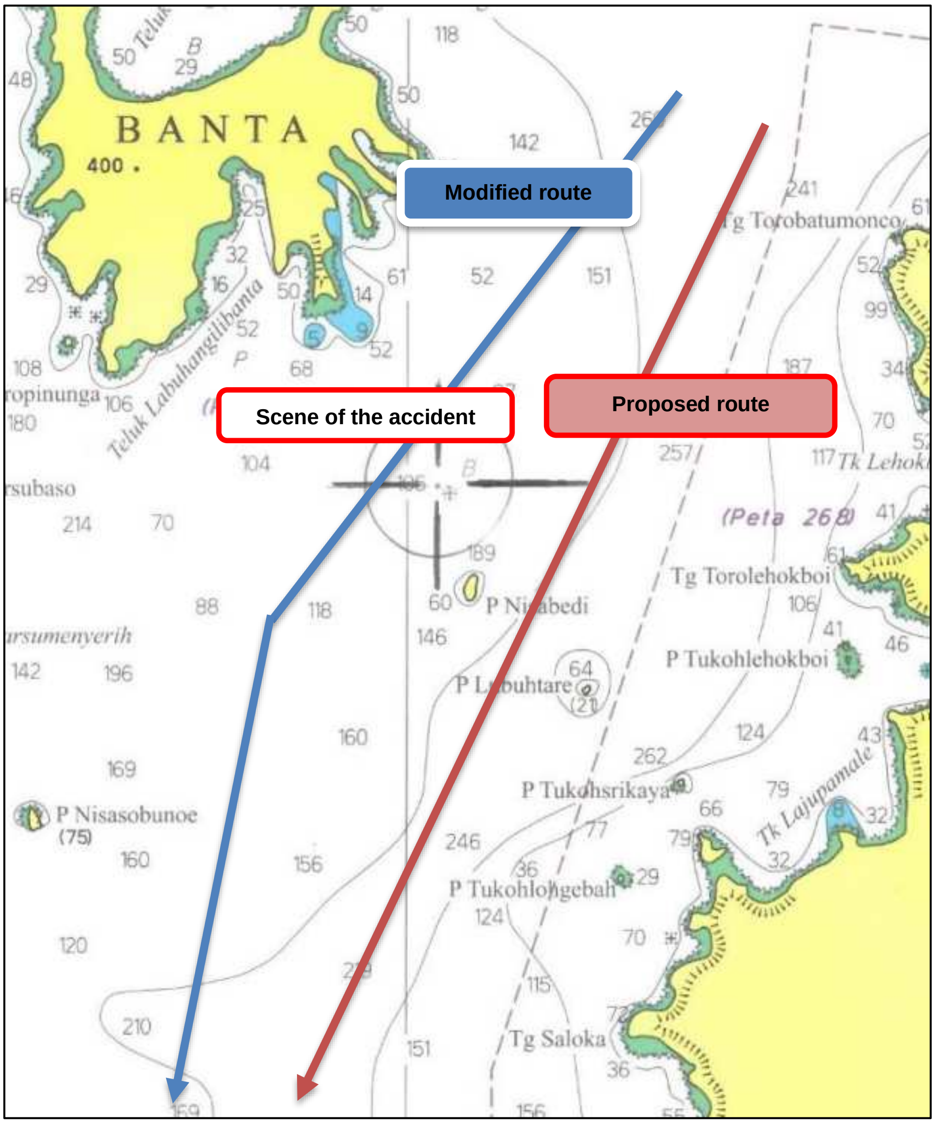


Figure 7: Navigational Chart ID 295

4.3.3 ENCs used and issue/revision status

The PAZIFIK has ECDIS certification both as a primary and as a backup navigation system. An emergency set (coming home set) of small-scale paper charts is available on board.

The United Kingdom Hydrographic Office (UKHO) supplies the ECDIS on board with ENCs, transmitted by email or online, via the ChartCo software. All the charts used on board for the passage had the largest scale offered by the UKHO. Licence keys for the necessary ENCs and the latest updates were loaded into the ECDIS before the passage started on 5 July 2018 and the last update was made on 8 July 2018.

4.3.4 Paper charts for the sea area

During the investigation the BSU compared information on the scene of the accident provided on board by the ENC with other sources and charts. The local Indonesian paper charts (ID 268 and ID 295) and the British paper charts (BA 2903 and BA 2910) were analysed and compared. It was found that three of the four charts contain significant differences in respect of the symbols plotted at the scene of the accident.

Charts BA 2903 and BA 2910 (scale: 1:500,000) show the 'rock awash' symbol, i.e. a rock submerged temporarily or during high tide, at the scene of the accident.

The Indonesian Navigational Chart ID 295 (scale: 1:200,000) shows a rock symbol but it is not clear whether the rock is submerged from time to time. The Indonesian Navigational Chart ID 268-2 (scale: 1:50,000) does not show the 'rock awash' symbol but merely a shallow area with a water depth of 9 m.

Figure 8: Navigational Chart BA 2910; scale: 1:500,000

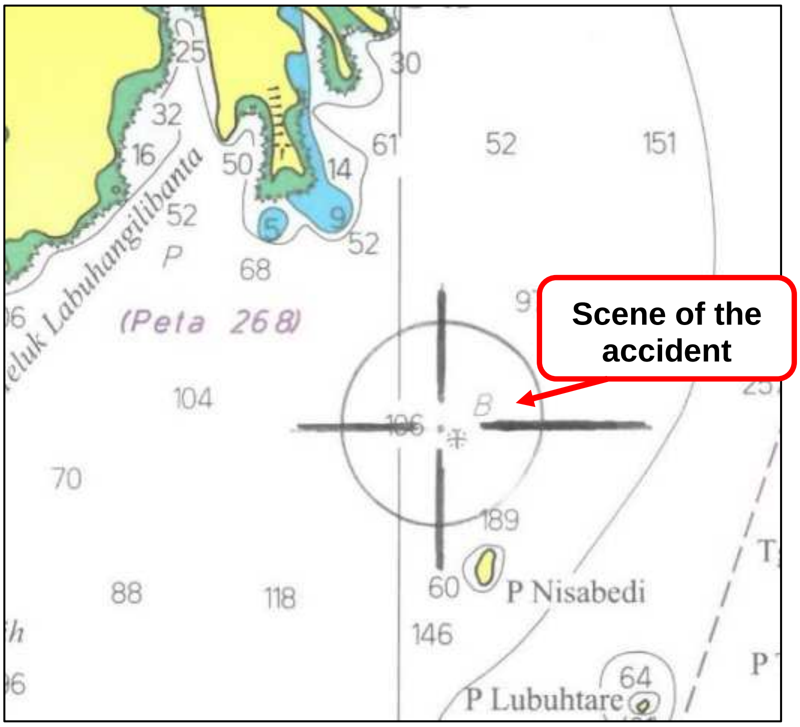


Figure 9: Indonesian Navigational Chart ID 295; scale: 1:200,000

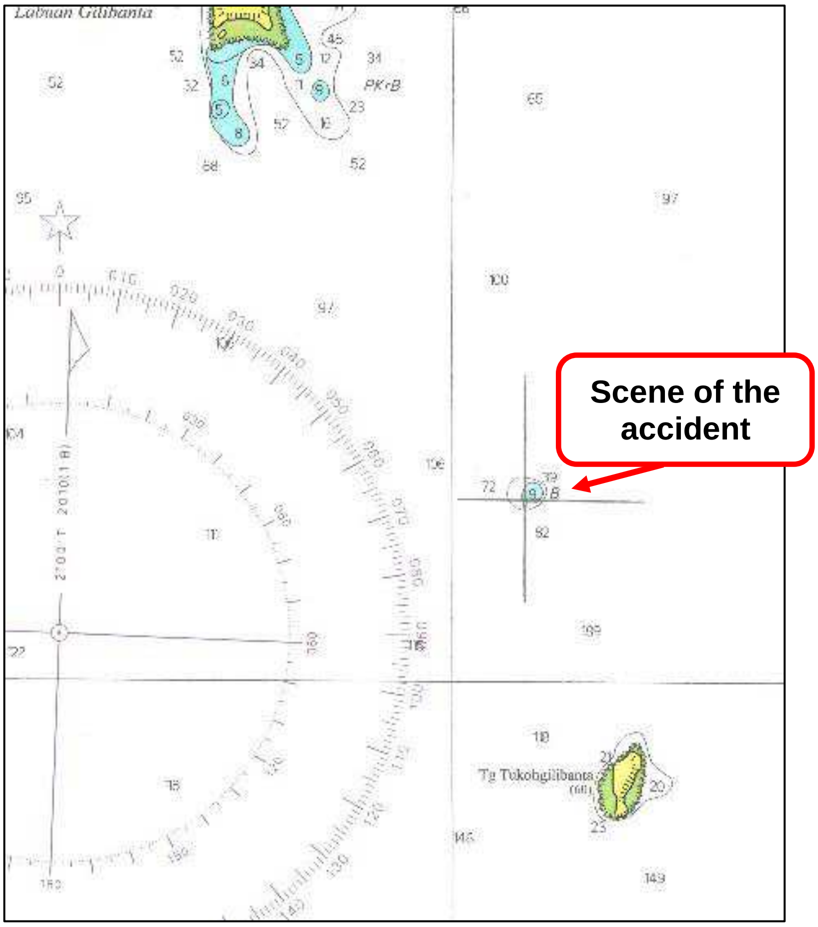
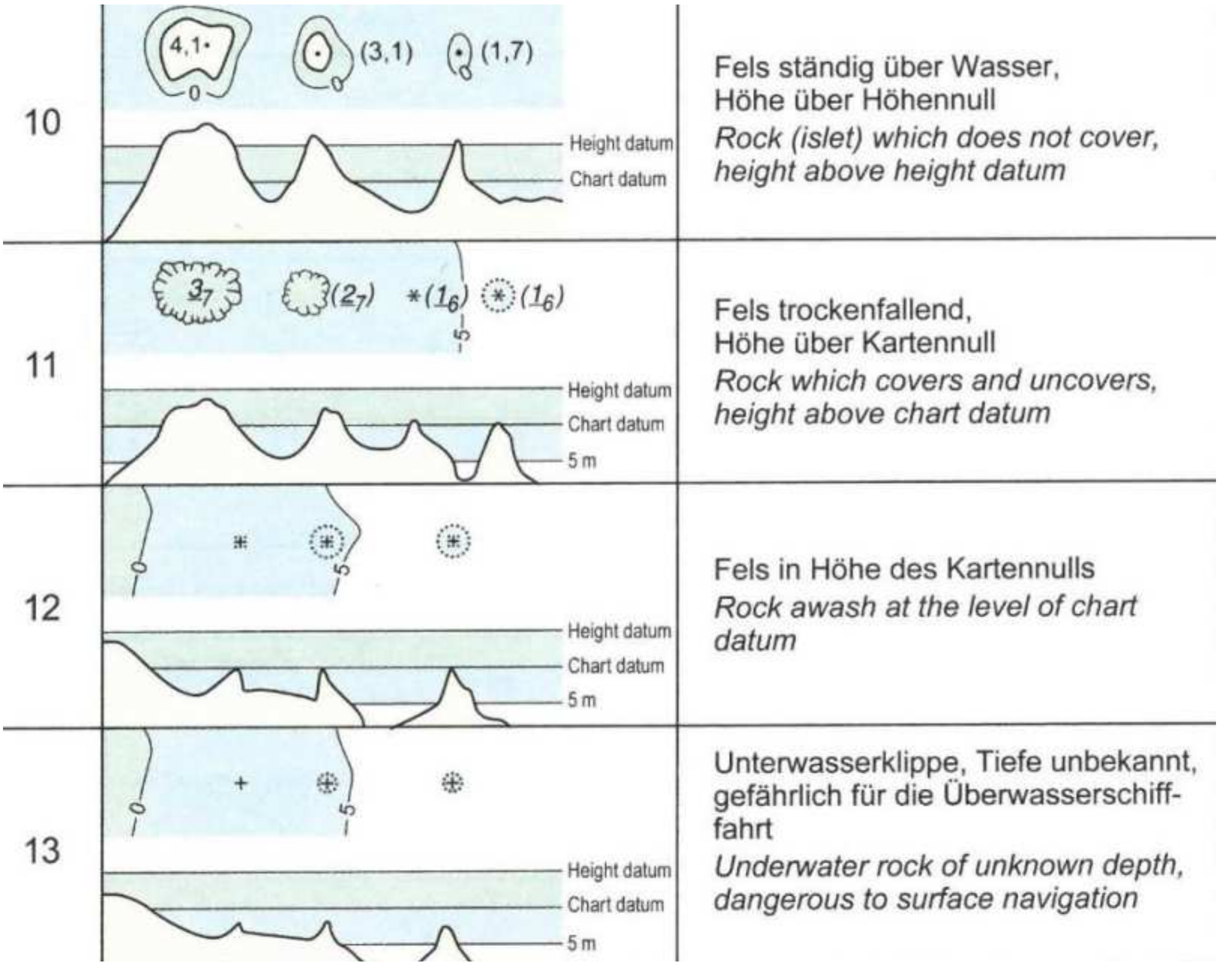


Figure 10: Navigational Chart ID 268-2; scale: 1:50,000

Proper rock designation in official paper charts according to INT1:



4.4 Analysis of the course of the voyage as per the ECDIS

The course of the voyage is recorded in the ECDIS and statements of the crew are consistent with the recordings.

Figure 11: Voyage according to route planning

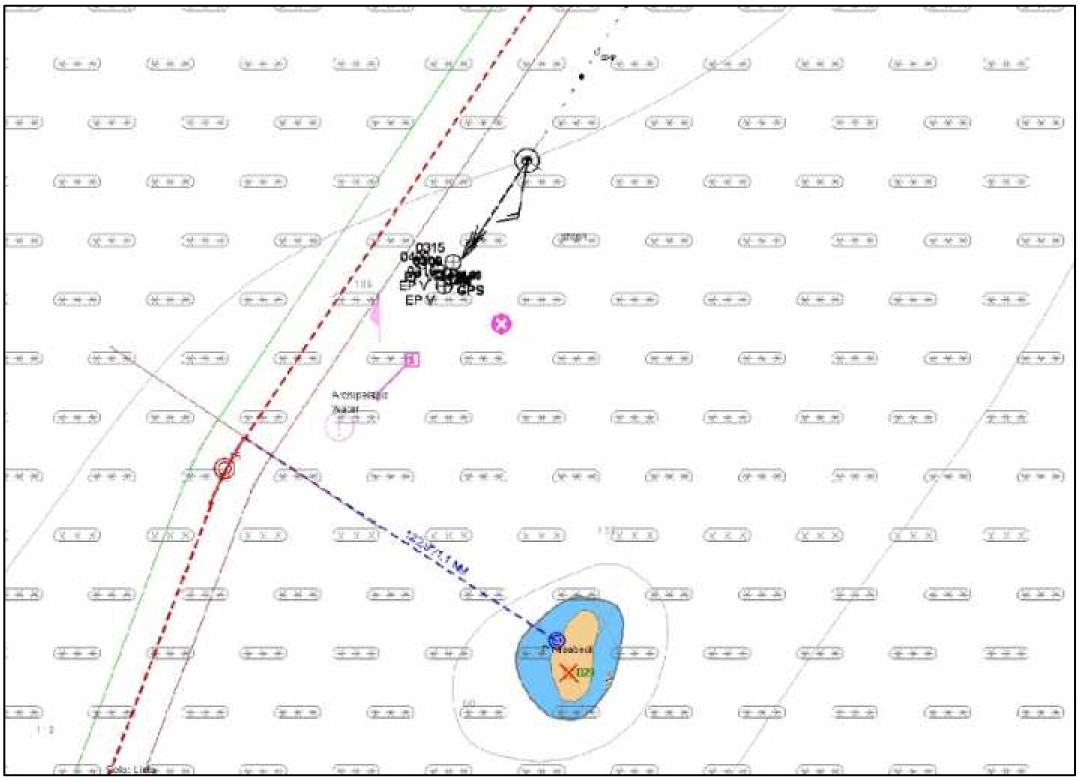


Figure 12: Deviation from route planning up until grounding

The ENC displays the following symbol for an isolated danger near the place of grounding to the southeast and northwest of the island of Nisabedi:

 The following supplementary information is stored for this isolated danger:

"Underwater rock (always under water/submerged 1 MAR 2017)"

Figure 13: Information stored in the ENC

There is no additional depth information or depth contours for or near the isolated danger area. The general water depth in the Selat Sape passage around the isolated danger is specified at about 100 m.

Using the information available on board, it was impossible for the crew to obtain accurate information about the actual navigational danger. When the passage was planned and executed, it was assumed that sailing through the plotted isolated danger did not entail any risk, especially since this isolated danger was shown to be permanently submerged. In view of the information from other sources, which did not have to be available on board, the information is insufficiently described in the latest ENC, i.e. the one used. The crew did not believe the plotted isolated danger posed a risk during the passage. On the planned route the isolated danger was passed at a distance of about 0.7 nm. The distance to the nearest shallow waters of the island of Banta was about 0.8 nm. The CATZOC (category zone of confidence) for this area is assigned a 'C', indicating a positional inaccuracy of +/- 500 m or 0.27 nm. This means that a safe CPA (closest point of approach) to the island of Banta and to the plotted isolated danger is reduced to 0.53 nm and to 0.43 nm, respectively, in the worst case.

4.4.1 Cross track distance (XTD)

The cross track distance settings in ChartCo's manager influences the automated route checking in the ECDIS. This deviation is shown in the ECDIS as a red line on the port side and as a green line on the starboard side of the planned route. The procedural specifications on board define the cross track distance as follows:

> *3.2.12. Open waters, deep sea, open ocean, restricted waters, confined waters*
>
> *Open waters, deep sea and open ocean are defined as areas of water 24 nm off the coast or away from the nearest danger.*
>
> *Coastal waters are defined as areas of water 12-24 nm off the coast or away from the nearest danger.*
>
> *Restricted waters are defined as areas of water less than 12 nm off the coast or away from the nearest danger.*
>
> *Confined waters are defined as an area of the sea where the width of the safely navigable waterway does not exceed about two miles, such as a strait or channel.*
>
> *3.2.13. Cross track distance (XTD)*

Open waters	*3 nm*
Coastal waters	*1 nm*
Restricted waters	*1 nm*
Confined waters	*2x beam*

According to the procedural specifications, the confined waters definition applies to the Selat Sape passage. This requires a cross track distance setting of 2x beam or 64.4 m.

The passage plan cross track distance was set at 1,852 m (1 nm) in ChartCo's PassageManager for the entire voyage, with the below exception.

When the passage route was entered into the ECDIS, the cross track distance was set at 0.1 nm from Waypoint 14 (Banta Island) to Waypoint 18 (Sumba Strait), which corresponded with the owner's procedural specifications for this part of the voyage. Although not as defined in the manual on board, the cross track distance setting in the ECDIS of 185.2 m is explicitly appropriate for the relevant part of the passage because it exceeds the cross track distance required.

4.5 Information on the quality of chart data (ENC)

4.5.1 IHO requirements

In the ENCs in S-57 format currently available, the quality of hydrographic data is divided into categories, summarised and defined by the CATZOC (where ZOC stands for zone of confidence) attribute in the M_QUAL (quality of data) metadata area features objects. The cursor pick query function on an ECDIS makes it possible to display data quality or the optional display of quality symbols can be switched on.

The following table shows the available categories of data quality with corresponding levels of accuracy.

ZOC categories (S-57)

ZOC Category	Position Accuracy (note 2)	Depth Accuracy (note 3)		Seafloor Coverage	Typical Survey Characteristics
A1	± 5 m + 5% depth	=0.50 + 1%d		Full area search undertaken. Significant seafloor features detected and depths measured.	Controlled, systematic survey (note 6) high position and depth accuracy achieved using DGPS and a multi-beam, channel or mechanical sweep system.
		Depth (m) 10 30 100 1000	Accuracy (m) ± 0.6 ± 0.8 ± 1.5 ± 10.5		
A2	± 20 m	= 1.00 + 2%d		Full area search undertaken. Significant seafloor features detected and depths measured.	Controlled, systematic survey achieving position and depth accuracy less than ZOC A1 and using a modern survey echo-sounder and a sonar or mechanical sweep system.
		Depth (m) 10 30 100 1000	Accuracy (m) ± 1.2 ± 1.6 ± 3.0 ± 21.0		
B	± 50 m	= 1.00 + 2%d		Full area search not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey achieving similar depth but lesser position accuracies than ZOCA2, using a modern survey echo-sounder, but no sonar or mechanical sweep system.
		Depth (m) 10 30 100 1000	Accuracy (m) ± 1.2 ± 1.6 ± 3.0 ± 21.0		
C	± 500 m	= 2.00 + 5%d		Full area search not achieved, depth anomalies may be expected.	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.
		Depth (m) 10 30 100 1000	Accuracy (m) ± 2.5 ± 3.5 ± 7.0 ± 52.0		
D	worse than ZOC C	Worse Than ZOC C		Full area search not achieved, large depth anomalies may be expected.	Poor quality data or data that cannot be quality assessed due to lack of information.
U	Unassessed – The quality of the bathymetric data has yet to be assessed				
Column: 1	2	3		4	5
Source: IHO S-57 Ed3.1 Supp 3 (Jun 2014), pp 13-14					

In addition to the resulting quality information, chart objects (e.g. submerged rocks, wrecks, obstacles or depth contours) can be furnished with specific information on horizontal (QUAPOS, POSACC) or vertical (VERACC) accuracy. This information can also be retrieved on an ECDIS using the cursor pick query function or seen on the display.

4.5.2 Activities at the IHO

A dedicated working group (Data Quality Working Group – DQWG) at the IHO[2] is focusing on options for improving user awareness and the presentation of quality data, amongst other things. To assist mariners a guidance document is being developed (S-67, Mariner's Guide to Accuracy of Depth Information in Electronic Navigational Charts), which reiterates the meaning of ZOC symbols (with background information) and their use in navigation. Furthermore, suggestions for a more intuitive presentation of quality data are being discussed and examined for suitability.

4.5.3 S-101 data format

For the new ENC data format, S-101, the information on the quality of chart data has been moderately enhanced, so as to be able to map the data quality's variability over time, amongst other things. As a resulting variable the quality of bathymetric data (QoBD) is stored in the metadata. A gradation similar to CATZOC can be found here, too.

The following table shows the available QoBD values with corresponding accuracies.

S-101 quality levels

QoBD value	data assessment	Category of temporal variation	full seafloor coverage, features detected	least depth of detected features measured	size of features detected	vertical uncertainty	horizontal position uncertainty
1	1: assessed	5: unlikely to change	YES	YES	value (m)	0.50 (fixed) 0.01 (variable)	5.00 (fixed) 0.05 (variable)
2	1: assessed	3: likely to change but significant shoaling not expected. 5: unlikely to change	YES	YES	value (m)	1.00 (fixed) 0.02 (variable)	20.0 (fixed)
3	1: assessed	3: likely to change but significant shoaling not expected. 5: unlikely to change	NO	NO	NULL	1.00 (fixed) 0.02 (variable)	50.0 (fixed)
4	1: assessed	3: likely to change but significant shoaling not expected. 5: unlikely to change	NO	NO	NULL	2.00 (fixed) 0.05 (variable)	500.0 (fixed)
5	1: assessed	1: extreme event 2: likely to change and significant shoaling expected 3: likely to change but significant	NO	NO	NULL	greater than 2.00 (fixed) 0.05 (variable)	greater than 500.0 (fixed)

[2] International Hydrographic Organisation.

		shoaling not expected. 5: unlikely to change					
O	2: assessed (oceanic)	VOID	VOID	VOID	VOID	VOID	VOID
U	3: unassessed	6: unassessed	NO	NO	NULL	Not available	Not available

4.6 Sailing directions

The electronic version of the UKHO's[3] sailing directions available on board (e-NP 34, Indonesia Pilot Volume 2) states the following for the Selat Sape route (6.99):

"The passage E of Pulau Banta is navigable but is seldom used, other than by ferries and other local craft, as tidal streams are strong and fewer anchorages are available […]."

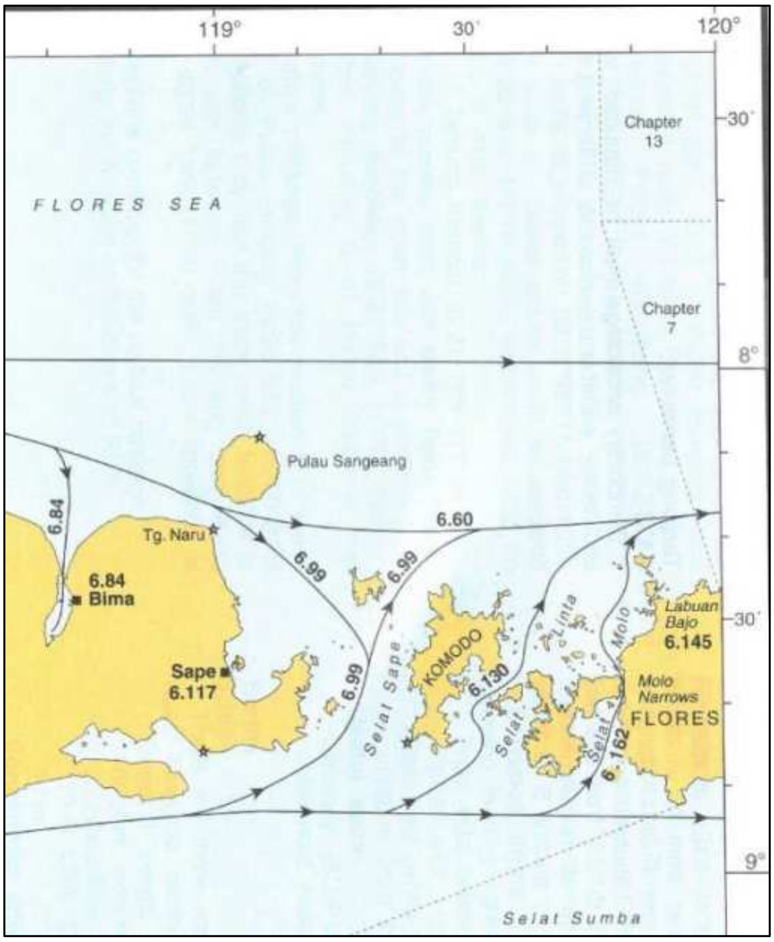


Figure 14: Chart p. 138 UKHO Sailing Directions NP 34

[3] United Kingdom Hydrographic Office.

With the exception of ferries and local vessels, the passage east of Pulau Banta is rarely used because of the prevailing tidal streams and fewer anchorages.

Furthermore, the following is written under the sailing direction for the island of Tokohgilibanta[4] (φ 08°30.46'S and λ 119°20.85'E):

"A drying rock, 1 mile farther NNW, is small and dangerous; the breakers on it being indistinguishable from the normal overfalls and sea conditions in the area."

This account corresponds entirely with the situation found at the place of grounding.

4.7 Photographs of the place of grounding

Figure 15: Waves breaking on rocks

[4] In the ENC the name of the island Tokohgilibanta changes to Nisabedi when the viewer zooms in.

Figure 16: Rocks above water

5 Actions taken

5.1 Owner

After the accident the owner carried out an analysis of the incident and cause. A summary of this analysis was sent to the entire fleet in a circular.

A safety instruction relating to voyage planning was addressed to the fleet and has come into force. This instruction's aim is to ensure that voyage planning be evaluated or inspected in greater depth ashore on randomly selected ships or ships with special routes, in addition to the current inspection of voyage planning on board.

Masters were reminded to look upon any isolated danger as being an actual hazard to the ship. The CATZOC usage instructions were reviewed.

Preventive measures include providing individual refresher courses in planning, voyage execution and operation of the ECDIS.

The owner wrote to the UKHO and informed it about the deviations between the paper charts and corresponding ENC.

5.2 UKHO

5.2.1 Position

According to the UKHO, the position of the rock shown on ENC-ID300295 is taken directly from the Indonesian Navigational Chart ID 295 at a scale of 1:200,000. This position differs with a 9 m shoal, which is plotted on the paper-based Navigational Chart ID 268-2 with a larger scale of 1:50,000. Although both Indonesian charts are compiled using the WGS 84 datum, there is a discrepancy between them in respect of position.

5.2.2 Depth

Chart ID 268-2 shows a depth of 9 m at this position. The chart indicates that this depth measurement dates back to 1904. Chart ID 295 – with a smaller scale – shows a rock in unknown depth in the form of a 'rock awash' symbol permanently submerged (depth: 0). It is likely that the rock symbol was consciously used in the small-scale charts for reasons of generalisation. The reason why one chart shows 'rock awash' and the other a permanently submerged rock ('underwater rock') is unclear. The UK charts use Indonesian charts as a basis but show the more dangerous scenario, 'rock awash'. The UKHO is not responsible for updating the ENCs of other nations but has forwarded the information to the Indonesian Hydrographic Office for review. Surveying of the area around the island of Komodo is planned for the near future and this will be used as an opportunity to map the position and minimum depth of these rocks precisely.

6 CONCLUSIONS

Culminating in the PAZIFIC running aground, this accident is due to the not fully engineered ECDIS, which is approved as a primary means of navigation and displaces other important sources of information, such as sailing directions, without the establishment of a consistent replacement for them.

There are significant differences between traditional voyage planning using paper charts and digital voyage planning using ENCs. Planning a voyage using paper charts often entails referring to sailing directions, the list of lights and pilot charts with proposed routes plotted. Besides drawing on their experience, officers of the navigational watch therefore also refer to sources of data other than the navigational chart. Paper charts and sailing directions have developed over centuries and become more accurate in many areas. However, most of the world's sea areas are looked upon as being inaccurately surveyed and given the CATZOC attribute of the M_QUAL metadata area features objects class in the ENC, while paper charts only provide an indication of the date of a survey. The cursor pick query function on an ECDIS makes it possible to display data quality or the optional display of quality symbols can be switched on. In addition to the resulting quality information, chart objects (e.g. submerged rocks, wrecks, obstacles or depth contours) can be furnished with specific information on horizontal (QUAPOS, POSACC) or vertical (VERACC) accuracy. This information can also be retrieved on an ECDIS using the cursor pick query function or seen on the display.

Category D of the CATZOC attribute is specified as unverified due to poor quality and insufficient information. Moreover, this category is poorer than category C, where horizontal accuracy is +/- 500 m and vertical accuracy at a water depth of 30 m +/- 3.5 m with a probability of 95%. In the sea area in question it is mapped at the ENC's best available scale, where the shoal in the ENC at a scale of 1:180,000, published by the Indonesian Hydrographic Service on 30 March 2018 and last maintained on 18 September 2018, is plotted about 2 cbl southeast of the scene of the accident and designated as 'underwater rock' ('always under water/submerged', 01/03/2017). Plotting it in this manner would correspond with CATZOC attribute category C, however.

The master and the second officer did not consider the plotted isolated danger, which is near the place of grounding, a threat to safe passage when they planned the passage. The information in the explanatory note about this isolated danger in the ECDIS/ENC did not cause the crew to conclude that it would pose a hazard to them or their ship. The master and the second officer stated that the lack of depth information for the isolated danger or area surrounding it prompted the assumption that the water depth corresponded to the surrounding area. There was no appropriate designation around the isolated danger, nor was there any highlighting by a safety contour or the like for lack of depth contours.

In contrast, the best scale (1:50,000) of the Indonesian paper-based Navigational Chart 268 (WGS 84, 2012) even shows the shoal at a specific depth of 9 m. The chart stems from Dutch surveys carried out in 1904. In the Indonesian paper-based Navigational Chart 295 (WGS 84, 2016) at a scale of 1:200,000, the shoal is plotted without a specific depth and about 2 cbl further southeast as compared to the larger scale 268, i.e. as in the ENC, obviously incorrectly, otherwise the PAZIFIK would not have run aground. This chart is also based on Dutch surveys carried out in 1904-1908. In the British paper-based Navigational Chart 2910 (WGS 84, 2012) at a scale of 1:500,000, the shoal is correctly plotted without a specific depth. This chart refers to Indonesian charts from 1981 to 2011 and is based on surveys carried out between 1901 and 2011.

There is clearly a discrepancy between the ENC and corresponding paper charts. The ENCs can be obtained through the RENC (Regional ENC Coordination Centres, PRIMAR in Norway at the Hydrographic Service in Stavanger and IC-ENC in the UK at the Hydrographic Service in Taunton) and their distribution centres. The actual ENC is produced and authorised by the national hydrographic services.

Deck officers are required to navigate using all available means to ensure safe voyage planning. But how should one assess the available means?

The owner's safety management system (SMS) defines procedural specifications, which the crew is required to observe. Since the PAZIFIC is a tanker, the guidelines of the OCIMF (Oil Companies International Forum), which charter contracts often refer to, are also observed. These guidelines go so far as to stipulate specific settings for an ECDIS. For example, the CATZOC attribute in the ENC influences the water depth to be maintained and the range of the track chosen for the route. On the other hand, only the largest scale required for the sea area should be used in paper charts. This may even lead to a situation where if the crew has to make specific settings in an ECDIS in accordance with procedural specifications, less cargo may be carried in order to comply with the required under keel clearance or the ship's track is adjusted so narrowly with the so-called XTD (cross track distance) setting that any deviation would trigger alarms.

In this case the officer on watch had to evade fishing boats near the scene of the accident and leave his course (with a XTD setting of 0.1 nm on each side), causing him to run onto the shoal not plotted in the ENC. This accident would probably not have happened with paper charts, as more accurate surveys are available and given their very nature unsound surveys result in more distance being kept from shoals. Added to this is the information from the sailing directions. NP 34 Chapter 6 (Indonesia Pilot Volume 2) states that the eastern passage of Pulau Banta is navigable but rarely used. In addition, the scene of the accident is described as a dangerous drying shoal indistinguishable from tide rips.

Although this information is also available in the digital version of the sailing directions available on board, it is difficult to find a reference to the ENC when the shoal as such is incorrectly plotted in the ENC, as opposed to the paper chart where a reference would be consciously sought. At the same time, it should not be forgotten that the ENC in S-57 format is merely a structured image of the information from conventional paper charts and does not contain any pointers to the digital sailing directions. Had there been a link between the isolated danger and the NP-34 electronic sailing directions in the ENC, then a correct description of the isolated danger would have been recognised immediately and the route probably not chosen. The accident is therefore attributable to the ECDIS and the settings specified.

The tracks on the voyage from Indonesia to Australia were ultimately supplied by ChartCo, a service provider. It was the shortest route. Although it must be verified on board, a route in the ECDIS will normally be used if regarded as checked. Accordingly, on the section in question the XTD was set from 1 nm to 0.1 nm. At 1 nm there would have been an alarm during the track verification in the ECDIS and at 0.1 nm XTD the PAZIFIC would not have run aground unwittingly had the track been strictly adhered to. However, the ECDIS's biggest shortcoming is that the CATZOC attribute is not included in the route planning. At a horizontal accuracy of +/- 500 m, this attribute should have been included in the alarms. This would have been an important alarm in the ECDIS in addition to the existing 30 alarms and warnings. Although the accuracy is displayed if required on the screen in the form of symbols with up to 6 stars, these symbols are difficult for the officer on watch to understand, have no effect on the automated system and it is left to the user to interpret them.

The Selat Sape passage is to be avoided on the PAZIFIK from now on, especially since local sources indicate that several ships have already ran aground at the scene of the accident. This eliminates the survey accuracy issue at this position. In many other sea areas crews can rely on local pilots with up-to-date sounding charts, which are more accurate than navigational chart data.

A dedicated working group (Data Quality Working Group – DQWG) at the IHO is focusing on options for improving user awareness and the presentation of quality data, amongst other things. To assist mariners a guidance document is being developed (S-67, Mariner's Guide to Accuracy of Depth Information in Electronic Navigational Charts), which reiterates the meaning of ZOC symbols (with background information) and their use in navigation. Furthermore, suggestions for a more intuitive presentation of quality data are being discussed and examined for suitability. For the new ENC data format, S-101, which is scheduled to replace the S-57 format in 2023 as per existing plans, the information on the quality of the ENC has been moderately enhanced, so as to be able to map the data quality's variability over time, amongst other things. For example, the Goodwin Sands in the English Channel change by 2.4 m per week. Areas that had a water depth of 20 m 12 years ago are now drying out. As a resulting variable the QoBD is stored in the metadata. A gradation similar to CATZOC can be found here, too. A decision on the extent to which the new QoBD attribute will be included in the ECDIS's voyage planning and verification function is still outstanding.

Measures taken after the grounding to protect the crew, secure the ship and cargo, and assess the situation were carried out professionally and in accordance with good seamanship.

Due to the measures taken by the owner after the accident, the publication of safety recommendations has been dispensed with.

7 SOURCES

- Written explanations/submissions/photographs
- Ship's command
- Owner
- Reports and technical paper
- Navigational charts and ship particulars, Germany's Federal Maritime and Hydrographic Agency, UKHO and Indonesia
- Official weather report, DWD
- Recordings and documentation on board