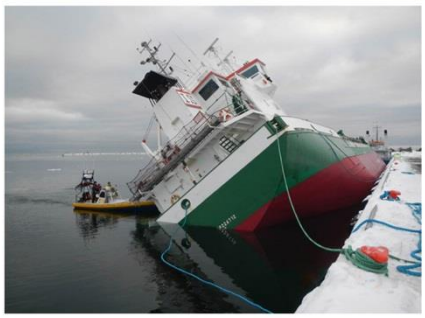
Statens haverikommission
Swedish Accident Investigation Authority



Final report RS 2016:07e

VICTORIA – Running aground at Fladen, Halland County, den 19 September 2015

File no. S-172/15

02/09/2016

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring again, or limiting the effects of such an event. However, it is not the purpose of SHK investigations to apportion blame or liability, whether criminal, civil or administrative.

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ISSN 1400-5735

This document is a translation of the original Swedish report. In case of discrepancies between this translation and the Swedish original text, the Swedish text shall prevail in the interpretation of the report.

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Postadress/Postal address
P.O. Box 12538
SE-102 29 Stockholm
Sweden

Besöksadress/Visitors
Sveavägen 151
Stockholm

Telefon/Phone
+46 8 508 862 00

Fax/Facsimile
+46 8 508 862 90

E-post/E-mail
info@havkom.se

Internet
www.havkom.se

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General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is a state authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended to clarify, as far as possible, the sequence of events and their causes, as well as damages and other consequences. The results of an investigation shall provide the basis for decisions aiming at preventing a similar event from occurring in the future, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

SHK accident investigations thus aim at answering three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any supervisory role and its investigations do not deal with issues of guilt, blame or liability for damages. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. These issues are, when appropriate, dealt with by judicial authorities or e.g. by insurance companies.

The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

The investigation

SHK was informed on 20 September 2015 that a serious marine casualty involving VICTORIA with registration D5IK5, IMO 9129029, had occurred at Fladen, 19 September 2015 at 18:15.

The accident has been investigated by SHK represented by Mr. Mikael Karanikas, Chairperson, Mr. Rikard Sahl, Investigator in Charge, Mr. Dennis Dahlberg, Operations Investigator and Mr. Alexander Hurtig, investigator with specialisation in behavioural sciences.

Mr. Patrik Jönsson has participated as coordinator for The Swedish Transport Agency and Mr. Ulf Holmgren as coordinator for the Swedish Maritime Administration.

Investigation material

Interviews have been conducted with the crew aboard VICTORIA, DPA (Designated Person Ashore) at Venturi Fleet Management, the pilot of VICTORIA at the time it departed Rostock and the pilot who assisted VICTORIA from the site where it ran aground to Halmstad.

Documentation has been obtained from the vessel and the shipping company.

A meeting with the interested parties was held on 12 May 2016. At the meeting SHK presented the facts discovered during the investigation, available at the time.

Limitations

SHK has noted that the European Maritime Safety Agency (EMSA) has since 2006 investigated, among other things, quality assurance of schools in the Philippines that provide STCW[1] training and the course content for training at ”management level”. During the investigations, certain shortcomings have been noted, including the introduction of audit plans and follow-up measures, as well as course content for “management level”. The European Commission has notified the Philippines about these shortcomings and has continuously conducted discussions on plans to implement measures and also followed these up. EMSA has carried out five follow-up audits and plans to return early 2017. In this investigation, SHK has found no reason to further investigate whether the quality of the crew members’ training carried out in the Philippines has been a contributory factor to the event.

[1] STCW - International Convention on Standards of Training, Certification and Watchkeeping for Seafarers.

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Vessel **data**	
Flag state/Register of Shipping	Liberia
Identity	VICTORIA
IMO number/call sign	9129029 / D5IK5
Vessel data	
Type of vessel	Bulk carrier
Port/year of construction	Daedong Shipbuilding, 1997
Registered tonnage	27,792
Length overall	190 metres
Breadth	32 metres
Draught, max	11.62 metres
Deadweight at max draught	46,931 tons
Main engine, output	Hyundai-MAN B&W 6S50MC MK6, 8561 kW
Propulsion system	Fixed propeller
Bowthruster	No
Rudder system	Conventional
Service speed	14 knots
Ownership and management	Lasting Asset Limited , owner / Venturi Fleet Management
Classification society	Bureau Veritas

Information on the voyage	
Ports of call	Rostock, Germany – Conakry, Guinea
Type of journey	International
Cargo information	35,852 tons of wheat
Crew	23

Information on marine casualty	
Type of marine casualty	Grounding
Date and time	2015-09-19 18:15 local time
Position of the marine casualty	57˚10,78N 011˚44,44E
Weather	Wind: V 7-10m/s
Consequences	
Injuries to persons	None
Environment	None known
Vessel	Hull damage, lost rudder

SUMMARY

The bulk carrier VICTORIA departed Rostock 18 September, 2015 at 22:48 local time, loaded with a total of 35,852 tons of wheat. The vessel had a draught of 10.1 meters at the time of departure. The master had decided that the able seaman on duty would hand-steer the vessel until it had passed Skagen. The planned route went from Rostock via the Route T further via the Route H in the Great Belt and then the Route T back through the Great Belt and the Kattegat.

On September 19, 2015 around 18:15, the vessel ran aground at Fladen and received extensive hull damage. No persons were injured and there was no damage to the environment.

The investigation has shown that the vessel, after passing the buoy 6 in the Route T, deviated from its intended course, which was not noticed by the officer on watch. The officer on watch had eight hours of rest divided into two four-hour periods the last 24-hour period before the grounding. The officer on watch also monitored the crew that was foaming the hatches on the cargo deck while he alone was responsible for watch keeping on the bridge. Just before the grounding the master, chief engineer and electrician came up to the bridge to discuss trial run of the ship's cranes with the responsible officer on watch.

The grounding occurred due to a lack of adequate attention to navigational tasks, which in turn was due to distractions caused by other duties, likely in combination with fatigue, which meant that the vessels course and position were not followed.

An underlying cause was inadequate resource planning in terms of the deck officers duties over the first 24 hours after departure from Rostock.

During the investigation it was also noted that the vessel passed near a 10.4 meter reef in the Route H which was not marked with buoys, and that there have been shortcomings in the route planning.

The company has after the accident, inter alia, decided to equip the company´s vessels with ECDIS and to revise and supplement the ISM manual and its safety management system (SMS).

The Swedish Maritime Administration has after the accident, placed a light buoy west of Fladen.

SHK recommends the Danish Maritime Authority to consider and evaluate the buoyage along Route H.

Safety recommendations

In light of the measures taken by Venturi Fleet Management and the Swedish Maritime Administration, SHK has decided not to issue recommendations to these operators.

The Danish Maritime Authority is recommended to:

- Consider and evaluate the buoyage along Route H with this report in mind. See section: 2.4.3. *(RS 2016:07 R1)*

1. FACTUAL INFORMATION

1.1 Course of Events

1.1.1 Conditions

VICTORIA had been at berth in Rostock, Germany for four days in order to load wheat that was to be transported to Conakry, Guinea.

Before departure, the second officer had made a route plan which the master had approved and the remaining deck officer had read and signed. The route went from Rostock via Route T and onwards via Route H in the Great Belt and then Route T again through the Great Belt and Kattegatt (fig. 1).

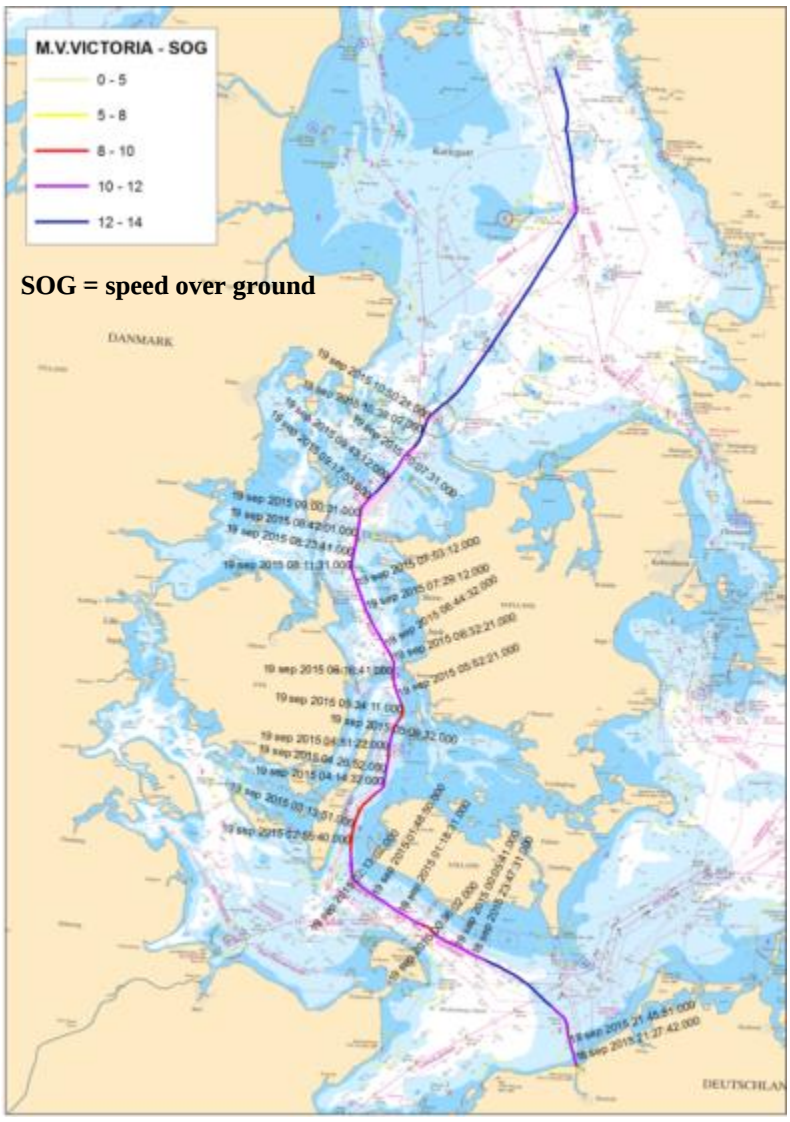


Figure 1. VICTORIA's voyage from Rostock to the site where it ran aground at Fladen, times in UTC[2].

[2] UTC Coordinated Universal Time. UTC + 2 = local time for the incident.

1.1.2 The voyage

The vessel left Rostock on 18 September at 22:48 local time, loaded with a total 35,852 tons of wheat. The vessel had a draught of 10.1 metres at the time of departure. The master had decided that the able seaman on duty would hand-steer the vessel until it had passed Skagen. The master thus planned for the vessel to be operated without a dedicated lookout on the bridge in the relatively difficult to navigate and heavily trafficked route between Rostock and Skagen.

According to the pilot on board VICTORIA when it departed Rostock, all equipment on the bridge was in good condition. Rudder and engine manoeuvring was also functioning satisfactorily.

Two hours before the vessel arrived at the pilot boarding position north of buoy 7 in Route H (fig. 2), the master contacted DanPilot[3] and requested a pilot through the Great Belt and further up to Skagen as the master believed the passage through the Great Belt entailed compulsory pilotage for VICTORIA. There was however no pilot available at the time. During the conversation, however, the master was informed that pilotage was not compulsory and the master thus decided to continue the voyage without a pilot.

The pilot from Rostock left VICTORIA at 00:12.

Soon thereafter, the master also left the bridge and the second officer took over duty. Three hours later, the master returned to the bridge to assist the second officer. At 04:00, bridge watch changed watch and the chief officer took over the bridge watch from the second officer. Approximately 10 minutes later, just before buoy 7 in Route H, VICTORIA passed close to a 10.4-metre unmarked reef (fig. 2).

[3] DanPilot – Denmark's pilots. They provide pilotage through the Great Belt.

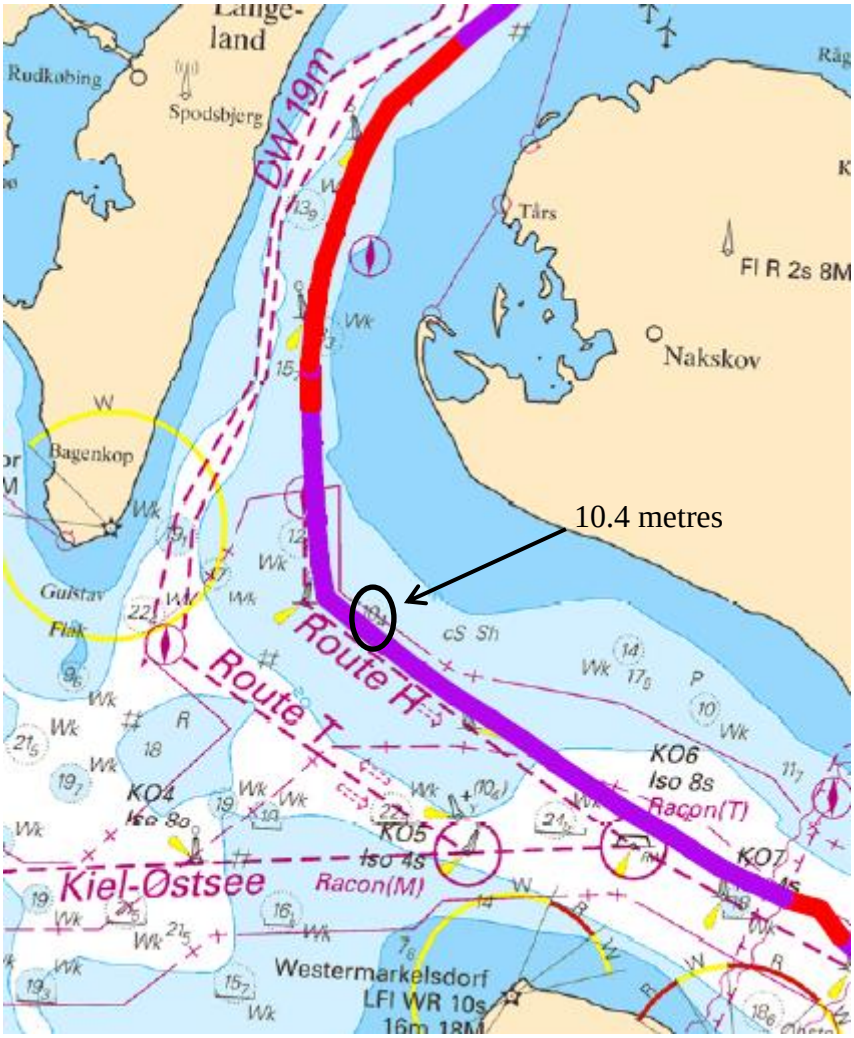


Figure 2. Route H.

The chief officer had watch until 08:00, when the third officer relieved him. The master left the bridge 30 minutes later to go down to the cabin/office in order to perform administrative duties following the last port of call. The bridge was thus manned by two officers from 03:30 to 08:30, when the master increased the manning on the bridge.

Once the chief officer had left the bridge at 08:00, he went to check the cargo and instruct the deck crew to seal the hatches of the cargo hold. He carried out this work up until 12:00 when he took lunch and thereafter rested until 16:00.

At 12:00, the second officer took over watch on the bridge until 16:00, when he was relieved by the chief officer. At this point, the vessel was in Route T approx. 6 M[4] southwest of buoy 6. The chief officer was also responsible for the crew who were working on deck to seal the cargo hatches, where, according to the information given in interviews, the increasing wind meant that they got water spraying up on deck.

[4] M - Nautical mile; corresponding to 1,852 metres.

According to information given in the interviews, the chief officer ordered a change of course to 340° at buoy 6 in Route T at 16:25. From the AIS tracks, however, it is clear that VICTORIA's COG[5] following the change of course averaged 353° (fig. 3).

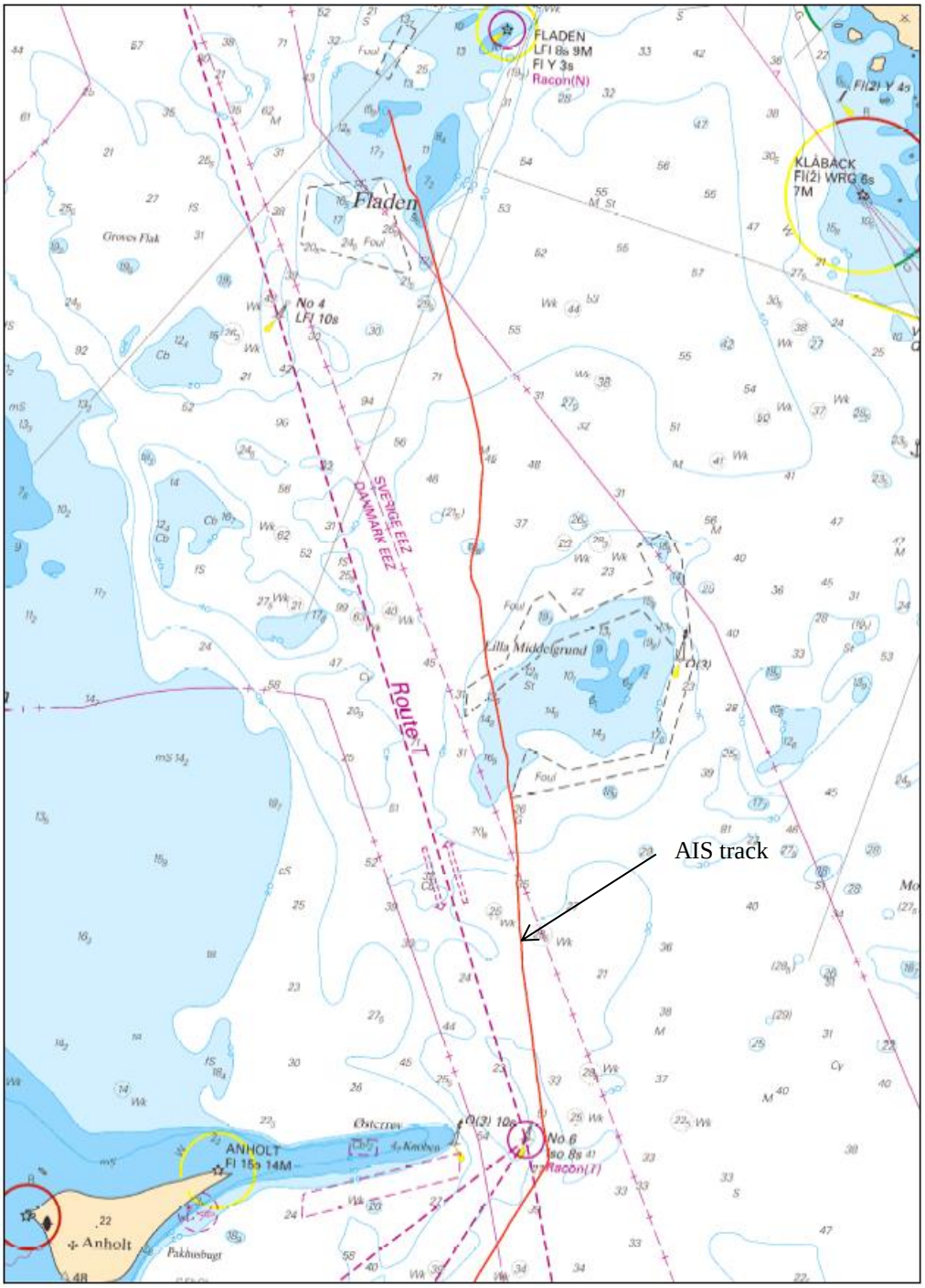


Figure 3. AIS track, marked in red after the turn at buoy 6 on Route T.

The chief officer also stated that the alarm function of the vessels GPS[6] brought his attention to the fact that the vessel had a starboard drift, causing him to order the helmsman to steer 335°. The helmsman

[5] COG - Course Over Ground.
[6] GPS - Global Positioning System; a satellite navigation system.

has stated that he was ordered to steer 330° due to strong currents in the area. It was this course that the helmsman steered throughout his entire time on the bridge. According to the chief officer, he checked the vessels position at 17:00 and marked the position on the navigational chart (fig. 4). According to the crew, the radar was not useful as an aid to navigation due to the distance from land and clutter[7]. The navigational instrument that he relied on was the vessels GPS. The chief officer has stated that he did not check the course steered by the helmsman on the gyrocompass.

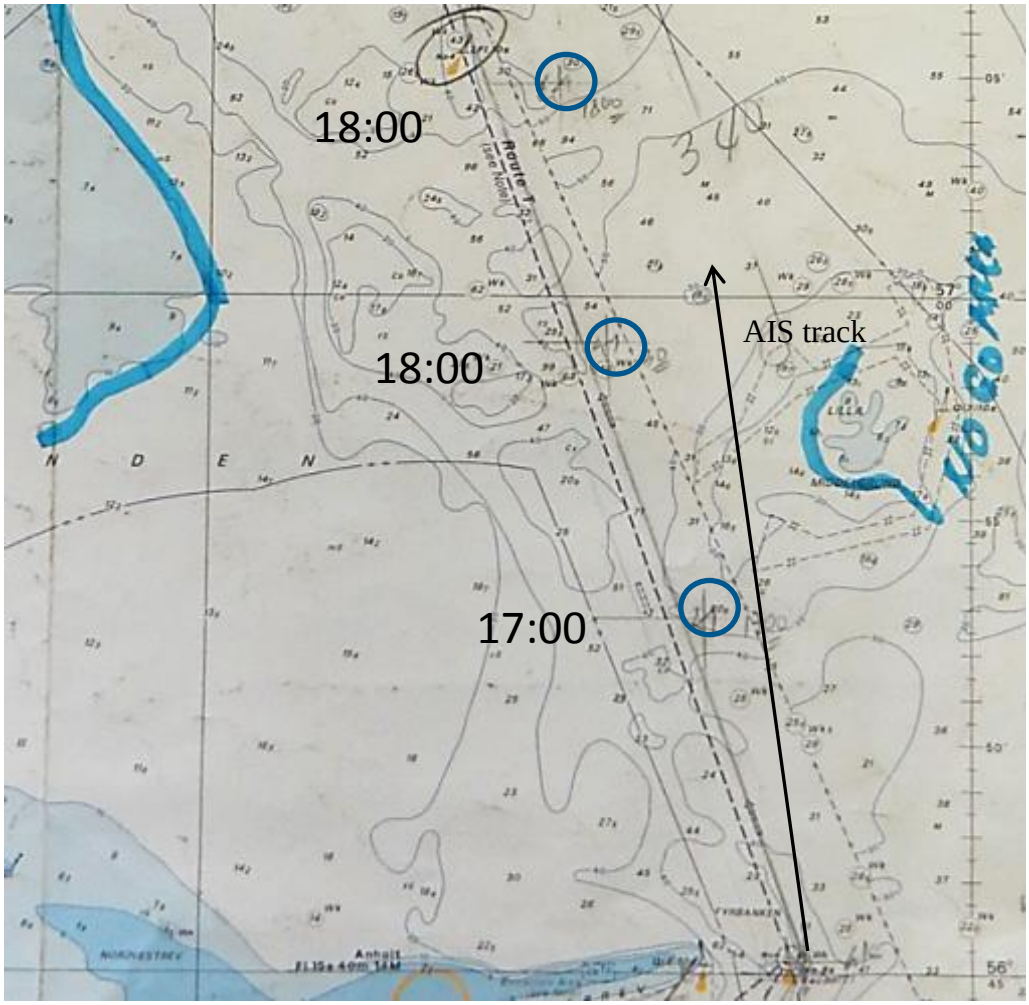


Figure 4. VICTORIA's navigational chart for the voyage with fixed positions, indicated by the blue rings. The position fix at 18:00 was made after the accident. The arrow shows the average AIS track (fig. 3).

Thereafter, the third officer and an able seaman came to the bridge to relieve the chief officer and the helmsman so that they could eat their dinner. At this point, the chief officer stated that the vessel was to steer 335° due to starboard drift. After just over 20 minutes' break, the chief officer and the helmsman returned to the bridge, having eaten dinner. The third officer informed the chief officer that the drift had increased but that he had not changed course or marked a position on

[7] Clutter is a term used for unwanted echoes, particularly in radar systems, caused by reflections from waves on the water's surface, rain, etc. Clutter can cause serious performance problems in radar systems.

the navigational chart. The third officer has also stated that he did not check the course steered by the helmsman on the gyrocompass.

From the AIS track (fig. 3), it is clear that the vessel performed a change of course to port by approx. 10° around 10 minutes after the chief officer had taken over bridge watch following his dinner break. Just a few minutes thereafter, there was a drastic change of course to starboard by approx. 25°. The vessel held this course for around 10 minutes, to then steer to starboard yet again, now changing course by approx. 20° in a slower turn which ended on a course of 345°; a course which the vessel essentially held until it ran aground.

Shortly after the chief officer had returned to the bridge, the master, the chief engineer and the electrician came up to the bridge to discuss with the chief officer the matter of performing a test run of the vessels cranes before arrival at Conakry, Guinea some 12 days later. However, the master did not participate in the navigation during the time he was on the bridge.

The chief officer has stated that he neither saw the buoys in Route T nor the Fladen lighthouse on the radar. At around 18:15, severe shaking and vibrations were felt on board VICTORIA. The chief officer began immediately to check the vessels position, but before he obtained a fixed position, VICTORIA ran hard aground at a speed of 12.2 kts (fig. 5), with the chief officer, helmsman, master, chief engineer and electrician still on the bridge.

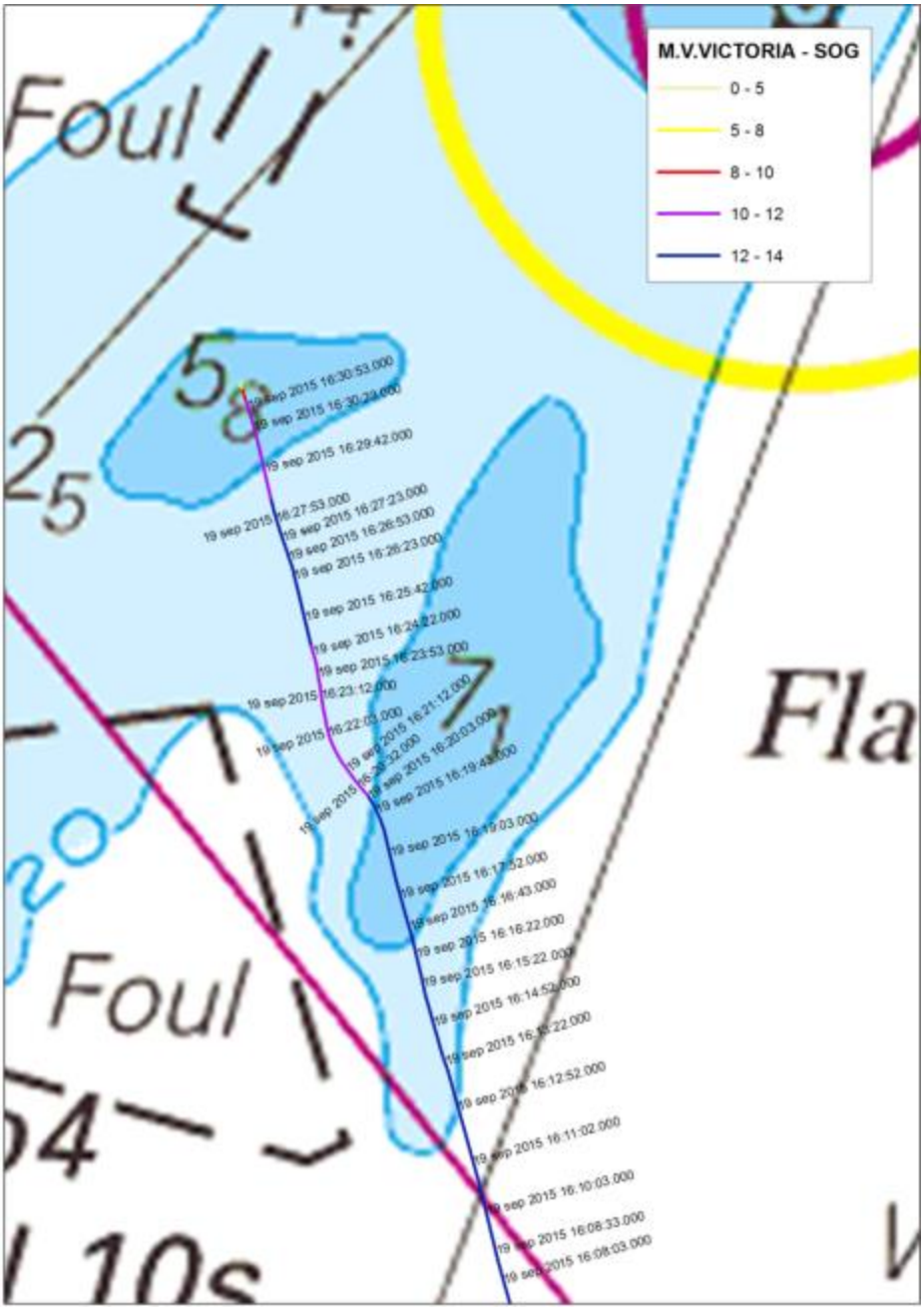


Figure 5. VICTORIA's AIS track, times in UTC.

1.1.3 Measures carried out after running aground

After the vessel had run aground, the crew performed a damage check of the vessel, which revealed a water leak into the bulbous bow, an empty ballast tank. No oil leakage was found. Over two hours after running aground, the master informed the shipping company that the vessel had run aground. Neither the sea rescue service nor any other Swedish authority was informed about the accident. For further information on the rescue operations, see section 1.11.

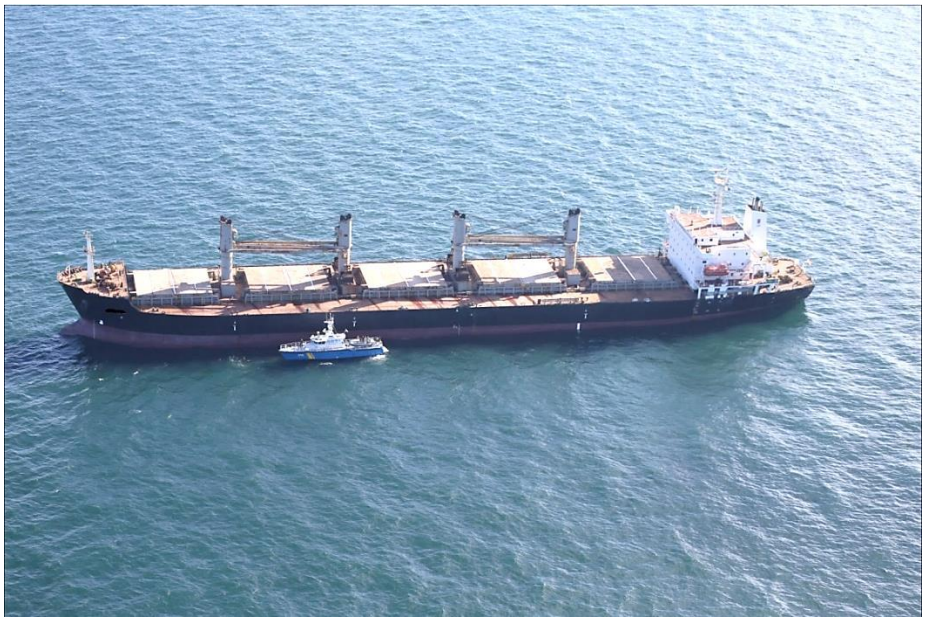


Figure 6. VICTORIA aground at Fladen Image: The Swedish Coast Guard.

1.2 Injuries to persons

No injuries to persons arose.

1.3 Oil spillage

The accident did not result in the spillage of oil into the sea.

1.4 Damage to the vessel

At Remnotowa Shiprepair Yard in Gdansk, Poland, the following damages were noted.

Hull damage amounting to 138 tons of steel had to be repaired and replaced.

The propeller blades sustained notches and damage to the front edge which, according to the accident report, indicates that the propeller was operating at the time the vessel ran aground.

On the steering mechanism, it was noted that the rudder horn was missing and that the rudder stock was affected by a ductile overload fracture and was bent towards the port side.

1.5 The vessel

1.5.1 General

The bulk carrier VICTORIA was built in South Korea in 1997. The vessel has five cargo holds with a total capacity of 58,740 m^3. On deck, the vessel is equipped with four loading cranes. The bridge, engine room and living quarters are all situated in the vessel aft part. The main engine is a Hyundai-MAN B&W with an output of 8561 kW.

VICTORIA is equipped with a conventional rudder and the vessels propulsion consists of a propeller with fixed blades. The vessel was inspected by the classification society during the latest shipyard visit which lasted from 4 June to 16 July 2015 in Romania. The vessels gyrocompass was serviced on 12 July 2015 during the shipyard visit.

1.5.2 The bridge

The bridge is constructed with a console with Yokogawa autopilot and manual steering in the middle of the bridge and radar on both starboard and port sides of the console (fig. 7). The rudder indicator is located in the ceiling approx. 1.5 metres starboard of the vessels centre line, which means that the helmsman had a parallax error of approx. 2-3 degrees to take into account when steering manually.

Figure 7. The bridge of VICTORIA.

The navigational equipment consists of two JRC radar sets - one of which with an ARPA function[8] - GPS and DGPS[9], and GMDSS[10] with a number of VHF stations. There was no electronic navigational chart on board of either type ECDIS[11] or ECS[12].

1.5.3 VDR[13]

The vessel was equipped with a VDR-S[14]. The recording function was however not in operation at the time when the vessel ran aground. When SHK attempted to extract data from the unit, it was discovered that the last recorded data was from 22 July 2015.

The vessels VDR-S was last subjected to functional checks by NOVA Electronics on 12 July 2015, and was approved.

1.6 Crew

1.6.1 General

The master had worked at sea since 1993, beginning by working as a cadet combined with officer training in the Philippines. After completion of his training, he served as an officer on board various vessels, and had served as a master on board bulk carriers since 2012. He had served on VICTORIA since 8 August 2015. The master had been in the area a number of times previously, though never as a master.

The chief officer had worked at sea since 2005 as a cadet whilst undergoing officer training in the Philippines. After completion of his education, he served as an officer on board various vessels, and had served as a chief officer since 2012. He had served on VICTORIA for 4.5 months. This was the first time he had operated a vessel in the area.

The second officer had served in his position since 2005. This was the first time he had operated a vessel in the area.

[8] ARPA -= Automatic Radar Plotting Aid (calculation of the echo's movements).
[9] DGPS - Differential Global Positioning System; a system of relative GPS measurements. This enables greater accuracy.
[10] GMDSS - Global Maritime Distress and Safety System.
[11] ECDIS - Electronic chart display and information system; can be used as a replacement for paper charts.
[12] ECS - Electronic Charting System; cannot be used as a replacement for paper charts.
[13] VDR - Voyage Data Recorder.
[14] VDR-S –Voyage Data Recorder Simplified; records data from fewer units on board compared with VDR.

1.7 The fairway

1.7.1 General

Route T runs from a position 5 M north-east of Skagen to approx. 25 M west of Cape Arkona. Route T is marked with buoys, light buoys and mid-channel light buoys (fig. 8). There are two routes running through Langeland Belt; Route T, which is marked here as a deep water route with an established depth of 19 meters (DW 19) and Route H with an established depth of 12 metres and which, according to *Admiralty Sailing Directions* and Danish navigational chart 103 (INT 1303), vessels with a draught of 10 metres or less *must* follow. The IMO Ships' Routeing stated however that ships with a draft of 10 meters or less *should* choose the nationally recommended Route H. Route H only has marking in the form of mid-channel buoys with lights. At buoy 7 there is a severe turn to starboard, northbound. Just before buoy 7 there is a shoal at a depth specified in the navigational chart as 10.4 metres, which VICTORIA passed close by. At buoy 7 (where the vessel changed course), there is another shoal at a depth of 10.6 metres. Both shoals are without marking (fig. 2).

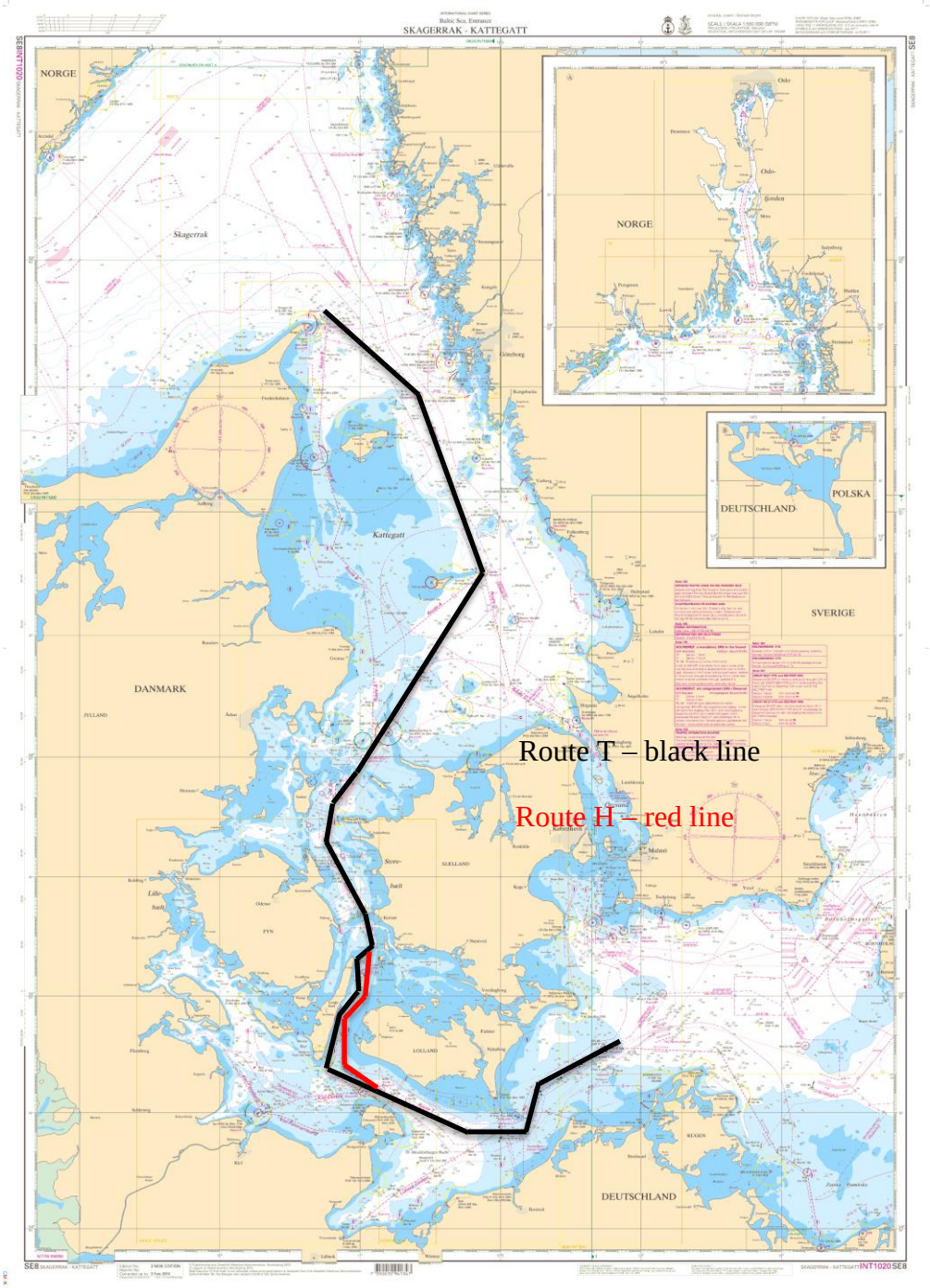


Figure 8 Route T (black) and Route H (red).

The *Admiralty Sailing Directions* also specify that the marked deep-water route must be avoided by vessels with a draught which allows them to navigate outside the deep water route; changes in depth due to meteorological and other effects must however be taken into account.

The Maritime Safety Committee, a working group within the IMO[15], has provided the following information and recommendations[16] regarding Route T.

[15] IMO – International Maritime Organisation.

- The effect of sea level variations caused by a combination of tide and metrological conditions together with unknown obstructions on the sea bottom and sand migration could decrease the depth with as much as 2 metres.
- Ships with a draught of 11 metres or more should use pilotage services for the passage.
- Shipowners and masters should consider the full potential of new and improved navigation equipment introduced in the SOLAS chapter V, including Electronic Chart Display and Information System (ECDIS) when navigating in these narrow waters.

The Baltic Pilotage Authorities Commission strongly recommends masters of vessels that seldom operate in the area to use a transit pilot for the voyage to and from harbours in the Baltic Sea.

The request for a transit pilot from DanPilot must be made at least 18 hours before the vessel is in the boarding position.

1.7.2 Accident site

Fladen lighthouse is in the north-east part of the bank, but at the time there was no stick or buoy to mark the west part of the bank. The deep water channel that separates Fladen from Groves Flak is marked with a mid-channel buoy (buoy 4). Lilla Middelgrund, which lies south of Fladen, is marked by a light buoy east of the shoal, but there is no marking west of the shoal, (fig. 9).

[16] IMO recommendation SN.1/Circ.263 of 23 October 2007.

Figure 9. Navigational Chart, Kattegat, Image: Swedish Maritime Administration no.: 10-01518.

1.7.3 VTS areas

A VTS[17] area is an established area of special interest for maritime safety and the environment, where one or more types of maritime traffic information services are provided. Maritime traffic information is a service for monitoring, organisation, information and assistance to shipping traffic in order to improve its safety and to protect the environment within an established VTS area (traffic area).

In order to help vessels passing the Great Belt Bridge and the Hatter Barn area, there is a VTS known as BELTREP which is run by the Great Belt VTS. Reporting to BELTREP is obligatory for all vessels with a gross tonnage[18] of 50 and over and vessels with an air draught[19] of 15 metres or more.

[17] VTS (Vessel Traffic Service).
[18] Gross tonnage – nonlinear measure of a vessels overall internal volume.

The VTS area stretches from Sjællands Odde in the north to a line which intersects the northern part of Langeland (fig. 10). The area of Kattegatt where the vessel ran aground is not a VTS area.

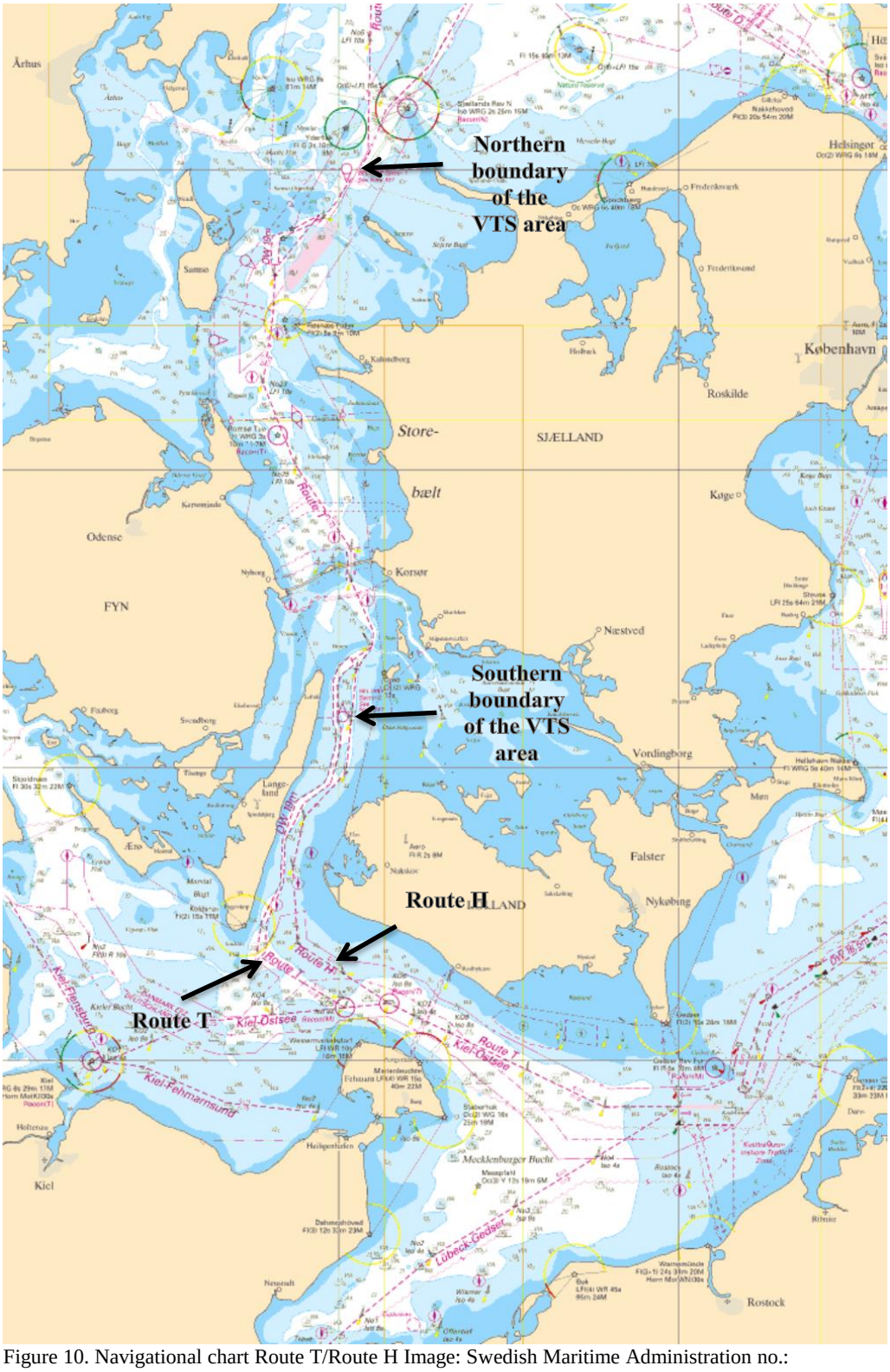


Figure 10. Navigational chart Route T/Route H Image: Swedish Maritime Administration no.: 10-01518.

[19] The air draught is a vessels highest actual height above the water.

1.8 Safety management for the vessel and shipping company

1.8.1 General

The International Management Code for the Safe Operation of vessels and for Pollution Prevention (the ISM Code) provides guidance for shipping company management and the operation of its fleets, and is intended to promote the development of maritime safety and the prevention of pollution within the shipping industry. Since 1 July 2002, all merchant vessels in international traffic which are covered by IMO's maritime safety convention SOLAS[20] must follow the code. The only exception is the smallest of vessel. The code has been implemented within the European Union via Regulation (EC) No 336/2006 of the European Parliament and of the Council on the implementation of the International Safety Management Code within the Community and repealing Council Regulation (EC) No 3051/951.

The ISM Code means that all vessels covered by it must have a Safety Management System (SMS), i.e., a structured and documented system which enables the shipping company's personnel to effectively implement the company's safety and environmental protection policy. The system shall include instructions and procedures which ensure safe operation of the vessel and protection of the environment. It shall also include a plan of action for emergency situations.

VICTORIA had a valid certificate and documentation of approved safety management. In the following section, relevant parts of the safety management system are presented.

1.8.2 Safety of navigation instructions

Passage plan

The planning procedure, as described, consists of four phases: an initial appraisal phase in which all available and relevant facts are assessed, a planning phase which is based on the initial assessment, an execution phase, and finally a monitoring phase.

Where the planning phase is concerned, it is emphasised that safe operation must be observed, taking into account the draught and the possibility of squat[21] with the resulting reduction of the under keel clearance.

The execution phase is the formulation of the tactics which are intended in order to carry the plan through. According to the instructions, the reliability of the vessels equipment shall be taken into account, as

[20] SOLAS - International Convention for the Safety of Life at Sea.

[21] The squat effect is a phenomenon which occurs when a vessel is passing through shallow waters or fairways and in channels, and causes the vessel to have a greater draught. Squat occurs as a result of the speed of the water flow and irregular pressure against the hull as the vessel passes through the water. The water particles increase in speed when passing along the hull, which leads to an increase in the dynamic water pressure around the hull. According to Bernoulli's principle, the static water pressure decreases and the vessel is drawn towards the seabed.

well as the estimated time of arrival towards critical points, to allow a more detailed assessment, especially where the matter of under keel clearance is concerned.

Regarding the monitoring phase, it is emphasised that monitoring of the vessels equipment is a prerequisite for the total control of the safe movement of the vessel and, consequently, for the assurance of safe navigational practice.

A checklist has been produced for passage planning – "Voyage Planning Check List".

Bridge watch

The purpose of the bridge watch instructions is to determine the procedures of taking over and performing a bridge watch, bearing in mind that the officer on watch is the master's representative and is primarily responsible at all times for the safe navigation of the ship. Therefore the master is bound to ensure that watch keeping arrangement are adequate for maintaining a safe bridge watch.

Apart from the duty to ensure the sufficiency of the bridge watch, the master is also responsible to ensure adequate rest time for the officer on watch so that they will be fit for duty in an efficient and safe way. Regarding the matter of a lookout on the bridge, a thorough lookout should be constantly maintained, and the lookout themselves may not carry out other tasks which may interfere with lookout duty. It is also stated that the helmsman cannot simultaneously be tasked with lookout duty.

When deciding the manning of the watch on the bridge, the following, inter alia, shall be taken into account:

- Any unusual demands on the bridge watch that may arise as a result of special operational circumstances.
- Use and operational condition of navigation aids such as radar or electronic positioning equipment.
- Proximity of navigational hazards which may make it necessary for the officer in charge of the watch to carry out additional navigational duties, e.g., the combination of an area which is difficult to navigate and a high traffic density.

When an officer takes over watch, they must personally ensure themselves regarding the vessels position, course, speed and draught.

The officer on watch on the bridge must check the course steered, position and speed at sufficiently frequent intervals, using any available navigation aids necessary in order to ensure that the vessel follows the planned course. In addition, the officer on watch shall not be assigned or undertake any duties which would interfere with the safe navigation of the ship.

1.8.3 Emergency preparedness

The vessels SMS specifies which measures should be taken in the event the vessel runs aground. Immediate measures regarding e.g., checking damage to the vessel and injuries to the crew are listed first. When the immediate measures have been taken, the shipping company must be contacted and the measures taken noted in the vessels log book. Contact with the coastal state or sea rescue authorities is not mentioned.

1.9 Route planning

The vessels route planning was ready 24 hours before departure. The second officer had first planned to take Route T all the way, but the master changed the route plan so that the vessel would take Route H through the Great Belt. The second officer had set out waypoints, course lines, courses and "no go areas" on the navigational chart. He also entered all waypoints into the vessels GPS, where there was an alarm which would be triggered if the vessel deviated from the course.

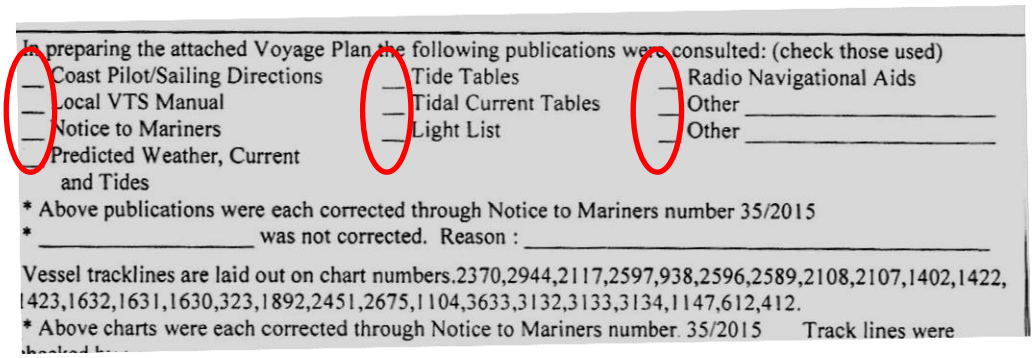
An inspection of the route planning has revealed the following.

Apart from just after departure from Rostock, the speed had been specified as 12 kts for the entire voyage, all the way to Conakry (fig. 11).

CHART No.	WAYPOINT		TRACKLINE				DISTANCE TO GO (Total)	DISTANCE FREQ. (Max interval 15 min)	Master's instructions / special procedures / hazards of special concern
	Long.	Lat.	Course of Advance	Speed of Advance	Distance to Next Waypoint	Min. Expected Depth			
2944	012-02.50E	54-17.20N		10.0		17.90Mtrs.	3837.0M		ROSTOCK P/STN.
2944	011-47.20E	54-25.40N	313	12.0	12.1 M	17.30Mtrs	3824.9M		TAKE CAUTION OF
2117	011-08.80E	54-36.20N	296	12.0	24.8M	22.00Mtrs	3800.1M		STRONG CURRENT
2117	010-53.00E	54-42.20N	303	12.0	11.0M	14.40Mtrs	3789.1M		FLOWS IN THE AREA OF
2597	010-52.20E	54-50.00N	357	12.0	7.8M	12.30Mtrs	3781.3M		CHANNEL UP TO
2597	010-54.20E	54-54.90N	013	12.0	5.0M	13.90Mtrs	3776.3M		SKAGEN P/STN.
2597	011-01.60E	54-59.30N	044	12.0	6.1M	13.80Mtrs	3770.2M		
938	011-03.40E	55-09.90N	006	12.0	10.7M	24.60Mtrs	3759.5M		
938	011-06.10E	55-12.30N	033	12.0	2.9M	20.70Mtrs	3756.6M		
938	011-06.50E	55-13.70N	009	12.0	1.4M	30.00Mtrs	3755.2M		
938	011-02.40E	55-18.90N	336	12.0	5.7M	33.00Mtrs	3749.5M		

Figure 11. Excerpt from VICTORIA's route planning.

The checklist to be used for the route planning does not specify the factual basis used during planning (fig. 12).


In preparing the attached Voyage Plan the following publications were consulted: (check those used)

__ Coast Pilot/Sailing Directions
__ Local VTS Manual
__ Notice to Mariners
__ Predicted Weather, Current and Tides
__ Tide Tables
__ Tidal Current Tables
__ Light List
__ Radio Navigational Aids
__ Other _____
__ Other _____

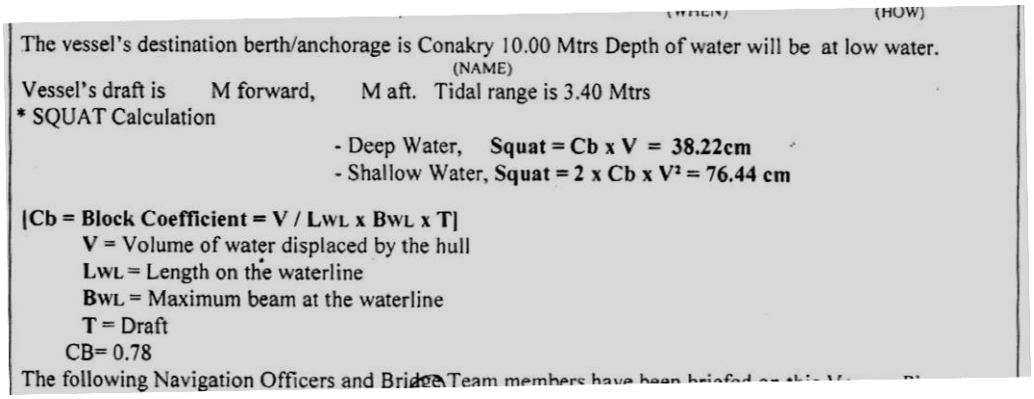
* Above publications were each corrected through Notice to Mariners number 35/2015
* _____ was not corrected. Reason : _____

Vessel tracklines are laid out on chart numbers.2370,2944,2117,2597,938,2596,2589,2108,2107,1402,1422, 1423,1632,1631,1630,323,1892,2451,2675,1104,3633,3132,3133,3134,1147,612,412.
* Above charts were each corrected through Notice to Mariners number. 35/2015 Track lines were

Figure 12 Excerpt from the checklist used for the route planning.

On the route plan in question, VICTORIA's draught is not specified. There is however a calculation of the squat effect, in which the draught is a parameter (fig. 13), though the formula for Squat – Deep Water is incorrect as the speed (V) should be squared. The crew has however used the correct formula in the calculation. In the squat effect calculation, the crew has factored in a speed of 7 kts and thus received a result of 38.22 cm in deep water and 76.44 cm in shallow water.

SHK has calculated the squat based on the speed specified in the route planning for passage of the Great Belt; i.e., 12 kts. The result of this calculation is 112.32 cm in deep water and 224.64 cm in shallow water.


(WHEN) (HOW)

The vessel's destination berth/anchorage is Conakry 10.00 Mtrs Depth of water will be at low water.
(NAME)

Vessel's draft is M forward, M aft. Tidal range is 3.40 Mtrs

* SQUAT Calculation

- Deep Water, **Squat = Cb x V = 38.22cm**
- Shallow Water, **Squat = 2 x Cb x V² = 76.44 cm**

[Cb = Block Coefficient = V / LWL x BWL x T]

V = Volume of water displaced by the hull
LWL = Length on the waterline
BWL = Maximum beam at the waterline
T = Draft

CB= 0.78

The following Navigation Officers and Bridge Team members have been briefed on this V...

Figure 13. Squat calculation from the route plan checklist.

The route planning states that the vessel shall call the pilots in Conakry on VHF channel 16 or 14 approx. 25 M from boarding position. There is however no mention of routines for ordering pilots in Denmark or any information concerning the Great Belt VTS.

1.10 Meteorological information

SHK has had SMHI make a summary of the weather conditions and wave formation at the Fladen lighthouse during the afternoon and evening of 19 September 2015.

The wind was around West 7-10 m/s. It was clear to half-clear with a visibility of over 10 M. The air temperature was 16 degrees and the temperature in the water was 15 degrees. The significant wave height

(SWH)[22] was 0.7 metres bearing 260°; i.e., roughly the same direction as the wind.

The currents in the area were almost non-existent during the afternoon and evening (0.08-0.03 kts).

The water level in the Great Belt at the time of the vessels passage was between +6 and +8 cm. The water level at Fladen was +16 cm at the time the vessel ran aground.

1.11 Rescue operation

According to the Civil Protection Act (2003:778), the term "rescue services" denotes the rescue operations for which central government or municipalities shall be responsible in the event of accidents in order to prevent and limit injury to persons and damage to property and the environment.

At 23:37 on 19 September, JRCC[23] received information from a vessel passing Fladen that "a vessel seems to have run aground there". JRCC attempted to call VICTORIA on VHF channel 16 a number of times but received no response.

At 23:58, JRCC contacted the Swedish Coast Guard to notify them of a vessel which was presumed grounded at Fladen.

JRCC sent a digital selective call (DSC) via VHF to VICTORIA at 00:03 but received no immediate response. At 00:13, VICTORIA called JRCC via VHF to inform that the vessel had run aground.

Immediately thereafter, JRCC contacted the Swedish Coast Guard to notify of the contact made with VICTORIA and that the master on board had confirmed that the vessel was grounded, that there were no personal injuries and that they were checking all tanks.

The coast guard's vessel KBV 312 left Ringhals at 00:15 to head towards Fladen. At 01:02, KVB 001 also left Gothenburg, and soon thereafter KBV 034 also left Malmö to head towards Fladen.

KBV 312 arrived at the scene of VICTORIA's grounding at 01:48 and circled the vessel to check the area. There were no signs of environmental emissions from the vessel. The vessel had 10-metre draught astern and 7.5 metres draught forward, which led the coast guard to assess that the vessel was firmly aground.

At 06:14, the Swedish Transport Agency's inspector boarded VICTORIA. The inspector checked the scope of damages and the vessels stability and requested a salvage plan from the shipping company.

[22] The wave height is generally given in terms of the significant wave height (SWH), i.e., the mean value in wave height within the top third of the waves. The highest waves are 1.6 to 1.8 times the SWH. Sometimes a few isolated waves can reach double the height.
[23] JRCC – Joint Rescue Coordination Centre.

The coast guard's divers began diving to inspect VICTORIA at 11:03. The underwater inspection revealed that the vessel was hard aground in its middle section, where the fuel tanks are located. The stern of the vessel and the bulb were free in the water. There was a tear three metres long in the forward part of the vessel and water was entering the vessels ballast tanks.

On 22 September at 14:40, bunker boat LEON moored to the side of VICTORIA to prepare for lightering[24] of bunker fuel (fig. 14). At 17:44 on the same day, lighterage commenced and was completed on 25 September at 15:47. By this time, 977m³ of bunker oil had been pumped out from VICTORIA. A total of 35m³ of bunker fuel which was not pumpable remained aboard VICTORIA.

Figure 14. VICTORIA lightering bunker fuel to LEON. Image: The Swedish Coast Guard.

On 25 September at 18:30, the bunker boat left VICTORIA and thereafter began lightering of the vessels cargo (fig. 15). On 26 September at 20:47, VICTORIA notified that they had come clear of the shoal after lightering 6,000 tons of the cargo. With the help of a tugboat, the vessel anchored at a nearby anchorage. Divers from the coast guard performed an additional inspection of VICTORIA and found no leakage from the bunker tanks.

[24] Lightering means that the cargo or bunker fuel is transferred from one vessel to another.

Figure 15. VICTORIA lightering the cargo Image: The Swedish Coast Guard.

On 27 September at around 15:40, VICTORIA left anchorage with a pilot on board and tugboat connected astern in order to head towards Halmstad. Before departure from the anchorage, the pilot noted that the vessels gyrocompass was out of order. This meant that the radar apparatus could only be used for navigation if they were set to "Head Up" mode[25]; i.e., without assistance from the gyro. Nor was the pilot's laptop with AIS function, which was connected to the vessels pilot plug, receiving any course information as the gyrocompass was not functioning. The magnetic compass was however functioning normally.

Once the anchor was up, the pilot noted that the vessel had major steering problems. It was therefore decided that the rudder function would be checked in the steering engine room. Upon inspection, it was established that the steering engine appeared to be functioning as the rudder stock moved in accordance with the given rudder orders. Since the vessel could not be steered in an appropriate manner, the pilot was forced to use the tugboat connected astern to steer the vessel. The pilot decided not to take the vessel into Port of Halmstad, instead he decided to go for anchor 1.5 M south-west of the fairway buoy. The following morning, divers performed yet another inspection and established that VICTORIA was missing her rudder. As several tugboats had arrived to assist, a meeting was held in which all those involved went through how entry to the port would be achieved. Thereafter, VICTORIA was brought in to berth in Halmstad with three pilots on board and with the assistance of three tugboats.

[25] Head up mode means that the radar image is not gyro-stabilised, unlike the North Up or Course Up modes.

1.12 Regulations and supervision

1.12.1 Route planning

The international requirements for voyage planning applicable to the event are regulated in the international regulatory framework SOLAS, chapter V, regulation 34. It is stated here that the master must make sure to check that the planning has been done with the help of a relevant navigational chart and nautical publications, and that IMO's guidelines and recommendations have been observed. The guidelines referred to are primarily Resolution A.893 (21) *IMO Guidelines for Voyage Planning*. The requirements in SOLAS regarding voyage planning have been implemented in Sweden via Chapter 2 of the Swedish Transport Agency's regulations and general advice (TSFS 2011:2) on navigational safety and navigational equipment.

In accordance with *IMO Guidelines for voyage planning* A.893 (21), the vessels route must be plotted on the navigational chart along with courses, hazardous areas and report points. The route planning must also contain but not be limited to:

- Safe speed, having regard to the proximity of navigational hazards along the intended route or track, the manoeuvring characteristics of the vessel and its draught in relation to the available water depth; (3.2.2.1).
- Necessary speed alterations en route, e.g., where there may be limitations because of night passage, tidal restrictions, or allowance for the increase of draught due to squat and heel effect when turning; (3.2.2.2).
- Minimum clearance required under the keel in critical areas with restricted water depth; (3.2.2.3).
- The method and frequency of position fixing, (3.2.2.6).
- Report points and VTS areas (3.2.2.7).

1.12.2 Watchkeeping

In chapter VIII STCW[26], there are international requirements regarding watch keeping (cf. the Swedish Transport Agency's regulations [TSFS 2012:6] regarding watch duty). STCW stipulates that an officer on watch must:

- keep the watch on the bridge, in no circumstances leave the bridge until properly relieved ensure that a proper of lookout is always maintained,
- continue to be responsible for safe navigation of the vessel, despite of the presence of the master on the bridge, until

[26] STCW - International Convention on Standards of Training, Certification and Watchkeeping for Seafarers.

master explicitly announces that he or she has taken over this responsibility and this is mutually understood, and
- notify the master when any doubts regarding safety.

It is also stated that during watch, the steered course, position and speed must be checked at frequent intervals by using all available aids to navigation necessary to ensure the vessel is following the intended course.

The officer on watch on the bridge may not be assigned or undertake any duties which may interfere with safe navigation of the vessel.

1.12.3 International Regulations for Preventing Collisions at Sea

Regulation 5 of the International Regulations for Preventing Collisions at Sea (Colregs)[27] states that "Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision."

1.12.4 VDR

SOLAS Chapter V, regulation 18.8[28] states that VDR and VDR-S, including all sensors, are to be inspected annually. The inspection is to encompass the accuracy and persistence of the recorded data and the possibility to gain access to the recorded data. The inspection must also encompass the state of the protective covering and devices for localisation. A copy of the inspection certificate must be kept on board, together with the vessels other certificates.

Guidelines for testing VDR equipment and the formulation of the inspection report can be found in IMO circular MSC.1/Circ.1222 *Guidelines on annual testing of Voyage Data Recorders (VDR) and simplified Voyage Data Recorders (S-VDR).*

1.12.5 Reporting of incidents and accidents at sea

In accordance with Chapter 6, Section 14 of the Maritime Act (1994:1008), the master of a foreign merchant vessel in Swedish territory must immediately report to the authority prescribed by the Government in the event of the vessel running aground, for example. Section 20 of the Accident Investigation Ordinance (1990:717) states that such reports should be made to the Swedish Transport Agency.

Chapter 20, Section 10 of the Maritime Act states that a master is sentenced to a fine if he neglects to provide such a report.

[27] Colregs - Convention on the International Regulations for Preventing Collisions at Sea.
[28] Cf. Chapter 4, Section 15 of the Swedish Transport Agency's regulations and general advice (TSFS 2011:2) on navigational safety and navigational equipment.

1.12.6 Regulations for hours of work and rest at sea

The MLC[29] and the STCW Code define requirements and goals for a crew member's physical and mental wellbeing. They include requirements for hours of work and hours of rest and stipulate that each member state must ensure that these hours are regulated[30]. The STCW Code looks especially at standards for watch keeping and defines the exceptions that can be made. The flag state of vessel VICTORIA is Liberia, which has ratified the MLC and is party to the STCW Convention/Code.

Under point 1 in Standard A2.3 under regulation 2.3 of the MLC, the terms hours of work and hours of rest are defined. Hours of work "means time during which seafarers are required to do work on account of the vessel". Hours of rest "means time outside hours of work; this term does not include short breaks".

In accordance with the Maritime Labour Convention, work may not exceed 14 hours in a 24-hour period or 72 hours in a seven-day period. In accordance with the Maritime Labour Convention and the STCW Code, hours of rest may not be less than ten hours in a 24-hour period or 77 hours in a seven-day period.

According to the MLC, hours of rest may be divided up into a maximum of two periods per 24-hour period, and one of these must be a period of at least six hours. In addition, the time between these two periods may not exceed 14 hours. The STCW Code, which deals specifically with standards for watch keeping, allows certain exceptions. Up to three periods of rest can be allowed, though one of the periods within a 24-hour period must be at least six hours. The two other periods of rest may not be shorter than one hour each and exceptions can be made for up to two 24-hour periods over a seven-day period. The total hours of rest may not be less than 70 hours for a seven-day period.

Both the MLC and the STCW Code state that if a crew member must perform a task in order to ensure the immediate safety of the vessel, persons on board or the cargo, the regulations shall not prevent this to do so. In such cases, the master shall be permitted to make exceptions to the regulations for a crew member, until normal operation is restored. As soon as practically possible after the vessel has returned to normal operation, the crew member who has worked during scheduled hours of rest should be afforded the opportunity to take a sufficient period of rest.

[29] Maritime Labour Convention 2006.
[30] Regulation 2.3 of the MLC and Chapter 8, Section A-VIII/1 of the STCW Code "Fitness for duty".

1.13 Company organisation and management

Venturi Fleet Management S.A. was formed in October 2014. In December 2014, the company took over management of VICTORIA. At the time of the accident, the company managed 10 bulk carriers with a gross tonnage of between 20,000 and 32,000. VICTORIA is the oldest vessel.

1.14 Fatigue

Fatigue can primarily be said to be a loss of wakefulness and can be set to resistance compared to how alert a person is. Fatigue is not a constant function in the sense that the impact on performance and execution of duties remains the same over time; the scope of various impairments of performance varies depending on the state a person is in, but also their surroundings and the nature of these.

The first signs of fatigue can be slight cognitive changes which lead to simple mistakes. Simple mistakes can be linked to the individual's perception, understanding and analysis of their surroundings. Sometimes other cognitive impact may be in question, such as a decision being somewhat delayed. Fatigue can for example lead to the need for a certain amount of effort or reflection in order to remember something. These negative effects are aggravated the more tired a person becomes.

There are several factors which can have an additional impact on how tired the individual feels. Working under stressful conditions, for example, clearly has a positive effect on the perceived level of fatigue, even if the individual is in fact exhausted.

The normal circadian rhythm for a person entails that we sleep during the night and are awake during the day. A normal night’s sleep or other main consecutive period of sleep for a person with a normal circadian rhythm is between seven and nine hours. The need differs from one person to the next, but lies within this time span. A main consecutive period of sleep shorter than seven hours means a varying degree of sleep deficit. Less than five hours’ consecutive sleep represents a critical deficit.

The regulations stipulate that one of the periods of rest shall be at least seven hours long, which in itself may mean that the main consecutive period of sleep of seven hours is not being achieved. A period of rest of six hours together with other periods of rest may however be sufficient for good recuperation.

1.14.1 Assessment of fatigue

An assessment of the master and chief officer's fatigue has been performed with the purpose of establishing whether or not they had received sufficient rest and sleep.

SHK has reviewed the crew's hours of work and rest and this information has been checked during interviews with the crew members concerned. This combined information has provided a foundation for the investigation.

The master

The information from the interviews has enabled us to produce a comprehensive overview for the master. It has become apparent that there have been several periods of rest over the span of 24 hours prior to the event, but that these have been very limited in their scope. On the basis of the collected information, our assessment is that the master has only had a total of between three to five hours' sleep and rest in these 24 hours. These hours were divided into several periods, and a long, consecutive period of rest was never taken. During the interview, the master said that he did not feel tired at the time the vessel ran aground.

The Chief officer

The chief officer had the 4-8 watch on the bridge when the vessel was at sea, with the possibility of a main consecutive rest period of at most eight hours, which was normally ample time for the chief officer to get sufficient sleep.

The investigation has revealed that over the 24 hours prior to the vessel running aground, the chief officer had eight hours' rest, divided into two separate periods; 00.00-04.00 and 12.00-16.00. Furthermore, the chief officer ate his lunch during his period of rest in the afternoon. In accordance with the records of seafarers' daily hours of work and rest, the two periods of rest were to be five hours each. Irrespective of the hours of rest recorded here or those actually taken, the chief officer did not have at least six consecutive hours of rest and therefore neither had a consecutive period of sleep of at least five hours. This suggests that the chief officer was working with a sleep deficit before and at the time of the vessel running aground. However, the period of rest taken between 12.00 and 16.00 prevented the deficit from being critical. During the interview, the chief officer said that he did not feel tired at the time the vessel ran aground.

1.15 Distraction

Distraction, or the act of someone becoming distracted, is a common phenomenon. It has different consequences in different situations, depending on what the individual has done and what exactly it was that interfered.

The distraction can be something the individual sees, hears or comes to think of that draws their attention from one thing to another. Perception of time is for example an ability which is impaired when we are distracted; i.e., time passes quicker than perceived.

Complex duties such as navigating a vessel are often subject to many different sources of distraction. Education, training and experience teach us when it is important to focus on a particular task or how to prioritise between different duties in a certain situation. But if a task is allotted a disproportionately large amount of attention, this can mean it becomes distracting and other important details are overlooked. An interference can also mean that it is difficult to identify a deterioration which has occurred, i.e., that a person does not understand that there is a problem as they are busy with too many duties at one time.

The expected difficulty and complexity of a task may affect the individual's resource allocation in terms of attention and alertness. In a very complex situation, which is also understood as such, the individual is naturally more alert and attentive to their duties. This allocation process is largely unconscious. A change in duties - e.g., a very complex duty becoming simpler in nature - can have a particularly large impact on an individual's alertness whilst carrying it out. This could for example be a navigational duty which in some phases is quite complex, to then become simpler due to changes in circumstances, such as the task at hand going from navigation of an archipelago to navigation of open waters. If this situation is compared with that of a distraction, such as attempting to perform an additional complex task in parallel, this has consequences for overall performance. The duty subject to change is then unconsciously demoted in priority and attention and alertness are focused on the new task which is deemed more complex or critical, whether consciously or unconsciously.

2. ANALYSIS

2.1 Navigation in connection with running aground

Soon after VICTORIA changed course at buoy 6 in Route T, the chief officer gave the order to the helmsman to steer 335°, according to information provided in the interviews. It was also this order that the third officer said was applicable during the short time he was on watch on the bridge during the chief officer's dinner break. The helmsman has stated that during his time on the bridge he followed the chief officer's order which, according to him, was to steer a course of 330°. The crew on the bridge has also stated that there were no changes with regard to this, right up to the vessels running aground.

However, the AIS track gives an entirely different picture of how the vessel was actually navigated. The course over ground (COG) held by the vessel until around 17:35 was an average of approx. 353˚, according to the AIS recorded data. Following this, there was a change of course by 10° to port, likely in connection with the chief officer taking over watch after dinner and the third officer pointing out the drift when handing over. A few minutes later, a new change of course was made; this time 25° to starboard. Yet another change of course was made thereafter; this time, slowly back to port - 343° COG.

Each crew member has thus provided information which is inconsistent with that of the other crew members and indeed with the AIS track. Taking into consideration the prevailing wind and current, the drift does not explain the difference between the course stipulated in the chief officer's order and the COG. VICTORIA must thus have actively steered a course which deviated from what the chief officer and third officer had intended. If we assume that the more-or-less consistent information provided by the bridge crew is correct and not a reconstruction after the event, there must either have been a technical fault with the gyrocompass in connection with the turn at buoy 6 or the helmsman read the course incorrectly from the gyrocompass.

It seems unlikely the gyrocompass would have been read incorrectly throughout the almost two-hour long sequence of events from the turn at buoy 6 to running aground, especially seeing as the vessel carried out a number of turns along the route. If that would be the case the course has been read incorrectly during all turning operations; i.e., at the times when the vessel had a COG of 353°, 343°, 368° and finally 343°.

It is just as unlikely that due to a technical fault the gyrocompass suddenly began to display incorrect values in connection with turn. In the event of a fault, the compass normally begins to "peregrinate". The idea that it should instead have "jumped" and made it necessary to perform a turn in order to follow the course stipulated in the order is therefore unlikely, and should also have caused reactions among the crew.

Indeed, after the grounding, the Swedish pilot that embarked the vessel at the anchorage for pilotage towards Halmstad noticed that the gyrocompass was not functioning. According to SHK, the most likely explanation is that the compass was damaged and became unusable in connection with the hard grounding.

In summary, it would appear that material information on what occurred on the bridge during the sequence of events after the turn at buoy 6 - information which could explain why the vessel was navigated in the way it was - has not come up during the interviews. The lack of VDR data has meant that it is not possible to bring clarity to the matter. Nor has the investigation been able to establish circumstances which - contrary to the information provided by the crew - could form the basis of a reasonable hypothesis as to why the vessel deviated from the intended route. SHK shall therefore refrain from speculation regarding misunderstanding or human error, for example. There is however cause to perform a more in-depth analysis of why the course deviation, regardless of how it arose, was not noticed.

2.2 Why did the vessels deviation from the planned course go unnoticed?

Both the chief officer and the third officer have stated that the vessels GPS brought their attention to the fact that the vessel was deviating from the intended course and interpreted this as a drift due to currents and wind. As shown in section 2.1, however, the wind and currents cannot explain the drift. In reality, it seems that the vessel held a course different to the intended one.

Neither the chief officer nor the third officer seem to have checked the course that the vessel was actually steering, however, or the vessels true course over ground. This may explain why the course deviation was not noticed.

The investigation has shown that neither the chief officer nor the third officer took a fixed position after the vessels turning at buoy 6; i.e., for a period of nearly two hours and despite the GPS alert, which seems difficult to explain. There are of course positions noted in the navigational chart at 17:00 and 17:30, but these are not consistent with the vessels actual position in accordance with the AIS track. This suggests that the position fixes at these times were not made with sufficient accuracy, or that the positions in the navigational chart were noted later. It should be mentioned at this point that the crew admitted that the position in the navigational chart at 18:00 was noted after the vessel ran aground, which occurred at 18:15.

The fact that the vessel was manually steered by an able seaman without the latter being replaced by a lookout on the bridge also entailed that the crew and the lookout on the bridge were insufficient for an extended period and in a geographical area with a relatively high

traffic volume. At the same time, however, it should be noted that as there was a lack of marking on the west side of the shoal around Fladen and Lilla Middelgrund, a lookout would not have been able to identify the areas of shoal visually.

There are several factors which may explain why the situation on the bridge developed as it did.

During bridge watch, the chief officer was mostly occupied with monitoring the deck crew's work to seal the cargo hatches. The chief officer has explained that it was necessary to prioritise this work because of the water spray coming up on deck. Taking into consideration the weather conditions, as well as the vessels high freeboard, it seems doubtful that waves should have been spraying up on deck at the time. It is however quite likely that the risk of water spray on deck would increase drastically once the vessel had passed Skagen. Regardless of what the actual situation was here, it is clear that the monitoring of the work was a task carried out by the chief officer at the same time as being the only officer on watch on the bridge.

In addition to this, the chief engineer, the master and the electrician came up to the bridge to discuss with the chief officer the matter of functional tests of the cranes prior to calling at Conakry. This meeting, which thus took place during the chief officer's bridge watch, likely drew attention away from the task of navigation and, in SHK's view, constituted a distraction which could have been avoided. The next call to port was not to be for another 12 full days later and the vessel was in an area with a relatively high traffic density which should furthermore be deemed as difficult to navigate for the chief officer, who had no previous experience in this area.

Another factor which has likely affected the chief officer's ability to keep watch and his attention to both the deck work and navigation is the combination of fatigue and a heavy workload. The chief officer's hours of work and rest were not within permitted limits as he did not have a consecutive period of rest of at least six hours in the 24 hours prior to the incident. Fatigue in combination with the aforementioned distractions likely affected the chief officer's ability to handle the navigation satisfactorily.

2.3 Management

The navigation of a vessel places high demands on the officer on watch to remain certain of the vessels position at all times, whilst at the same time the forward voyage requires constant planning. It is because of this that both the STCW Convention and the vessels safety management system stipulate requirements that the officer on watch is not assigned nor carries out tasks which may interfere with the safe navigation of the vessel.

The regulations and routines established by the shipping company within the scope of safety management also state clearly that establishing an adequate bridge watch is proactive work in which several variables shall be taken into account. Among other things, it is stated that it is necessary to take into account unusual demands on the bridge watch which may occur as a result of special operational circumstances. In this case, management of the cargo was not entirely complete by the time the vessel departed from Rostock; they were to be completed whilst the vessel was underway. This meant that the chief officer, as mentioned above, had additional duties to attend to. Furthermore, the lack of available pilot for transit through the Great Belt necessitated changes in relation to the planning.

Serving as master of a large merchant vessel places high demands on continuous planning, follow-up and, where necessary, adjustment of the plan in the event of changes in circumstances, all to ensure safe operation of the vessel. The safety management also allows room for the master to act in this way.

In the present case, however, the changes in circumstances which arose seem to have primarily been resolved via ad hoc solutions during the course of the voyage which did not adequately take into consideration the consequences for bridge watch over the 24-hour period following departure from Rostock.

Despite the masters intermittent presence on the bridge and awareness of the chief officer's responsibility for the deck work and the fact that the officers had no previous experience of these relatively difficult to navigate and heavily trafficked fairways, he did not check the navigation or take any other measures to facilitate the officers' work.

In SHK's view, there is cause for the shipping company to go through safety management with its masters in order to ensure that they have understood the importance of proactive management and the potential for reorganisation of the work and the division of duties on board in a flexible and safe manner and based on changes in circumstances, by e.g., temporarily changing the bridge's watch system and its manning.

2.4 Route planning

2.4.1 General

SHK has inspected the route plan drawn up before departure from Rostock and has identified certain shortcomings which will be described in greater detail below. These shortcomings have not contributed directly to the vessel running aground, but there is cause to report them so that the shipping company can take necessary measures.

2.4.2 Pilot

It is only a few hours' voyage from Rostock to the boarding position for a pilot through the Great Belt. As DanPilot requires 18 hours' prior notice when ordering a pilot, it is necessary on a voyage such as this to order a pilot before the vessel leaves the berth. It is a shortcoming that this had not been taken into account in the scope of the route planning, despite the fact that the master clearly wished to have a pilot on board and as this was also recommended by the Baltic Pilotage Authorities (cf. 2.1.7.7 *IMO Guidelines for Voyage Planning*).

SHK has also noted that there was a lack of information regarding the Great Belt VTS (cf. 3.2.1 *IMO Guidelines for Voyage Planning*).

2.4.3 The route

The fact that VICTORIA chose to take Route H through the Great Belt is understandable as *Admiralty Sailing Directions and sea charts*, state that Route T should be avoided by vessels with a draught which enables them to navigate outside of these areas, and as vessels with a draught of 10 metres or less *must* follow Route H. It may be noted that the IMO Ships' Routeing states that the Route H *should* be followed by ships with a draft of 10 meters or less.

Adjacent to Route H and less than one nautical mile from the mid-channel buoys, however, are a number of reefs with a depth of 10.4 and 10.6 metres which are not marked with beacons such as light buoys. Furthermore, one reef is located at a relatively sharp turn point. In the present case, VICTORIA also came very close to one of these shoals.

In SHK's view, the requirement or to recommend for a vessel with a draught of 10 metres to take Route H combined with the lack of marking for reefs constitutes a risk situation which must be rectified. In order to reduce the risk of vessels running aground especially in the area around buoy 7 in Route H, the Danish Maritime Authority should consider increasing the number of light buoys along Route H. Furthermore, the discrepancy between the Admiralty Sailing Directions and charts on the one hand and the IMO Ships' Routeing on the other hand should be reviewed and addressed.

2.4.4 Speed, etc.

VICTORIA'S route planning contains a column for recommended speed between the waypoints along the route. This seems to have been filled in routinely with the same speed for almost all parts of the voyage. This means that the purpose of filling in this column; i.e., to draw the bridge officer's attention to instances where a reduction in speed is required - e.g., prior to passing through shallower waters - comes to nothing (cf. 3.2.2.1 *IMO Guidelines for Voyage Planning*).

It is also remarkable that the route planning gives one speed for the entire voyage through the Great Belt (12 kts) whilst the squat calculation uses another (7 kts). As is clear from SHK's calculations in section 1.9, there is a great difference between the vessels draught in shallow waters depending on whether the speed is 7 or 12 kts, which can entail risks.

SHK has also noted that the UKC[31] was missing from the route planning, despite the fact that the planning concerned areas - such as Route H - with a limited water depth (cf. 3.2.2.3 IMO Guidelines for Voyage Planning). Nor was there any mention of the material used for the route planning (cf. 2.1 *IMO Guidelines for Voyage Planning*).

2.4.5 Overall assessment

It is clear from the aforementioned that there have been shortcomings in the route planning, and that it did not follow *IMO Guidelines for voyage planning* in all respects. The planning was approved by the master and signed by the deck officers. This indicates that the established safety management has not achieved full and proper dissemination on board VICTORIA.

In SHK's view, there is therefore cause for the shipping company to review how the route planning is implemented, in order to ensure that established routines are followed and that all relevant information is observed and, where appropriate, also noted in the route planning.

2.5 Bridge equipment

The fact that the crew were unable to identify the buoys on the vessels radar may be partially explained by the prevailing weather conditions.

VICTORIA did not have ECDIS; nor did it have any other form of electronic navigational chart (ECS) on the bridge. An ECS enables the crew to quickly gain a visual overview of the vessels position in relation to its surroundings. There although no requirements to have ECDIS or an ECS installed, but it is in SHK's view appropriate for a vessel of VICTORIA's size to invest in such equipment in order to increase safety. This is also consistent with IMO's recommendations in SN.1/Circ.263 of 23 October 2007.

2.6 Emergency management

In Swedish territorial water, the master has a responsibility to contact the Swedish Transport Agency immediately in the event of an accident of a certain nature; running aground being of such a nature. However, VICTORIA's checklist does not include contacting the coastal state. This can mean that the crew will assume that the shipping company makes such contact. If the Swedish Transport

[31] UKC - Under Keel Clearance; minimum distance between the vessel and the sea bed.

Agency is not contacted immediately, the master risks being sentenced to a fine.

The shipping company should review the checklist in order to ensure the master has good support in the event of an accident and does not risk omitting to take certain measures, which can result in penalties.

3. CONCLUSIONS

3.1 Findings of the investigation

a) No fixed position was made for almost two hours on the last leg of the course before the grounding.
b) The chief officer prioritised other duties than navigating.
c) The master prioritised other duties than navigating.
d) The senior officers were holding a meeting on the bridge at the time the vessel ran aground.
e) VICTORIA's route planning did not follow IMO Guidelines for voyage planning.
f) VICTORIA passed through the Great Belt and Kattegatt without a pilot on board.
g) VICTORIA was close to running aground in Route H in the area around buoy 7.
h) Route H is obligatory for vessels with a draught of 10 metres or less according to Admiralty Sailing Directions and the sea charts.
i) Route H is recommended for vessels of 10 meters or less in depth according to IMO Ships' Routeing.
j) There were a number of shoal heads without light buoys in the immediate vicinity of Route H.
k) There was nothing to mark the west side of the shoal around Fladen.
l) There was nothing to mark the west side of the shoal around Lilla Middelgrund.
m) There was no VTS in Kattegatt.
n) VICTORIA was not equipped with ECDIS.
o) VICTORIA was not equipped with ECS as an aid to navigation.
p) The checklist for running aground did not include an item for the vessel to contact the coastal state.
q) Current VDR data was not available.

3.2 Causes

The grounding occurred due to a lack of adequate attention to navigational tasks, which in turn was due to distractions caused by other duties, likely in combination with fatigue, which meant that the vessels course and position were not followed.

An underlying cause was inadequate resource planning in terms of the deck officers duties over the first 24 hours after departure from Rostock.

4. MEASURES TAKEN

4.1 Venturi Fleet Management

Venturi Fleet Management has stated that it shall equip all vessels with ECDIS and encourage the use of the parallel indexing method when navigating narrow fairways.

In addition, the ISM manual and its safety management system (SMS) shall be reviewed and supplemented, for example where route planning and the checklist for running aground are concerned. It must also be ensured that distractions are eliminated when navigating in narrow fairways and that there is a greater focus on position fixes in narrow fairways.

4.2 The Danish Maritime Authority

The Danish Maritime Authority has in connection with draft of this report made contact with charts authority in Denmark to discuss a change in the information in the Danish charts with the intention of information becomes in accordance with IMO`s Ships routeing.

4.3 The Swedish Maritime Administration

Since the incident, the Swedish Maritime Administration has placed a light buoy west of Fladen (fig. 16).

Figure 16. New buoy by Fladen (red ring).

5. SAFETY RECOMMENDATIONS

In light of the measures taken by Venturi Fleet Management and the Swedish Maritime Administration, SHK has decided not to issue recommendations to these operators.

The Danish Maritime Authority is recommended to:

- Consider and evaluate the buoyage along Route H with this report in mind. See section: 2.4.3. *(RS 2016:07 R1)*

The Swedish Accident Investigation Authority respectfully requests to receive, by **5 December 2016** at the latest, information regarding measures taken in response to the recommendations included in this report.

On behalf of the Swedish Accident Investigation Authority,

Mikael Karanikas Rikard Sahl