

INTERIM REPORT 12 NOVEMBER 2019 ON THE INVESTIGATION INTO THE LOSS OF PROPULSION AND NEAR GROUNDING OF VIKING SKY, 23 MARCH 2019

The information contained in this interim report is based on investigations to date. Readers are cautioned that there is the possibility new evidence may become available that might alter the circumstances as depicted in this report.

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All times used in this report are UTC+1 unless otherwise stated.

1. BACKGROUND

On the afternoon of 23 March 2019, the cruise vessel *Viking Sky* experienced a black-out and loss of propulsion in gale to storm force conditions in the Hustadvika area of the Norwegian Coast. The master immediately sent out a mayday as the ship drifted towards shore.

Viking Sky was owned by Viking Ocean Cruises with technical management provided by Wilhelmsen Ship Management. It was the third in the Viking Star class of cruise vessels, was classed by Lloyd's Register and was registered with the Norwegian International Ship registry (NIS). The vessel had been built at Fincantieri in Italy and was delivered in January 2017.

Viking Sky was manned by 458 crew and was carrying 915 passengers. Most of the passengers were US (602) and UK (197) citizens, followed by Australians (69) and other nations (47).

1.1 Hustadvika

Hustadvika is the western part of the fairway between Bud and Kristiansund.

The Admiralty Sailing directions state:

Area 11, Hustadvika (63°00.00'N 7°00.00'E) is a notoriously dangerous area; the coast is completely exposed to the weather and extensive shoals lie offshore. Strong winds from SW to NW raise a large steep swell with hollow breaking seas, especially during the out-going tidal stream. These conditions are likely to be particularly severe in the area of Budadjupet between Bjørnsund (62°53.75'N 6°48.96'E) and Kolbeinsflua, 5 miles NNE. Breaking surf is reported to occur throughout the whole area.

A similar description is available in the Norwegian Pilot, book 4.

Viking Sky followed the main fairway when crossing Hustadvika the day of the incident.

1.1.1 Wind and sea conditions, Hustadvika 23 March 2019 1300

Strong gale to storm winds (Beaufort 9-10 or 22-25 m/s) from the southwest.

Total significant wave height¹ over deep water of 9-10 meters from west (with a mean wave period of 12-13 seconds (s)).

These weather conditions were as forecast.

1.2 Power and propulsion systems

Viking Sky's main propulsion system comprised two fixed pitch propellers directly driven by in-line variable speed electric motors with two three phase stator windings. The voltage at the main switchboard was stepped down from 6.6 kV to 2.2 kV, converted to

¹ The average trough-to-crest height of the highest one third of the wave heights (sea and swell) occurring in a particular time period. World Meteorological Organization definition.

direct current (DC) and finally inverted to variable alternating current (AC) and frequency, to control the propulsion.

The electric power generation on board *Viking Sky* comprised four diesel generators (DG) manufactured by MAN Diesels & Turbo (MAN). The vessel was equipped with two types of DGs, the small generators (DG1 and DG4) were 5040 kW each, the large generators (DG2 and DG3) were 6720 kW each. *Viking Sky* had two separate engine rooms, and there were one large and one small DG in each engine room, DG1 and DG2 in the forward engine room and DG3 and DG4 in the aft engine room. Each engine room had its own switchboard which were usually connected by tie breakers to create a single switchboard for power distribution.

On 16 March 2019, DG3's turbocharger failed rendering the DG inoperable. The day of the blackout, a MAN technician was on board to dismantle the damaged turbocharger in preparation for a replacement to be fitted at the next port.

2. NARRATIVE

2.1 The voyage

Viking Sky had started the last of six Northern Light cruises, in Bergen on 14 March. These cruises included the ports of Narvik, Alta, Tromsø, Bodø and Stavanger. The ship left Tromsø at 2210 on 21 March, scheduled to arrive in Bodø on 22 March. The plan was then to call at Stavanger on 24 March.

When the ship left Tromsø there were two licensed Norwegian coastal pilots on board. Using pilots were mandatory for parts of the voyage. Both pilots had sailed on *Viking Sky* several times before and were familiar with the ship and crew. The planned route was reviewed by the master and the pilots prior to departure.

The voyage south through Tjeldsundet and on towards Bodø was uneventful. The wind was forecast to increase over the afternoon and into the evening and the master was concerned that they would struggle to leave the quay in Bodø. Therefore, in consultation with the shipping company, he decided to cancel the visit to Bodø and head directly for Stavanger.

At approximately 1340 on 22 March, the staff captain, on the master's instruction, informed the crew about the forecast weather and instructed them to start preparing the vessel for the deteriorating weather conditions.

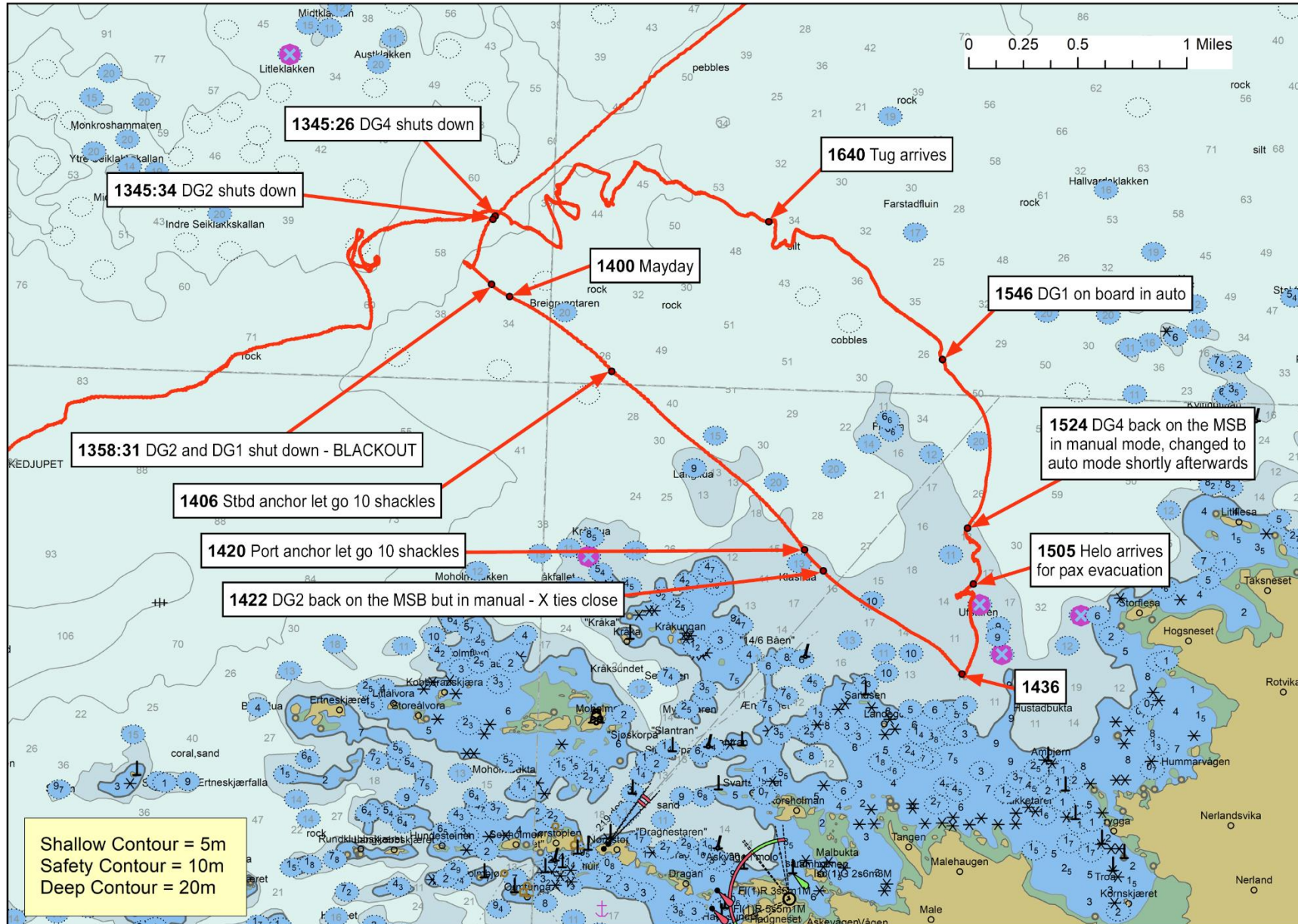


Figure 1: Sequence of events. Source: MAIB

2.2 The blackout

On the morning of 23 March, between 0500 and 0904, 18 lubricating oil low level and low volume alarms were registered by the operational DGs. Each alarm, having been accepted, cleared within a few seconds.

No more alarms were registered until 13:37:04 when DG4 registered an alarm indicating that the DG was shedding load as a result of low lubricating oil pressure. A few seconds later it registered a low lubricating oil pressure alarm. At 13:39:52, DG1 registered a low low lubricating oil sump level alarm. A little over five minutes later, at 13:45:26, DG4 shut down followed by DG2 eight seconds later. DG2 was restarted after approximately 11 minutes, but shut down again along with DG1 at 13:58:31, causing a complete blackout and loss of propulsion.

The bridge team immediately called the engine control room but, at that early stage, the engineers were unsure of the cause, or causes, of the blackout and therefore could not estimate when it would be possible to restore power. The officer on watch called the master, who quickly made his way to the bridge.

Having assessed the situation, the master broadcast a mayday at 1400. He then instructed the crew to drop both anchors. However, the anchors did not hold, and the ship continued to drift astern towards the shore at a speed of 6–7 knots. The General Alarm was activated at 1413 and the passengers and crew began to muster.

On receipt of the mayday, Southern Norway Joint Rescue Coordination Centre (JRCC) launched a major rescue operation and started scrambling resources, including helicopters, on a large scale.

2.3 Restoration of power

Within 30 seconds of the blackout, the emergency diesel generator started and powered the emergency switchboard. The engineers transferred a total of 10.8 m³ of lubricating oil to the lubricating oil sump tanks of the three operational DGs. They then started DG2 and restored power to the main switchboard, in manual load-sharing mode², at 1422. At 1429, the port propulsion motor was re-started and, approximately five minutes later, the starboard propulsion motor was started, providing sufficient propulsive power to maintain slow speed ahead. Over the next hour, DG1 and DG4 were re-started in automatic load-sharing mode and the starboard propulsion motor was re-started to enable the propulsion motors' output to maintain between slow ahead and half ahead.

Although the three operational DGs had been restarted, the engineers had to continuously balance the electrical load manually. The vessel was maneuvered towards open waters, still with both anchors lowered.

The first helicopter arrived at approximately 1500. The crew maneuvered the vessel to head into the weather to give the helicopters the best possible working conditions in order to start evacuating the passengers. The master had considered evacuating passengers and

² *Viking Sky*'s DGs was normally operated in automatic load-sharing mode, where the power management system automatically shared the electrical load among all the DGs connected to the main switchboard. The DGs could be operated in manual load-sharing mode or a combination of manual and automatic load-sharing mode where the electrical load on the DG in manual load had to be controlled manually.

crew to the lifeboats but, given the environmental conditions, this was considered to be too dangerous. The first helicopter hoisting operation took place five minutes later and evacuation of passengers continued until the next morning.

The first tugboat arrived at around 1640. However, the weather conditions were too severe to secure a towline.

At 0630 on 24 March the weather conditions had improved sufficiently to enable tugs to be made fast and towlines were secured fore and aft, although the vessel maintained its own propulsion. At approximately 0915, the master decided that the vessel was out of danger and that it was safe to stop the evacuation of the passengers. The local Police reported 479 evacuated passengers had been received at the emergency center ashore.

Viking Sky was moored alongside in Molde at around 1625 on 24 March.

3. INVESTIGATION

3.1 Substantially interested states collaborative approach

The safety investigation into this incident is being conducted in accordance with IMO Resolution MSC.255(84) Casualty Investigation Code (CIC), Directive 2009/18/EC of the European Parliament and of the council of 23 April 2009 and the Norwegian Maritime Code, chapter 18 II.

The Accident Investigation Board Norway (AIBN) is the lead investigating authority. The United Kingdom (UK) and the United States of America (USA) are considered Substantially Interested States (SIS) in accordance with the Norwegian Maritime Code section 474. The United Kingdom's Marine Accident Investigation Branch (MAIB), United States Coast Guard (USCG) and the United States' National Transportation Safety Board (NTSB) are working with the AIBN, as representatives of the SIS. In addition to the UK and USA, the Australian Transport Safety Bureau (ATSB) has also assisted in collecting evidence for the investigation.

The investigating authorities are working closely with Wilhelmsen Ship Management, Viking Ocean Cruises, MAN, Wärtsilä, Lloyds Register, the Norwegian Maritime Administration, the Norwegian Coastal Administration and other interested parties.

4. INITIAL FINDINGS

- The lubricating oil sump tanks of all the diesel generators were maintained at 28%–40% capacity. MAN's recommendation was to maintain them at 68%–75% capacity.
- The diesel generators shut down as a result of the loss of lubricating oil suction due to low sump tank levels, combined with pitching and rolling.
- All three operational diesel generators shut down within 19 minutes of each other, causing blackout and loss of propulsion.

- AIBN estimate that Viking Sky came within a ship's length of grounding, having passed over or in immediate proximity to 10 m shoals, before propulsion could be re-established.

5. ACTIONS TAKEN

Shortly after the incident Wilhelmsen Ship Management distributed a Safety Bulletin including recommendations to all their vessels.

The company has also identified several actions to be taken following their internal investigation of this incident. Specifically, they are reviewing the management of appropriate lubricating oil levels in operational machinery, the preparations for heavy weather and the instructions regarding blackout recovery. Additionally, in cooperation with Class, they are establishing procedures for sailing with one engine (or other critical equipment) inoperative while maintaining compliance with the Safe Return to Port³ requirements.

On 27 March 2019 the Norwegian Maritime Authority issued a Safety Message on risk assessment of critical systems which asked "*all shipping companies to take the necessary precautions to ensure the supply of lubricating oil to engines and other critical systems under expected weather conditions. This should be done in collaboration with the engine supplier and included as part of the ship's risk assessments in the safety management system.*"⁴

6. RECOMMENDATION

The safety advice issued by the Norwegian Maritime Authority is supported by the ongoing safety investigation, with the following recommendation:

All vessel owners and operators are recommended to ensure that engine lubricating oil tank levels are maintained in accordance with engine manufacturer's instructions and topped up in the event of poor weather being forecast.

7. THE INVESTIGATION WAY AHEAD

The safety investigation into this accident will continue as swiftly as possible to ensure any further appropriate actions to reduce the likelihood of similar incidents in the future and improve safety at sea are identified.

Areas of further investigation include:

- Engine room alarm management
- Passage planning

³ SOLAS regulation II-2/21 (Casualty threshold, safe return to port and safe areas)

⁴ Translated from Norwegian, original text available at

<https://www.sdir.no/contentassets/6a7de0c70733442a9e654767897b4c65/sikkerhetsmelding-om-risikovurdering-av-kritiske-systemer.pdf?t=1568816231988>

- Decision support
- Lubricating oil management
- Evacuation and LSA
- Safety management
- Local weather conditions and bathymetry
- Safe Return to Port

Once the safety investigation is complete, a report will be drafted and distributed to key stakeholders for a 30-day consultation period prior to it being published.

Accident Investigation Board Norway
Lillestrøm, 12 November 2019

SHIP PARTICULARS, VOYAGE AND CASUALTY INFORMATION

SHIP PARTICULARS	
Vessel's name	<i>Viking Sky</i>
Flag	Norwegian International Ship Register
Classification society	Lloyd's Register
IMO number	9650420
Type	Passenger
Registered owner	Viking Ocean Cruises AS
Manager	Wilhelmsen Ship Management (Norway) AS
Year of build	2017
Construction	Steel
Length overall	228.37 m
Draft	6.65 m
Gross tonnage	47842
VOYAGE PARTICULARS	
Port of departure	Tromsø, Norway
Port of arrival	Stavanger, Norway
Type of voyage	Coastal
Manning	458
MARINE CASUALTY INFORMATION	
Date and time	23 March 2019 at 1358
Type of marine casualty or incident	Machinery failure
Location of incident	63° 00.3' N, 006° 59.6' E
Place on board	Machinery space
Injuries/fatalities	18 passengers injured
Damage/environmental impact	None
Ship operation	On passage
Voyage segment	Mid-water
External & internal environment	Strong SW gale, Beaufort Scale 9-10, significant wave height 8-9 m
Persons on board	1373