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

Investigation Report 496/09

Very Serious Marine Casualty

Grounding with water ingress on 21 November 2009 to the south of São Miguel/Azores and constructive total loss of the MV S.GABRIEL

1 November 2010

www.bsu-bund.de

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.

Issued by:
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1 Summary of the marine casualty

The MV S. GABRIEL was sailing from Horta/Azores to São Miguel/Azores on 21 November 2009. At about 0500[1] local time, the vessel ran aground about 5 nm east of the port of Ponta Delgada (position: φ = 37°43.6'N and λ = 025°32.7'W) and started to take on water.

After the bunker fuel was transferred using a lighter, the vessel was hauled free and taken to the port of Ponta Delgada on 7 December 2009. The vessel was declared a total loss because of the damage and then towed to Leer, her present location.

[1] Unless stated otherwise, all times shown in this report are Universal Time Coordinated = GMT/UTC. Azores local time = UTC -1.

2 SHIP PARTICULARS

2.1 Photo

Hasenpusch Photo-Productions

Figure 1: Photo

2.2 Particulars

Name of vessel:	S. GABRIEL, ex SEA BREEZE
Type of vessel:	Motor vessel, general cargo ship
Nationality/flag:	German
Port of registry:	Leer
IMO number:	9251511
Call sign:	DBQB
Owner:	Briese Schiffahrts GmbH & Co. KG
Year built:	2002
Shipyard/yard number:	China Quingshan Shipyard, No.960306
Classification society:	Germanischer Lloyd
Length overall:	100.60 m
Breadth overall:	18.80 m
Gross tonnage:	4,454
Deadweight:	5,560 t
Draught (max.):	6.654 m
Engine rating:	4,320 kW
Main engine:	Caterpillar/MAK 9 M32 C
(Service) Speed:	15 kts max.
Hull material:	Steel
Minimum safe manning:	12

2.3 Voyage particulars

Port of departure:	Horta
Port of call:	Ponta Delgada, São Miguel/Azores
Type of voyage:	Merchant shipping International
Cargo information:	57 x 20' and 80 x 40' containers, 2 cars and 7 horses
Manning:	14
Draught at time of accident:	Fore: 4.20 m. Aft: 5.80 m
Pilot on board:	No
Number of passengers:	None

2.4 Marine casualty or incident information

Type of marine casualty:	Very serious marine casualty
Incident:	Grounding
Date/Time:	21 November 2009/0557 UTC
Location:	Approx. 5 nm east of Ponta Delgada
Latitude/Longitude:	φ 37°43.6'N λ 025°32.7'W
Ship operation and voyage segment:	High seas
Place on board:	Bridge
Consequences:	No personal injury or damage to cargo reported Total loss of vessel Oil or pollutant discharge was not reported by the vessel operator

Excerpt from Nautical Chart No. 1950, BA

Figure 2: Nautical chart

2.5 Shore authority involvement and emergency response

Agencies involved:	Port authorities, tug companies
Resources used:	Shipboard cargo handling gear, tug
Actions taken:	Salvage of cargo, lighterage of vessel, salvage by tug
Results achieved:	Vessel salvaged

3 COURSE OF THE ACCIDENT AND INVESTIGATION

3.1 Course of the accident

The MV S. GABRIEL was engaged on a regular shipping service which supplied the Azores from the Portuguese mainland. On her final voyage, the vessel sailed from the mainland port of Leixos to Ponta Delgada on São Miguel/Azores. The next port of call was Praia da Vitoria/Terceira Island and Horta/Faial Island, after which she was scheduled to return to the mainland via Ponta Delgada. She departed from the port of Horta at 1700 on 20 November 2009. At 2400, the master handed the watch over to the second officer.

The last recorded change of course was at 0526 to the south of Ponta Delgada Airport. The vessel ran aground at the plotted position (see Figure 3) at 0559 while at a steady speed of 12.3 kts.

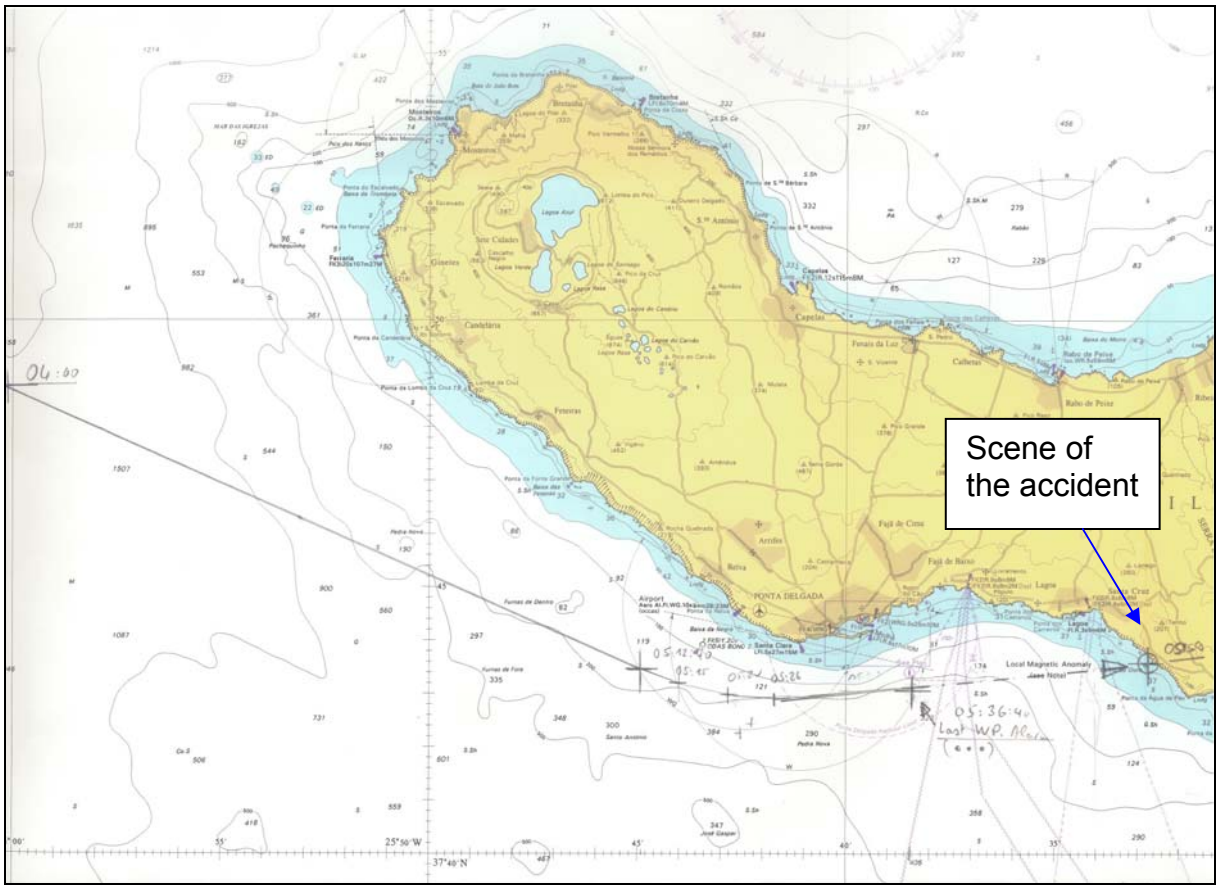


Figure 3: Scene of the grounding

The marine and navigation equipment was in proper working order up to the time at which the vessel grounded. Technical errors were not reported.

3.2 Investigation

Recorded AIS data, VDR data, photographs and witness statements were provided for the investigation. The BSU surveyed the vessel on 22 April 2010 and 15 July 2010 in Leer.

The vessel is fitted with a Saab R4 AIS and a DM 300 S-VDR (voyage data recorder) made by Danelec Marine. Furthermore, a NautoPilot 2010 autopilot is fitted. This was also in operation at the time of the accident.

3.2.1 Damage

After the vessel was salvaged, a damage report was prepared by Germanischer Lloyd on 6 December 2009. This was based on an underwater survey by divers. This report indicated that the bottom plating was damaged between frame 10 and frame 140 in the area of the bilge keel from port to starboard by dents, holes and cracks. The largest crack (1,500 mm in length) was discovered at frame 85 on the starboard side.

No damage to the hull was discovered in the area of the engine room. According to the audio recordings of the VDR, it was reported that the engine room was flooded about 1 hour and 48 minutes after the vessel ran aground. Since dry docking had not taken place up to the time at which this investigation report was prepared, it was not possible to properly clarify how the engine room flooded. Underwater photos taken at the port of Ponta Delgada were the only means available for assessing the damage.

Figure 4: Damage to the propeller

3.2.2 Weather report

The BSU requested an official report on the wind and sea conditions from the Maritime Division of Germany's National Meteorological Service (DWD). The report contains the following summary.

A 6-7 Bft west to north-west wind prevailed on the night of the accident. The strongest gusts (8 Bft) were measured at Ponta Delgada Airport. It is assumed that the wind sea and swell stood at 3-4 metres. According to the climatological maps of the BSH, the tide was setting to the south-east at less than 0.5 knots.

3.2.3 AIS recordings

The BSU was provided with a recording of the AIS data by the Portuguese Port and Maritime Transport Institute (IPTM). Local time is shown on the status bar at the bottom of each figure.

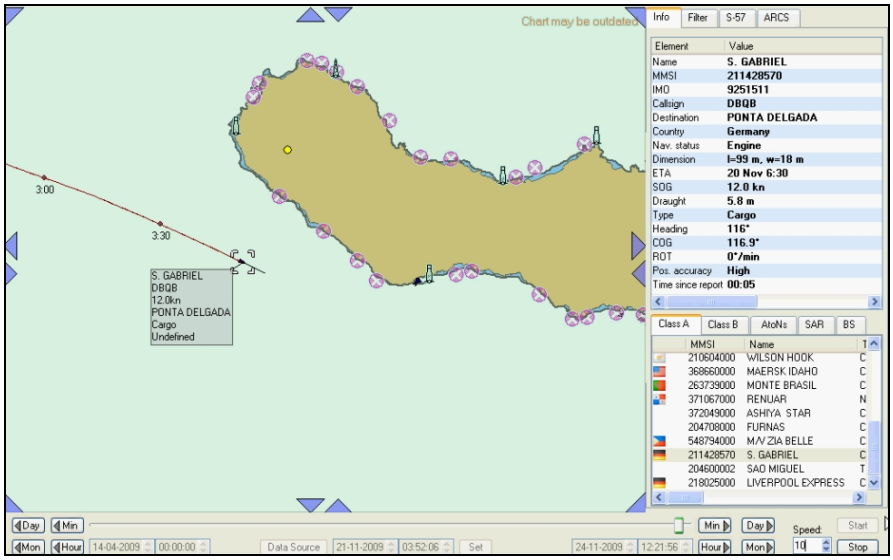


Figure 5: AIS data from 0452

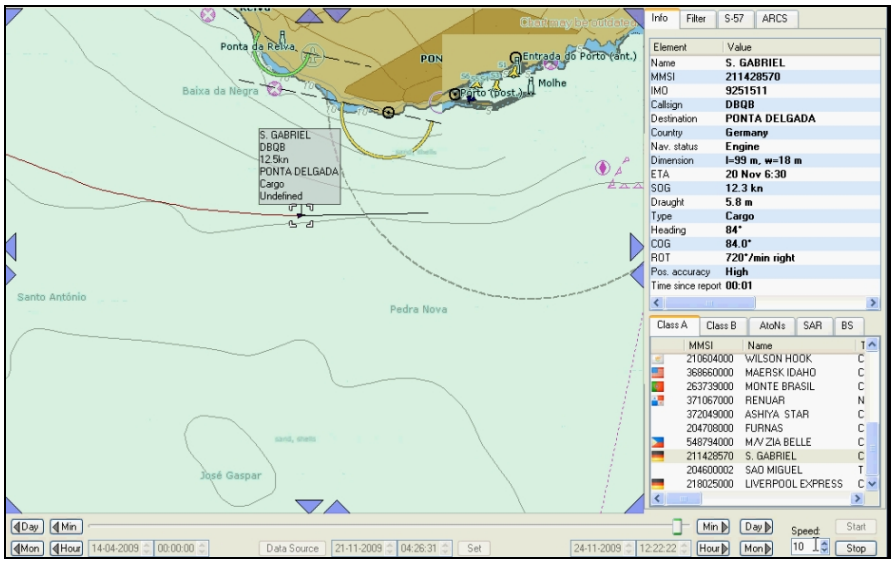


Figure 6: AIS data from 0526

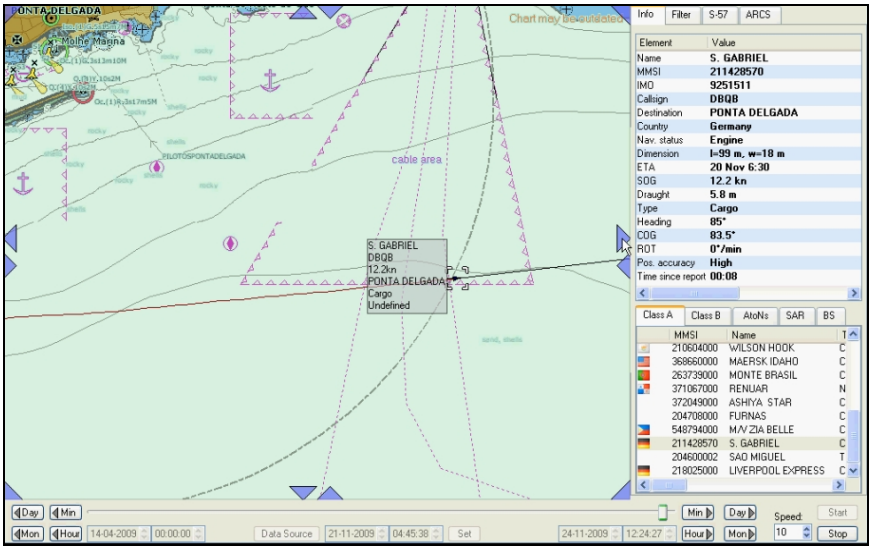


Figure 7: AIS data from 0545

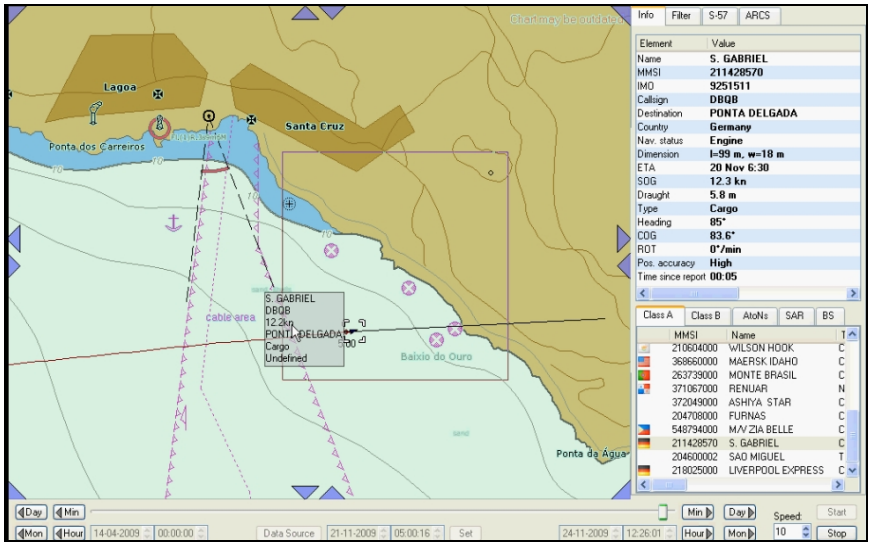


Figure 8: AIS data from 0600

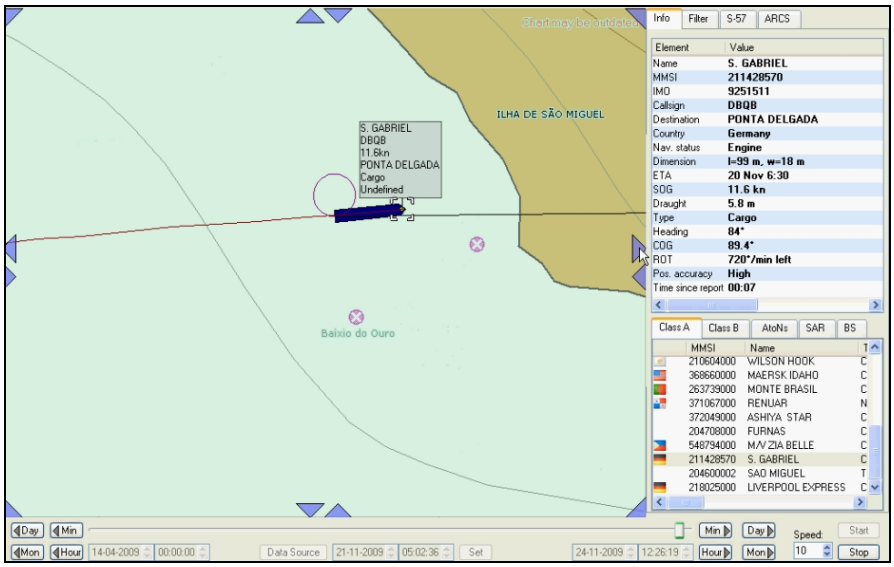


Figure 9: AIS data from 0602

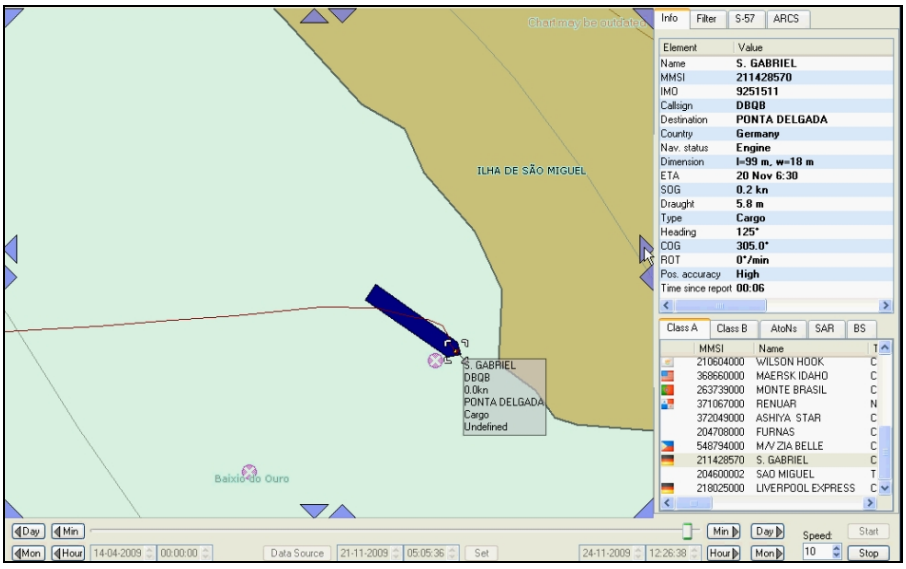


Figure 10: AIS data from 0605, vessel has run aground

3.2.4 Photos of the scene of the grounding

The BSU was provided with the following photos by the Bensaude-Shipping Agents Ltd., Ponta Delgada.

Bensaude-Shipping Agents Ltd., Ponta Delgada

Figure 11: First photo of the grounded vessel

Bensaude-Shipping Agents Ltd., Ponta Delgada

Figure 12: Second photo of the grounded vessel

The high elevations of the island can be seen in the background of each photo. The vessel is grounded in an extremely high position on rocks very close to the shore far behind the surf zone.

3.2.5 Watch systems

The vessel operator stated that the usual three-watch system is used when the vessel is in sea operation. The second officer keeps watch from 0-4,[2] the chief officer from 4-8 and the master from 8-12 (there is no third officer on board). A two-watch system is operated on island routes; in this case, the second officer keeps watch from 0-6 and the master from 6-12. Since only the master and the second officer were involved in the watch system, the chief officer, who is in charge of loading and unloading, should be able to concentrate fully on this task.

In the letter of 23 September 2010, the vessel operator points out that the usual three-watch system was also operated on S. GABRIEL when the vessel was on an island route. The timing was adapted to the ship operation and the master could have assumed his “Overriding Authority” at any time and also involve the Chief Officer in the watch. Apart from that did the island routes only involve passages of less than 24 hours.

One of the three ordinary seamen trained in watchkeeping was assigned to the officer in charge of the navigational watch both on island routes and for the normal three-watch system. These worked in a three-watch system with two 4 hour shifts per day irrespective of whether the vessel was on an island route, or not. This means that during the night the watchkeeper should also have taken over/been relieved at 2400 and 0400 when the vessel was on an island route.

In contrast with the normal routine on island routes, rather than the master, the chief officer was to take over the watch from the second officer at 0600 on the day of the accident. According to the timetable, the vessel was scheduled to arrive at Ponta Delgada shortly after 0600 and the chief officer wanted to make additional preparations for the forthcoming loading and unloading operations on the bridge.

3.2.6 Witness accounts

All the witnesses interviewed were willing to provide information. Furthermore, the audio recordings of the VDR were analysed.
According to statements given, the 51-year-old Bulgarian second officer has been employed by the vessel operator since 2008. After five months at sea, he spent three months on leave and had been back on board since 1 October 2009.
The ship arrived at the port of Horta at 0100 on 20 November 2009 during the regular watch of the second officer.
The second officer slept from 0145 to 0730 and then began routine tasks while the chief officer supervised the loading and unloading operations.
On the afternoon of 20 November 2009, the second officer carried out a boat drill in the port with trainees until about 1700. According to entries in the deck log book, the vessel cast off at 1700 under pilotage.

[2] The shipboard watch system times are Universal Time Coordinated GMT/UTC

He took over the watch from 1730 to 1915 to enable the master to eat his supper. After that, he left the bridge, ate and rested until midnight.
He took over the watch at 2400. The position was 38°06.3'N and 026°58.3'W; the course was 114° and the speed 12.5 kts.
A NW wind of 6 Bft and heavy 4-5 metre swell caused the vessel to roll heavily.
The second officer reportedly recorded the position at 0530 by means of a radar bearing on the Ponta Delgada breakwater and a second bearing on the coastline a ¼ mile away on the port side next to the course line.
Since the course passed through sheltered waters for the next 15 minutes, he reportedly sent the lookout from the bridge to the superstructure to check for damage or flying objects caused by the heavy rolling.
When he realised that the vessel was 1.5 nm away from the subsequent scene of the grounding, he reportedly attempted to change the course by 60° to starboard using the autopilot. Since the vessel did not respond to the manoeuvre due to the heavy sea state, he switched to manual steering control and set the helm to 'hard starboard'. However, this manoeuvre was too late to prevent the vessel from grounding.
Startled by loud noises from the main engine and propeller, the master entered the bridge at 0557 and assumed command. He could see a steep rock face on the port side and stated that he ordered that the helm be set to 'starboard'; however, there was no response and the main engine was stopped by means of the emergency shutdown.
The general alarm was sounded at 0605 and Ponta Delgada informed over VHF.
The chief officer stated that he usually entered the bridge 30 minutes to 1 hour before his watch started. However, he was unable to sleep properly on this occasion because the vessel was rolling heavily and only slept more deeply after the vessel was in the lee of the land. He was then awakened due to the noise caused by the vessel running aground.
A 34-year-old ordinary seaman was posted as lookout for the 0-4 watch. He stated that he was reportedly called to the bridge at 2400 by the second officer and that normal discussions were held during the watch.
According to the lookout, the next lookout, a 38-year-old ordinary seaman, was woken at 0345, appeared on the bridge at just before 0400 and took over the 4-8 watch. According to statements given, both individuals spoke with one another and walked to and fro on the bridge.
At the instruction of the second officer, one or two engine alarms that had accumulated were to be checked by the lookout and he was to make a round of the superstructure, at which he left the bridge at 0545.

3.2.7 Working hours

The time sheets of the master, chief officer and second officer for October and November 2009 were sent to the competent state trade supervisory office in Emden for evaluation of the working hours and rest periods pursuant to Seamen's Law. The evaluations revealed that there were significant transgressions below the required rest periods and above the required working hours. It is striking that all three officers worked at certain times or periods, primarily between 0800 and 1800. Moreover, long

periods were discovered in which none of these individuals worked, which leads one to suspect that there must have been other 'officers/watchkeepers"[3].
As regards this the vessel operator states that the working hours the three nautical officers were assigned to from 0800 to 1800 were limited to the stay at the quay in Lissabon where the vessel had to wait. However, it was ensured, that a nautical officer was always on board during the period of time from 1800 – 0800.

3.2.8 Voyage data recorder (VDR)

The MV S. Gabriel is fitted with a DM 300 S-VDR made by Danelec. The removable hard disk and final recording medium (black box) were provided for the marine casualty investigation. The recorded radar images, positions, speeds and headings are consistent with the recorded AIS data. However, no consistency can be found between the audio recordings for the period 0000 to 0600 and the witness accounts.

According to the recorded sounds on the bridge, the master handed the watch over to the second officer at 2350 on 20 November 2009. Following that, the only sounds that can be heard up to 0600 are made by one person and there are no discussions. A lookout was neither called to the bridge at 0000 nor at 0400.
Movements can no longer be heard on the bridge from 0523 onwards. A final audible waypoint alarm is recorded at 053640 at the position 37° 43.17'N and 025° 39'W. At 055825, sounds made by a person can be heard once again on the bridge and at 055925 loud grounding noises. At 055955, the master appears on the bridge and asks: "*What's going on second? Where we are?..."*
The general alarm is issued at 060100.

3.2.9 Inspection of the VDR bridge microphones

An inspection of the positioning and operability of the VDR microphones on the bridge was carried out during a survey of the vessel on 22 April 2010 in the port of Leer. Excepting the microphone outside in the starboard bridge wing, all the microphones were intact.

According to the following plan, the microphones on the bridge were positioned as follows: one at the chart table, one amidships at the conning position and one at the radio equipment on the port side.

[3] Quote from the letter of the state trade supervisory office in Emden, 1 March 2010

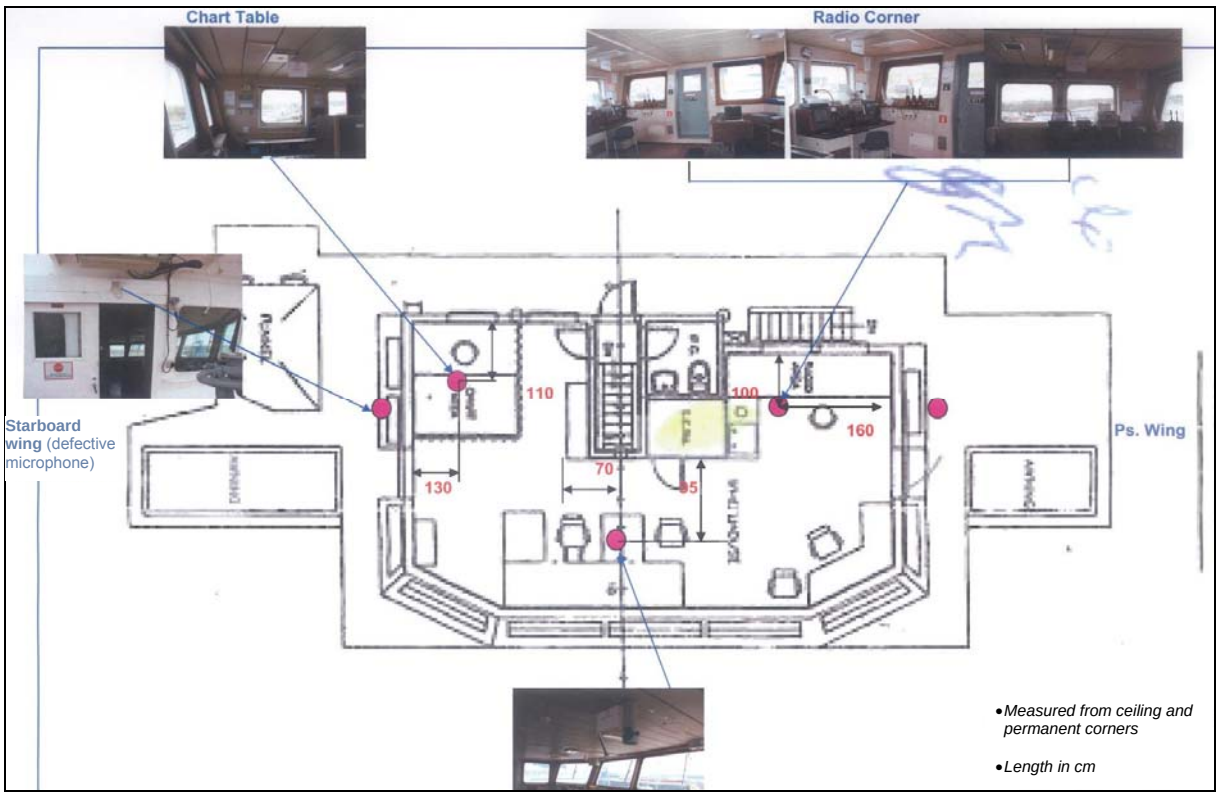


Figure 13: Positioning of the microphones

Testing on the bridge involved the simulation of sounds, such as the opening and closing of doors, loud and normal conversations, movement and other acoustic sounds in order to categorise the audio signals recorded on the day of the accident. The recording quality was quite satisfactory and even quiet sounds were easy to analyse in the subsequent evaluation.

4 ANALYSIS

4.1 Watch system and working hours

The watch roster for 'island routes' described in statements is inadequate and not consistent with the relevant regulations. Art. 85 Seamen's Law (SeemG) stipulates that a three-watch system is to be operated on vessels of this size. Said article goes on to state that maritime labour performed by crew members assigned to watchkeeping duties must not exceed eight hours per day. According to art. 138 SeemG, the only exceptions in which a two-watch system is permitted are for vessels with a GT not exceeding 2,500 and in the sea area off the Portuguese mainland.

The MV S. GABRIEL has a GT of 4,454 and the ports of the Azores are off the continental shelf. A two-watch system is inadmissible in two respects and would not be approved by the Ship Safety Division (BG Verkehr).

According to the Minimum Safe Manning Certificate approved by the See-BG[4], the S. GABRIEL must be manned by a crew of at least 12 people. This certificate prescribes a ship's command responsible for navigational operations of three people: the master, the chief officer and a second officer of the watch (second officer).
In a regular three-watch system, the master inevitably (and with the approval of the flag State) takes over one of the watches.

4.2 Lookout and bridge team

The written testimony of the crew members is not consistent with the actual course of the accident. With the available evidence, in particular, the acoustic recordings of the voyage data recorder, it was possible to make a detailed and different analysis of the events. During the watch period from midnight until the vessel grounded, the sounds recorded by the voyage data recorder were made by only one person on the bridge. Accordingly, the watch was carried out only by the second officer.

Every vessel must use sight, sound and any other available means appropriate for the given circumstances and conditions to maintain a proper lookout at all times. This must provide a detailed overview of the situation and potential risk of collision, grounding or other navigational hazards[5]. In pilotage waters and in the time from sunrise to sunset, the officer of the navigational watch is responsible for manning the look-out with a suitable person[6]. Furthermore, the officer of the navigational watch is required to check the course, position and speed of the vessel at close intervals appropriate to the prevailing traffic situation using the prescribed and available navigational aids so as to obtain full and proper knowledge of the location[7].

[4] Renamed the Ship Safety Division (BG Verkehr)
[5] STCW Code A-VIII/2 (13.2)
[6] Art. 13 para. 3 (2) Ship Safety Ordinance, STCW Code A-VIII/2 (15)
[7] Art. 13 para. 3 (4) Ship Safety Ordinance, STCW Code A-VIII/2 (24)

It is apparent that this was not carried out to a sufficient extent. If it had been, then the large rock formations of São Miguel (see Figures 11 and 12), which were on the course of the S. GABRIEL, would have been identified at an early enough stage both visually and by radar (Figure 14):

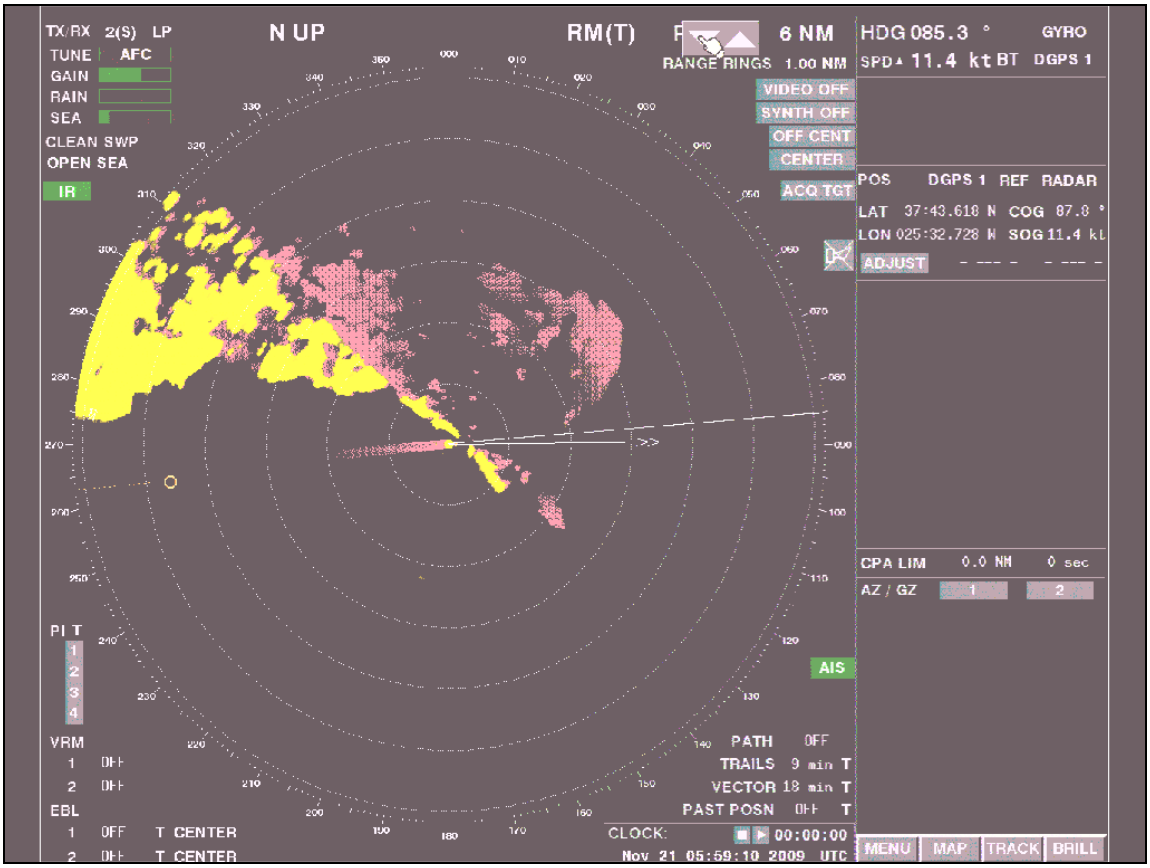


Figure 14: Radar image of the grounding

As basic principles and a minimum standard for safe, diligent navigation, the above regulations should be rigorously applied. These basic principles of seamanship were not observed. The officer of the watch was alone on the bridge from the time at which he took over (2350) to when the vessel ran aground. A proper lookout was neither maintained nor was position fixing carried out to a sufficient extent.

The vessel was fitted with a permanently installed bridge navigational watch alarm system (BNWAS) in accordance with Annex 1 C.I.3 (4.2) Ship Safety Ordinance. It is incumbent on the responsible officer of the navigational watch to ensure that the BNWAS is used regularly during the navigational watch. The watch alarm may not be switched off, even temporarily. The audio recordings of the VDR indicate that the watch alarm was not enabled.

The alarm signal of an audible watch alarm, usually predominating existing ambient noises on the bridge, was not recorded. According to the VDR-recordings no noises of a person acknowledging a visual watch alarm or a subsequent audible alarm, respectively, can be heard prior to the accident. By virtue of these VDR-recordings

and after evaluation of the communication carried out through the watch alarm system after the accident, the watch alarm was apparently not activated.

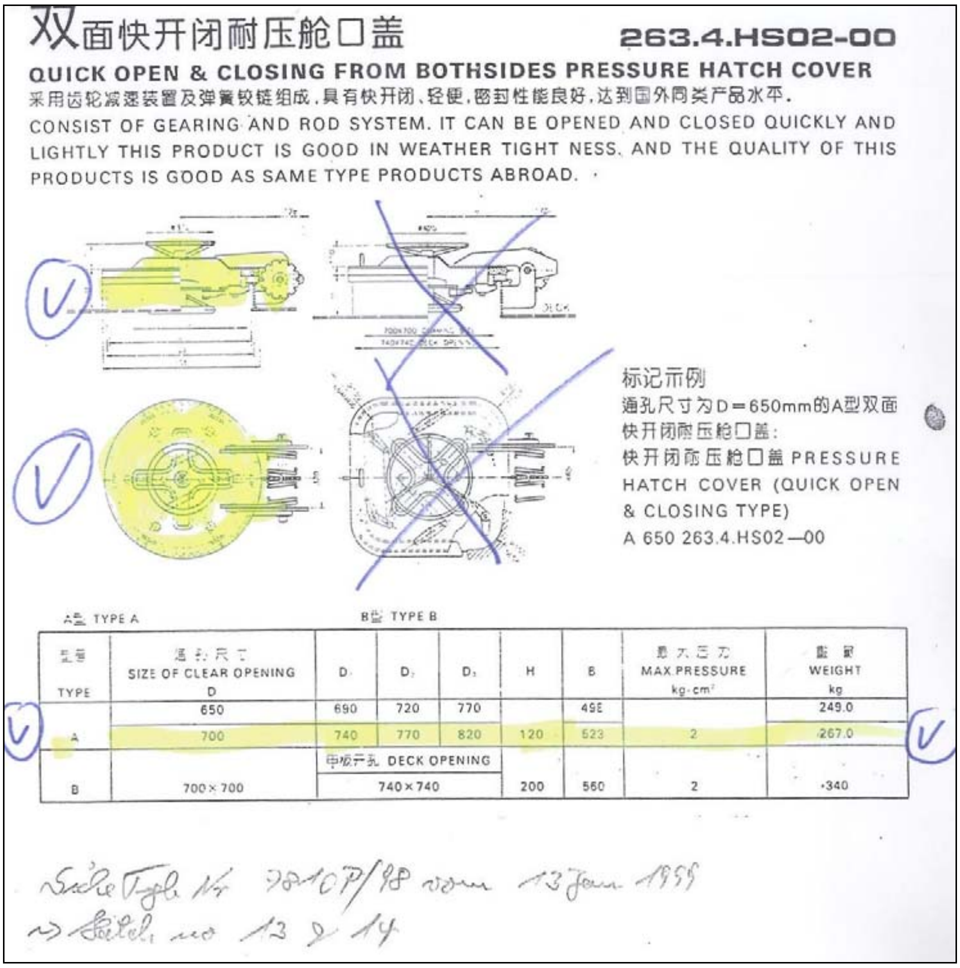
4.3 Flooding of the engine room

During the investigation, the BSU found that the hull is evidently completely damaged from the fore side of the engine room bulkhead up to the forecastle and that all the tanks in this area and the pipe tunnel, which runs along the port side, are completely flooded due to external damage.

The vessel operator indicates that all tanks in the double bottom of the engine room as well as the rudder blade are damaged. These damages are by all accounts located in the engine bottom tanks and are not visible from the engine room. During the survey carried out by divers damages to the shell plating level to the engine room were confirmed.

No visible damage to the shell plating visible from the engine room is evident in the engine room itself and the recordings did not indicate water ingress through the gland or sea-chest. However, the engine room flooded relatively quickly after the vessel ran aground and it is assumed that water entered through a larger opening, notably the entrance to the pipe tunnel at the forward bulkhead in the engine room. The entrance from the engine room is fitted with a round manhole cover 700 mm in diameter with a central locking system.

According to a letter dated 2 November 1999 from Germanischer Lloyd (GL) to the shipyard, this cover should be equipped with a remote indicator on the bridge, which displays whether it is open or closed and have a notice plate attached stating that it is to be kept closed at all times. *"The hatches shall be equipped with an indication showing on the bridge weather the hatch is open or closed. Additional a notice is to be affixed to each such hatch to the effect that it is not to be left open."*


双面快开闭耐压舱口盖 263.4.HS02-00

QUICK OPEN & CLOSING FROM BOTHSIDES PRESSURE HATCH COVER

采用齿轮减速装置及弹簧铰链组成，具有快开闭、轻便，密封性能良好，达到国外同类产品水平。

CONSIST OF GEARING AND ROD SYSTEM. IT CAN BE OPENED AND CLOSED QUICKLY AND LIGHTLY THIS PRODUCT IS GOOD IN WEATHER TIGHT NESS. AND THE QUALITY OF THIS PRODUCTS IS GOOD AS SAME TYPE PRODUCTS ABROAD.

标记示例
通孔尺寸为D=650mm的A型双面快开闭耐压舱口盖：
快开闭耐压舱口盖 PRESSURE HATCH COVER (QUICK OPEN & CLOSING TYPE)
A 650 263.4.HS02—00

A型 TYPE A　　B型 TYPE B

TYPE	SIZE OF CLEAR OPENING D	D	D₂	D₃	H	B	MAX.PRESSURE kg·cm²	WEIGHT kg
A	650	690	720	770		498		249.0
A	700	740	770	820	120	523	2	267.0
B	700×700	DECK OPENING 740×740			200	560	2	340

Figure 15: Approval drawing for the pipe tunnel cover

Particular attention was given to inspecting the engine room during the survey by the BSU on 15 July 2010. The access cover for the pipe tunnel is slightly different to the above drawing. The hinges are of a simpler design and the top of the cover is level; the centre of the cover is not reinforced/raised at the hand wheel.

Figure 16: Hinges and hand wheel on the cover

A sender for the remote indicator, which displays whether the cover is open or closed, is mounted on the side towards the engine room bulkhead and corresponding indicator lights for the position of the cover are located in the engine control room on the monitoring panel. It was not possible to test the electrical operability of the remote indicator during the survey. The notice plate mentioned in the letter from GL is fitted above the entrance and states the following:

Figure 17: Notice plate above the pipe tunnel cover

In contrast with the BSU's findings relating to the pipe tunnel cover being open, the vessel operator believes that the oil leakage pipes were the cause of the water

ingress in the engine room. Several oil tanks in the area of the engine room were damaged when the vessel ran aground. This led to the oil/water mixtures being forced through the various oil leakage pipes into the engine room. The incoming mixture of oil and water prompted the chief to switch off the pump in order to prevent oil from spilling into the sea. These lines were sealed temporarily during the subsequent salvage operation to prevent the engine room from flooding again. The entrance to the pipe tunnel was closed when the vessel ran aground. The cover was locked in place with four clamping screws in addition as a safety precaution only for the period in which the vessel was being towed.

Figure 18: Pipe tunnel cover locked in place

The BSU reviewed the system drawings and piping plans and is neither able to understand nor confirm the vessel operator's assessment that the water ingress in the engine room was caused by the oil leakage pipes.
The drawings indicate that all the oil leakage pipes of the open drip pan merge in collecting pipelines. Depending on the fluid collected, these collecting pipelines run into various tanks. The collecting pipelines run into the tank tops of the corresponding double-bottom holding tanks, but are fitted with swing-check valves at the tank inlets. This means that fluid can only flow through the collecting pipelines into the tanks, but cannot be forced upwards in the opposite direction. This setup corresponds to the classification rules and was also approved and accepted according to the documentation from GL.
Another possible cause of the ingress of water could be the sounding pipes of these tanks, which run into the engine room. However, according to the drawing as well as provisions, the sounding pipes are fitted with self-closing sounding valves. Theoretically, a release of water due to excess pressure in the tank is not possible

because these valves are closed automatically after the sounding operation. This dead-weight closing device must be raised for sounding. However, in practise it is often the case that valves are kept open for reasons of convenience when sounding or by funnels, which is not permissible but obvious during port state controls.
Both causes of flooding are more unlikely. From the perspective of the BSU, the statement that the chief switched off the pump to prevent oil pollution is questionable. When the bottom tanks sustained damaged the oil will in fact be pushed above by the water due to the different density, however, some degree of oil pollution would have been caused by the damaged tanks in any case. Furthermore, every means to rescue the vessel may be used in an emergency regardless of possible environmental pollution. It is far more likely that it was not possible to stem the inflow of water by pumping and therefore the water level rose steadily. However, the BSU finds this difficult to accept if the water entered through the discussed overflow oil lines.
It is not known whether every possible pumping option was used. Since only a small draining pump is routinely used in the engine room, it is conceivable that the crew did not use all available means for pumping. The drawing indicates that, inter alia, a bilge pump with a 200 m³/h direct suction unit and a 280 m³/h emergency suction unit on the sea water cooling pump were available; hence, 480 m³/h in total.
It was not possible to ascertain which pumps were actually used for pumping, whether all direct or draining valves were operational.
The evaluation of the VDR audio recordings revealed that at 0748, i.e. 1 hour and 48 minutes after the grounding, it was reported to the bridge that the engine room is flooded and the emergency power supply is needed *("the engine is flooding and we need start emergency generator").* Furthermore, it is reported that an open pipe tunnel cover *("pipetunnel was open, we are closing")* was responsible for the water ingress, which was now closed; however, water continued to pour out from the cover.
At 0816, German is spoken on the bridge and a telephone call is made.
Bridge conversation: *"Engine room is already finished. He says we should climb in with all hands and close the pipe tunnel; heavy fuel oil is already half way up the engine; the engine room is already flooded ..."*
Telephone call: *"... we cannot close the pipe tunnel, there is quite some pressure. Can't get a man to go in there. ... because water level is already higher. We can't pump because heavy fuel oil is already there."*
All the conversations recorded on the bridge concerning water ingress in the engine room refer to the pipe tunnel. There is absolutely no mention of another possible cause, e.g. through the oil leakage lines.

The information provided by the vessel operator was reviewed during the survey on 15 July 2010, leaks or repaired damage to the overflow oil line system were not discovered locally. Only two sounding pipe valves were additionally sealed with bungs because small amounts of water/oil mixture leaked in this area in spite of them being closed:

Figure 19: Closed sounding pipe valves

The opinion of the BSU according to which the water ingress occurred through the opening to the pipe tunnel is questioned by the vessel operator with letter of 23 September 2010. In the opinion of the vessel operators their own calculations lead to the assumption that an opening not bigger than 22 cm^2, corresponding to a pipe diameter of 5,28 cm, resulted in the water ingress in the engine room. It is demonstrated by means of photos that at first a high quantity of different oils leaked out in the engine room. The vessel operator therefore arrives at the conclusion that no water could leak out of the pipe tunnel into the engine room, since the engine room is free from oil. Calculations explain the fact, that the engine room would have been flooded within 1 minute, if the pipe tunnel had been opened. However, since the power supply on board could be maintained for 1,48 hours by the auxiliary diesels, this couldn't have been the case.

Another calculation is used to consider the case of the damage/opening to the pipe tunnel being just as big that the engine room would only have been flooded up to the auxiliary diesels after 1,48. These leakages would then be so minor, that the water would only have run out of the pipe tunnel opening in the engine room 35 minutes after the grounding. The crew would have had 35 minutes to close the tunnel. The vessel operator cannot think of an open pipe tunnel not being noticed for 35 minutes.

On the basis of the arguments brought forward, the witness testimonies and particularly the fact, that the salvage company had reportedly detected an oil film on the entire surface, the vessel operator is of the opinion that water leaking out through various small leakages at the fuel- und oil pipes ran from the double bottom tanks into the engine room. It is unclear whether the retention valves let the water pass due to the high pressure or if several retention valves, in particular the ones of the heavy fuel drainage pipes, were temporarily gummed in open condition, since the tanks are still flooded. The leakage was significantly lower then the emergency leakage.

The BSU cannot agree with the vessel operator's opinion. See following drawing excerpt of the leakage oil pipe in the engine room.

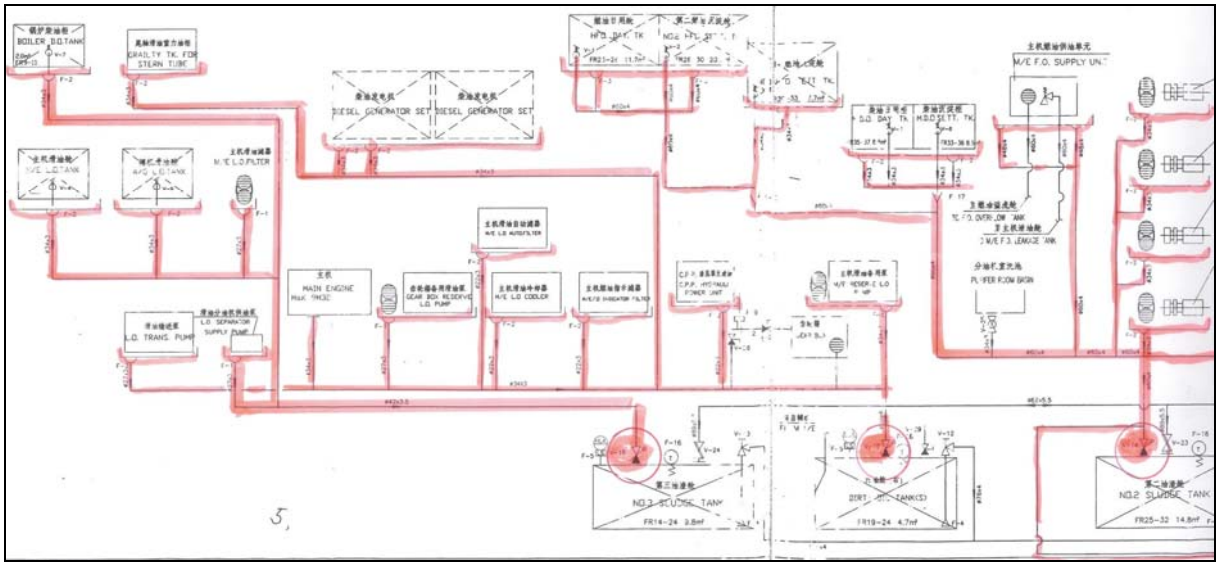


Figure 20: Leakage Oil Pipe Diagram

All pipe tubes of the open oil save tanks run into 3 tanks (Nr. 3 Sludge Tank, Dirty Oil Tank and Nr. 2 Sludge Tank) through the retention valves (V-16, V15, V14), here marked with red circles. The vessel operator is of the opinion that the retention valve of the mentioned heavy fuel oil drainage pipe was temporarily gummed. Satisfying the calculation would have required the failure of another retention valve of the other pipes, since the biggest pipe tube, amounting to 60x4, is to small for the calculated flow. The vessel operator assumes a diameter of 5,28 cm and damage surface of 22 cm^2. The pipe tubes inner diameter 60x4 is 5,2 cm and a surface of 21,24 cm^2, respectively. The vessel operator's supposition as to whether the tested retention valves do not resist a water pressure of 6 m water column, is questionable.

The oil film on the water surface in the engine room detected by the salvage company was still noticeable as a trace residue on the engine room walls. The engine room was accordingly almost flooded to the height of 6 m and the auxiliary diesels as well as the main engine were completely below water. Such a flooding leads necessarily to oil residues in the engine room being released e. g. in bilge, collecting tanks, engines and assets.

5 CONCLUSIONS

5.1 Summary

This very serious marine casualty is the result of inadequate shipboard working arrangements. The vessel operator in contrast assumes an individual nautical blame and a personal fault of the second nautical officer, which was not affected significantly by the shipboard working arrangements.

We are unable to exclude the possibility of the officer of the navigational watch being affected by fatigue caused by an excessive workload due to a watch system which is inadmissible for a vessel of this size and area of operation as well as the course of the voyage. According to the second officers own statement, he did not sleep. This statement is to be questioned since the last active course alteration was carried out 30 minutes prior to grounding. No sound made by a person on the bridge was heard up to about 1 min before the grounding. The course ran straight ahead at this time up to the scene of the grounding. Nobody reacted on clearly visible radar echoes of the coastline or noticeable other light signals.

5.2 Watch system

At 4,454 GT, i.e. well beyond 2,500 GT, legislation does not permit the operation of a two-watch system on the MV S. GABRIEL. Switching from the approved three-watch system when the vessel is in sea operation to a two-watch system for island routes is inadmissible by law. Furthermore, it is not – nor can it be – approved.
The approved three-watch system, in which the master is included on the watchkeeping schedule and only two other officers of the navigational watch are on board, also deserves critical scrutiny. The recommendation of IMO Resolution A.890(21) 'Principles of Safe Manning' dated 21 November 1999, which, however, is not stipulated under German law, states that the master should not be required to undertake regular watch duties on a vessel of this size. *"Except in ships of limited size, the provision of qualified deck officers to ensure that it is not necessary for the master to keep regular watches by adopting a three watch system."*
According to the IMO Resolution, the term 'limited size' refers to vessels of between 500 and 3,000 GT.

5.3 Lookout, watch alarm, course and position monitoring

The constructive total loss of the vessel caused by her running aground was due to misconduct during the navigational watch because

- a proper lookout was neither kept nor was a crew member assigned the role of lookout on the bridge;
- the watch alarm was switched off during the watch;
- no consistent course and position monitoring was carried out from 0523 onwards.

According to the recorded sounds, the officer of the navigational watch was alone on the bridge at the time of the accident and also throughout his entire watch. Based on the time sheets, it may be assumed that the duty officer's ability to concentrate was impaired due to lack of sleep. It is even possible that he was asleep for the thirty minutes leading up to the grounding.

In that regard, the BSU is using this accident as an opportunity to reiterate the importance of bridge manning appropriate to the situation. The BSU has repeatedly drawn attention to the role and judicious deployment of the lookout in previous investigation reports (see BSU reports Ref.: 343/04, Ref.: 371/04, Ref.: 476/05, Ref.: 450/07, Ref.: 01/08). As part of bridge management, it is incumbent on officers of the navigational watch to ensure that personnel on duty are posted to positions at which they are able to perform their duties most effectively and efficiently at all times during a watch.

It must be ensured that sufficient manning is in place for the prevailing circumstances, in particular at night and during voyages with heightened risk, such as in heavy traffic or areas covered by Vessel Traffic Services (VTS). At the same time, due regard must be paid to the bridge equipment and navigational aids on hand and what their performance limits are.

The MV S. GABRIEL was also equipped with a permanently installed BNWAS in accordance with requirements. Through not having the watch alarm enabled, the officer of the navigational watch dispensed with the possibility of utilising the warning/notification functions of the watch alarm in temporary phases of reduced attention, which may also occur on the bridge when the required rest periods are observed.

5.4 Water ingress in the engine room

Sufficient clarification of the events surrounding the water ingress in the engine room, in which the main engine, auxiliary engine and all electrical fittings positioned below the engine room's intermediate deck were damaged or destroyed, has not been possible since dry docking had not taken place up to the time at which this investigation report was prepared.

The BSU uses this accident as an opportunity to refer to a similar very serious marine casualty. In this case, the bow of the German MV NORDLAND ran aground on rocks in the Mediterranean Sea to the east of the Greek island of Kythira on 29 August 2000, causing her aft section to quickly sink. In this accident it was also proven that the engine room filled with water in spite of being perfectly intact outwardly, which resulted in the total loss of the vessel. It was found that water entered through the leak in the forecastle and flooded the pipe tunnel, which ran back to the engine room. The opening of this tunnel in the engine room was fitted with a manhole cover. After the accident, divers found the cover in the immediate vicinity of the manhole, but not on the opening.

Information given by marine engineers and inspectors indicates that in spite of clear instructions to keep openings permanently closed at sea, it is relatively common practise for such manhole covers to be opened at sea in order to ventilate the pipe tunnel. The required shipboard simplified voyage data recorder (S-VDR) does not record whether the pipe tunnel cover is open or closed. In contrast, the enhanced performance requirements for a full-spec. VDR stipulate that these must monitor and record the status of watertight and fire-screen doors.

Following evaluation of the VDR audio data and the surveys in Leer, the BSU presumes that on the S. GABRIEL the manhole cover of the pipe tunnel in the engine room was open at the time of the accident and it was not possible to close it properly after she ran aground. It was not possible to properly ascertain whether this was due to a design fault, incorrect installation of the central locking system or the cover seal being defective or worn. It was also not possible for the BSU to clarify whether late intervention or an operator error were contributory factors or whether debris lodged between the seal and cover due to the water pressure in the flooded pipe tunnel.
This would have required the pipe tunnel to be pumped out and a survey of the engine room's shell plating during dry docking.

5.5 Actions taken

The vessel operator points out in his comment on the BSU draft report that vessels were already instructed in the past by “Circulars” and internal advanced training to always keep the mentioned openings closed during ship operation. Furthermore the BSU recommendation is satisfied by repeatedly advising the responsible inspectors and vessel commands that closable openings in watertight bulkheads, leading to tanks, void spaces, cofferdams, pump rooms and also pipe tunnels, are to be kept closed in normal ship operation.

6 Safety recommendations

The following safety recommendations do not attribute a presumption of blame or liability in respect of type, number or sequence.

6.1 Owner and operator S. GABRIEL

The Federal Bureau of Maritime Casualty Investigation recommends that having regard to the area of operation of their vessel the **owner and operator** of the MV S. GABRIEL observe the statutory rules and regulations for manning the vessel and find a balance between the prescribed minimum manning and that which is actually necessary so as to enable compliance with work and rest periods as well as occupational safety legislation.

6.2 Ship's command responsible for the S. GABRIEL

The Federal Bureau of Maritime Casualty Investigation recommends that the **ship's command responsible** for the MV S. GABRIEL ensure that time sheets are carefully managed and correspond with the actual working hours. Where there is doubt as to whether the rest and work periods prescribed by the Arbeitszeitgesetz (act regulating working hours) can be adhered to, the operator must be informed in order to ensure the situation is remedied through increased manning. It must be possible at all times to man the bridge with a sufficient number of crew members when exposed to heightened risk, such in reduced visibility, heavy traffic, harbour mode or darkness.

6.3 Ship Safety Division (BG Verkehr)

The Federal Bureau of Maritime Casualty Investigation recommends that when setting minimum manning levels for the Minimum Safe Manning Certificate, the **Ship Safety Division (BG Verkehr)**[8] account for manning levels which correspond to the practical demands of the traffic area and the port rotation. In particular, according to IMO Resolution A. 890 (21), a three-watch system should be adopted and supervised and it should not be necessary for the master to keep regular watches. Art. 138 SeemG states that a two-watch system is only permissible on vessels sailing under German flag of up to 2,500 GT.

6.4 Owner and operator S. GABRIEL

The Federal Bureau of Maritime Casualty Investigation recommends that the **owner and operator** of the MV S. GABRIEL, together with the **marine engineers responsible**, ensure that lockable openings in watertight bulkheads and access points to tanks, voids, cofferdams, pump rooms and pipe tunnels are kept closed at all times while the vessel is in normal operation.

[8] With effect from 1 January 2010, the See-BG and the BGF have merged to form the Ship Safety Division (BG Verkehr).

7 Sources

- Investigations by the waterway police (WSP)
- Written statements
  - Ship's command
  - Vessel operator
- Witness accounts
- Expert opinion
- Nautical charts and vessel particulars, Federal Maritime and Hydrographic Agency (BSH)
- Official weather report by Germany's National Meteorological Service (DWD)
- Shipboard AIS and VDR data
- Radar plots by Vessel Traffic Services (VTS)/Vessel Traffic Centres
- Documentation from the Ship Safety Division (BG Verkehr)
  - Accident Prevention Regulations for Shipping Enterprises (UVV-See)
  - Guidelines and codes of practice
  - Ship files