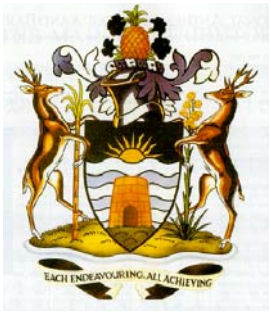

Department of Marine Services and Merchant Shipping
Antigua and Barbuda W.I.

Investigation Report

Very serious marine casualty:

Capsizing after grounding and death of 18 crew members of MV ROCKNES on 19 January 2004 in Vatlestraumen/sea area south of Bergen, South Norway

Joint investigation report in accordance with
IMO Res. A849(20)
by the flag State Antigua and Barbuda
and the State with substantial interest,
Federal Republic of Germany

Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Bundesoberbehörde im Geschäftsbereich des Bundesministeriums
für Verkehr, Bau- und Wohnungswesen

Extract from
The Merchant Shipping
(Accident Reporting and Investigation)
Regulations 1999 – Regulation 4:

"The purpose of investigating an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 1999 is to determine its circumstances and the causes with the aim of improving safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as necessary to achieve the fundamental purpose, to apportion blame."

Note

The report is not written with liability in mind and is not intended to be used in court for the purpose of litigation. It endeavours to identify and analyse the relevant safety issues pertaining to the specific accident, and to make recommendations aimed at preventing similar accidents in the future.

Prior to finalizing the investigation report draft copies have been distributed to parties having substantial interest in the findings and outcome of the investigation. Technical comments and contributions **received in return** have been respected **as deemed** appropriate. The Royal Norwegian Ministry of Fisheries and Coastal Affairs Authorities requested (reference 200400093- /BV) that following remark should be inserted into the introduction of the report:

Quote:

" Due to the fact that there is a litigation brought against the Norwegian government represented by our Ministry following the accident of MV "Rocknes", the Ministry of Fisheries and Coastal Affairs do not find it appropriate to comment on the report."

Unquote.

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List of Figures

1 Summary of the marine casualty

On the weekend of 17 and 18 January 2004 the Bulk Carrier ROCKNES loaded a cargo of gravel in the South Norwegian port of Eikefet, north of Bergen. After the loading works had been completed on Sunday evening, the vessel left Eikefet shortly before 09:00 h[1] on Monday, 19 January 2004, with a pilot on board and proceeded to bunker in Skålevik near Bergen, where she moored at 11:40 h. Four hours later, at about 15:40 h, MV ROCKNES continued its voyage, still with the pilot on board, heading for the intended port of discharge in Emden, Germany.

At about 16:23 h MV ROCKNES changed course to port in order to enter Vatlestraumen. At about 16:27 h the vessel touched ground with her starboard side in the narrow passage; immediately she developed list to starboard that could not be stopped. Within a few minutes MV ROCKNES capsized completely.

Twelve of the thirty persons on board could be recovered alive as a result of the rescue measures initiated immediately. Three of them were freed from the hull of the vessel floating keel upwards after several hours.

Escaping fuel polluted Vatlestraumen and the adjacent coastline. The Norwegian Coastal Authority collected a total of 1.291 tons of emulsified sea water which has been determined to be equivalent to 227,5 tons of IFO 380.

After the rescue attempts were discontinued, the vessel was towed into a bay on Ågotnes. The hull of the vessel was examined and it was decided to upright MV ROCKNES again. From 17 March 2004 onwards work proceeded on turning the vessel; on 29 March 2004 it was lying upright again. On 5 April 2004 MV ROCKNES was towed to the Bergen Mekaniske Yard at Laksevag near Bergen. The vessel was inspected and a decision was taken to reinstate it. To this end MV ROCKNES was towed to Poland for repairs and modifications. It was initially estimated that the necessary repair works would take more than one-and-a-half years.

In the course of this refurbishment a large amount of conversion work was carried out (see Section 7.1 of this report). Here in particular the findings of the technical commission of the affected coastal State, Norway, were taken into account; the commission had dealt with questions of stability (see Section 6.1 of this report).
At the end of June 2005 the vessel, now renamed “NORDNES”, was put back into operation again.

[1] All times stated in this report are local time Central European Time (CET) = UTC + 1 h

2 Scene of the accident

Nature of the incident:	Very serious marine casualty
Date/Time:	19 January 2004, approx. 16:27 h
Location:	Vatlestraumen, south of Bergen, off Revskolten light
Latitude/Longitude:	φ 60°20.2' N λ 005°11.0' E

Excerpt from Sea Chart 21 , Statens Kartverk Sjø

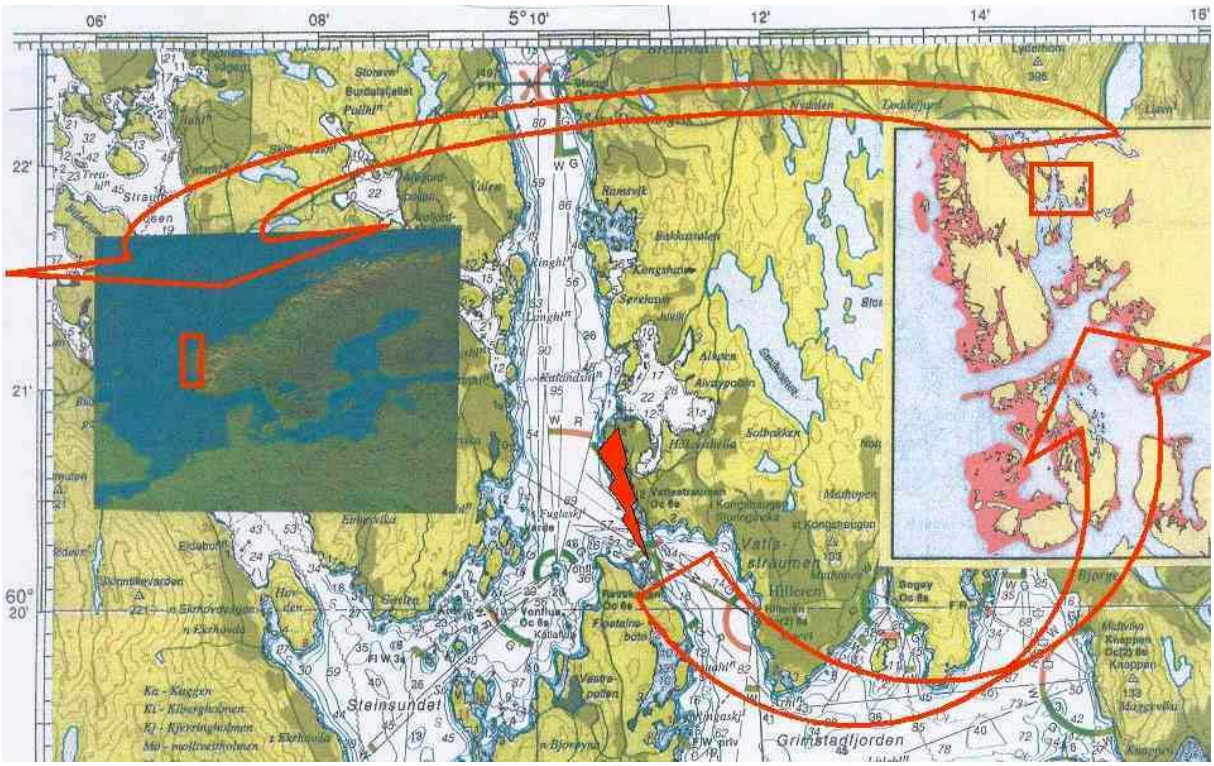


Figure 1: Scene of the accident
(enlargement of the excerpt)

3 Vessel particulars

3.1 PHOTO OF VESSEL

Figure 2: ROCKNES

3.2 VESSEL PARTICULARS

Name of vessel	ROCKNES (ex. KVITNES)
Type of vessel	Bulk Carrier, Supply (Free Fall Pipe [FFP]) Vessel, Self Unloading
Nationality/Flag	Antigua and Barbuda W.I.
Port of Registry	Cuxhaven
IMO Number	9229910
Call signal	V2OG8
Vessel operator	AJ Shipmanagement GmbH, Leer
Year built	2001
Building yard/building number	J.J. Sietas KG Schiffswerft GmbH & Co. / 1177
Classification society	Germanischer Lloyd
Damage Stability	SOLAS Amendments 90/91, Chap. II-1, Reg. 25-1
Required Survival Probability	53 %
Length over all	166.70 m
Breadth over all	24.50 m
Gross tonnage	17765 gt
Deadweight	25065 t
Max. draft	10.49 m
Engine rating	7300 kW
Main engine	MaK, Diesel Engine 8 M 43
Persons on board	30 (23 crew + 6 FFP Specialists +1 pilot)
Speed	14 kn

4 Course of the accident

4.1 CONVERSION KVITNES TO ROCKNES

The vessel was laid up at the Sietas yard in Hamburg as new building 1177 on 4 May 2000 and was delivered under the name KVITNES in August 2001. It was a self-unloading bulk carrier made of steel; the classification society was Germanischer Lloyd. An approx. 80 m long, swivel-type boom fitted forward amidships served to discharge the cargo. The associated deck superstructure was located on the fore ship from frame 204 to frame 219. Due to its height of about 20 m above the main deck and a width of about 8 m, visibility from the bridge covering the area ahead of the vessel was restricted, both from the two conning positions and from the centre of the bridge. The technical solution to this problem of the dead sector was to mount the S-band radar on the fore ship superstructure in conjunction with deflector panels to reduce interference echo.
As regards to the optical visibility, the principles to be observed are set down in SOLAS, Chapter V, Regulation 22, "Navigation bridge visibility ". Section 1.1 states: “The view of the sea surface from the conning position shall not be obscured by more than two ship lengths, or 500 m, whichever is the less, forward of the bow to 10° on either side under all conditions of draught, trim and deck cargo”. According to Section 1.2 no blind sector caused by cargo, cargo gear or other obstructions outside of the wheelhouse forward of the beam which obstructs the view of the sea surface as seen from the conning position, shall exceed 10°. The total arc of blind sectors shall not exceed 20°. The clear sectors between blind sectors shall be at least 5°. However, in the view described in paragraph (a)(i), each individual blind sector shall not exceed 5°. Observance of these specifications is determined by a line of sight test.

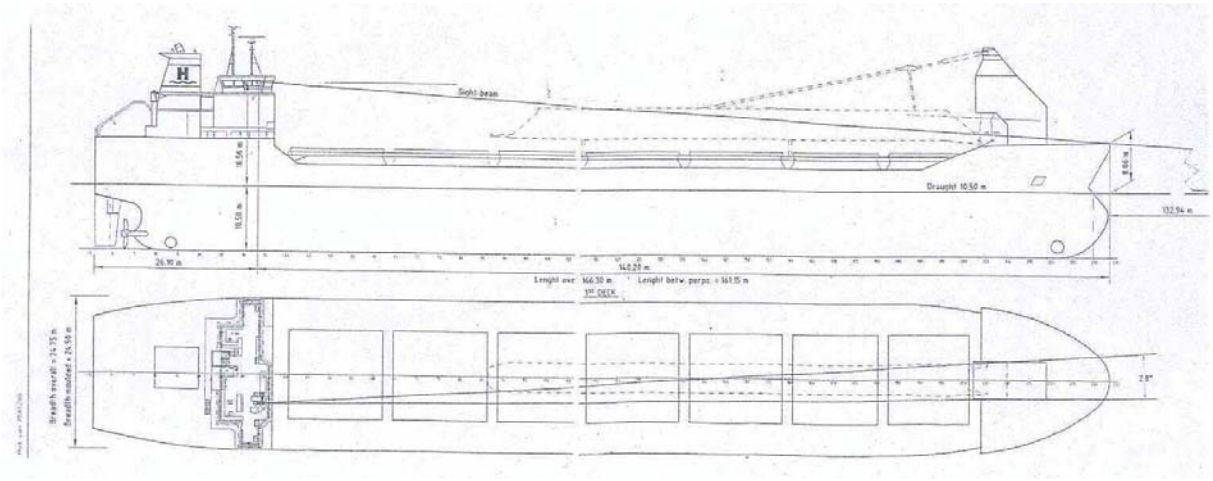


Figure 3: Approved line of sight plan KVITNES

The original building KVITNES bore the classification symbol NAV-O in accordance with the regulations of Germanischer Lloyd for "Bridge Design on Seagoing Ships, One-Man Control Console", according to which the SOLAS horizontal field of vision had to be satisfied directly by the two navigating and monitoring workstations. The dead angle caused by the fore ship superstructure of KVITNES was 2.8 degrees from the navigation workplaces; the visibility concealment on the sea surface ahead of the bow was 134.94m.
On the grounds of an agreement between the operators and owners it was decided to convert KVITNES for use in the offshore oil and gas industry. The conversion work began in November 2002 at the Kèppel Verolme yard in Rotterdam and was completed in March 2003 with return delivery of the vessel now renamed ROCKNES. The conversion was planned by the engineering firm Bureau voor Scheepsbouw, Ir. P. H. de Groot b.v. in Bloemendaal; Germanischer Lloyd remained the competent classification society. The key area of the conversion work lay in installing a flexible fall pipe system[2] that enabled the vessel to deposit its cargo of stones selectively on the sea bottom in a controlled process via the fall pipe[3]. In addition to a whole series of smaller conversion measures, the former cargo hold 5 in particular was redesigned for this purpose. A moonpool open downwards was installed on the starboard side through which the fall pipe system could be lowered and brought back up onto deck again; in addition the necessary hydraulic and electrical systems were housed there. The accommodation capacity of the deck house was extended from formerly 25 persons to now 50, so that the specialist staff additionally required could be taken on board for offshore assignments.

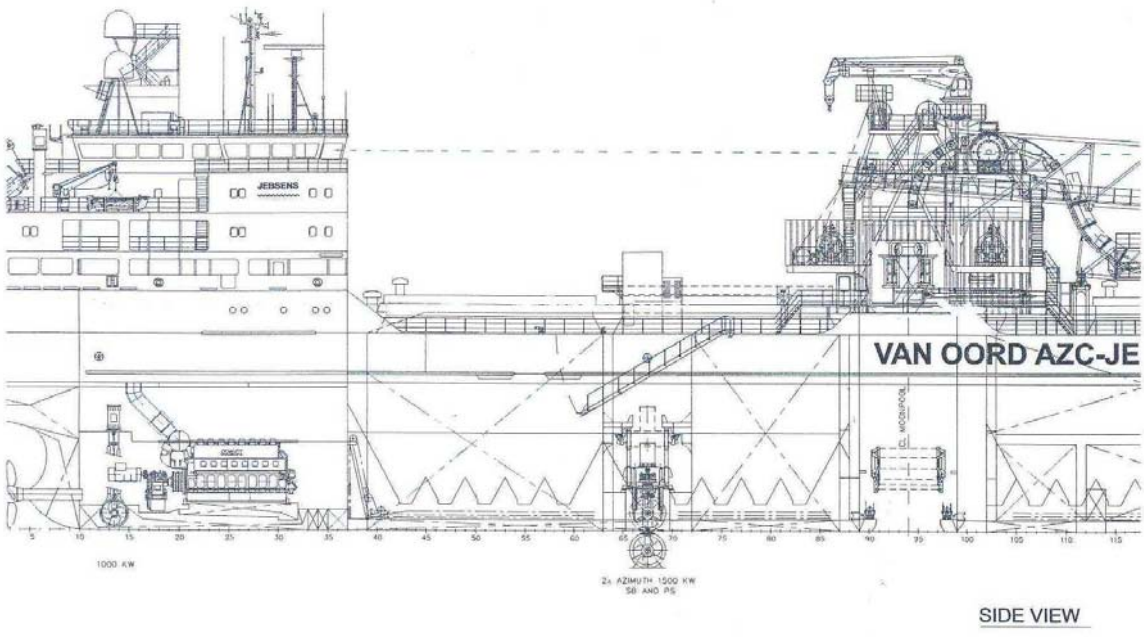


Figure 4: Side view of ROCKNES with new deck superstructure

[2] Flexible fall pipe systems – abbreviated to FFP
[3] This operation takes place for instance when under-water pipelines or sea cables are laid in order to protect them in this way with a layer of stones.

As a result of cargo hold 5 no longer being available, the cargo hold volume of MV ROCKNES was reduced from 20131.87 m³ to 17994.75 m³, corresponding to a cargo of about 3000 t. A further deck superstructure was installed to handle the flexible fall pipe, located on the starboard side from frame 88 to frame 109. The height of this stone chute was about 15 m above the main deck, and with the crane mounted on top the facility reached a height of about 20 m at a width of about 7 m. The vessel's lightweight was increased from 7307 t to 8960 t, with a vertical shift in the height of the centre of gravity from 9.66 m to 10.91 m. No fixed ballast was installed as compensation. As a function of the cargo centre of gravity and distribution, it was necessary to take on ballast water for compensation purposes. In the fully loaded and equipped condition altogether 1461 t ballast water were required; the individual standard loading cases were summarised in the Stability Booklet. In Volume 1, Point 2.4 of the Stability Booklet[6] it was recommended that the asymmetrical weight distribution resulting from the conversion be compensated by flooding tanks 49 and 52 on the port side and tank 50 on the starboard side. There was no binding specification.
After completion of the conversion work under the supervision of the surveyor of the classification society responsible on site, the new ship's lightweight and the new height of the centre of gravity were determined and a heeling test was conducted. The intact and damage stabilities were calculated anew, the Stability Booklet and Damage Stability Plan drawn up anew, and all documents were checked and approved by Germanischer Lloyd. MV ROCKNES had a loading computer available to determine the intact stability from case to case; the stability program used was also tested and approved by Germanischer Lloyd. The necessary data for the stability calculation such as cargo and equipment quantities and distribution, and ballast water volumes and distribution, had to be entered manually. At the same time the program checked whether the resulting limit curve of the initial stability was also still in the admissible area for the damage stability. If this was not the case, this was signalled to the operator by lighting up of the warning sign "Critical".
The deck superstructure of the stone chute on the starboard side for handling the flexible fall pipe consisted of a lattice structure. The overall height was about 15 m above the main deck; with the crane mounted, the height was about 20 m and the width about 7 m. This new structure, as a lattice structure, was not considered to be a cohesive visibility obstruction. The classification symbol NAV-O of the Germanischer Lloyd regulations was deleted as a result from the conversion of MV ROCKNES. The SOLAS horizontal field of vision no longer had to be satisfied directly from the two navigating and monitoring workstations, but instead from the conning position[4]. This position is not defined further in SOLAS and could be freely selected on the ROCKNES navigation bridge. If this position is selected close to the starboard wing, the stone chute and crane column are in a line and in the opinion of Germanischer Lloyd do not represent any inadmissible blind sector. The classification society did not require any updated line of sight plan from the yard for approval.

[6] „Operation of the ship“

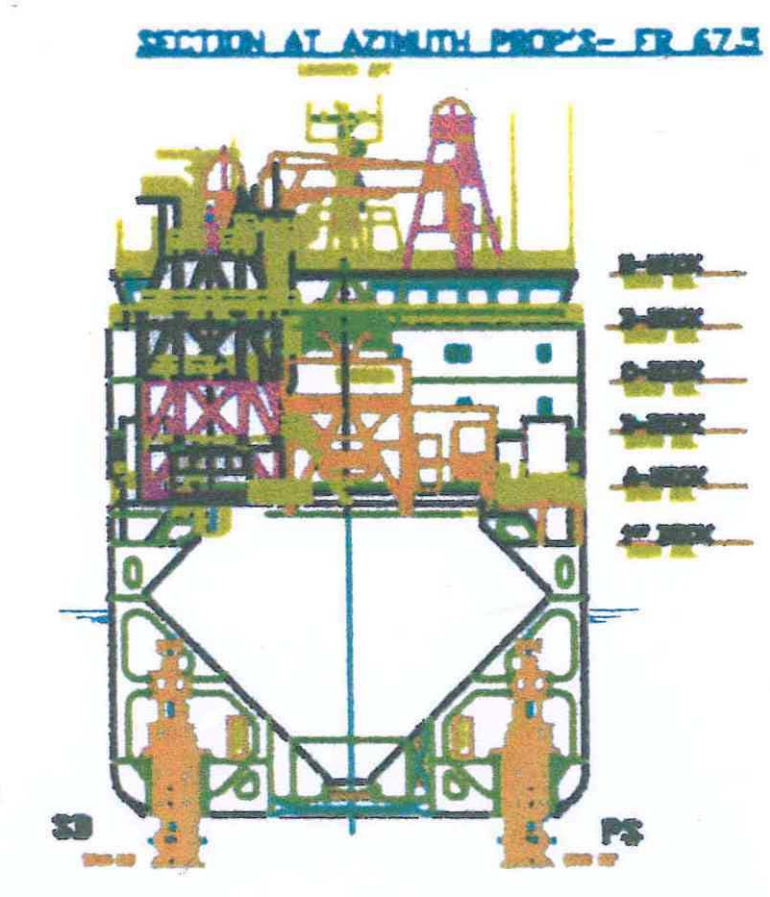


Figure 5: Cross-sectional drawing MV ROCKNES
(issued by the consultant engineers Bureau voor Scheepsbouw)

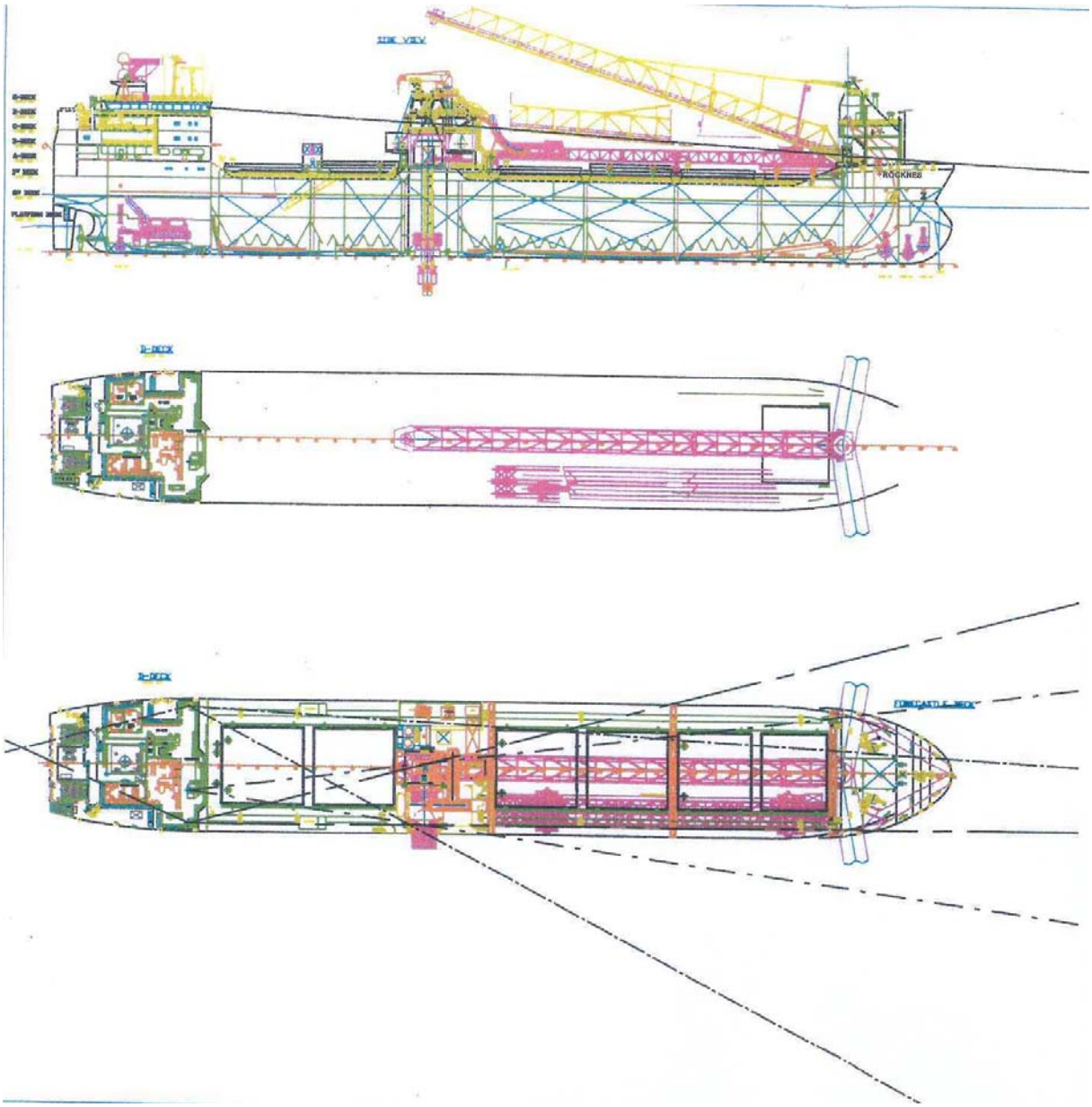


Figure 6: Line of sight plan ROCKNES
(issued by the consultant engineers Bureau voor Scheepsbouw)

4.2 WEATHER CONDITIONS

In the course of 19 January 2004 an area of low pressure with a centre over South Norway proceeded on a south-easterly course over South Sweden to the South-East Baltic Sea. Between 16:00 h and 17:00 h a weak south-east to south-south-east wind with an average force 1 Bft to 2 Bft was blowing in Vatlestraumen passage in the area of the southern navigation channel from Bergen. There was no precipitation and visibility was 25 km. The air temperature was about –1°C to –2°C and was dropping, the water temperature was about 7°C to 8°C. The sky was initially covered 4/8 with clouds, but these quickly broke up. The sun went down at 16:17 h, the civil twilight[5] lasted until 17:09 h. According to corroborated statements the light beacons controlled via photoelectric cells were still unlit at the time of the occurrence. With the prevailing wind the sea state could only develop within the range of just a few centimetres to 1 decimetre at most. The approx. 1.5 m to 2 m high swell running on the open coastal sea from the north-west could not run into the area under review. To summarise, low-wind, clear and precipitation-free frosty weather was prevailing in Vatlestraumen.
On 19 January 2004 the first high tide in Bergen was at 08:28 h, and the second high tide at 21:00 h. In Vatlestraumen the flood current starts to run north about 6 hours after high tide in Bergen and the ebb current starts to run southwards about 10 minutes before high tide in Bergen. Consequently on the day of the accident the flood current began to run northwards starting at about 14:28 h, while the ebb current began to run southwards starting at about 20:50 h. The pilot on board ROCKNES estimated the current setting northwards to be about 2 kn, and the captain of the Sea Rescue Boat “ODD FELLOW II” that had overtaken MV ROCKNES shortly before the entrance into Vatlestraumen estimated it at about 3 to 3.5 kn.

VOYAGE PLANNING

4.3.1 Local pilot

The pilot responsible on board ROCKNES on the day of the accident began his pilot training in February 1998. The training with the competent maritime administration[6] took three years with various intermediate certifications. The training was carried out selectively for a local sea area for which the trainee was provided with all the necessary nautical documents. Paper charts that were corrected via the Norwegian Notice to Mariners[7] or alternatively electronic sea charts were available for selection. On the basis of an agreement between C-Map and the authority responsible for the Norwegian pilots for testing electronic sea charts, the pilots had been able to use a C-Map system as an alternative to the paper sea charts since December 1999. In addition they were then still provided with the Norwegian Notice to Mariners, although these

[5] Civil twilight is the period of increasing darkness after sunset during which it is still light enough to read something outdoors; it is the time that the centre of the sun needs after sunset to reach 6 degrees below the true horizon.
[6] Norwegian National Coastal Administration (NNCA)
[7] Etterretninger for sjøfarende (Efs)

did not contain any correction service for the electronic charts drawn up by C-Map itself. The pilot of MV ROCKNES on the day of the accident had made use of this option and was using the C-Map chart, of which he had a version on his home computer. Accordingly a parallel paper sea chart that the pilot still had must have been an old edition of Chart 21.
According to the internal specifications of the waterways and shipping authority responsible for the pilots and their training, the pilots were obliged to have all relevant information about their local sea region at their disposal in order to be able to pilot vessels of all types and all sizes through the relevant estuary. Already during their training candidates were expected to draw up their own route book with all the relevant information about their estuary. They should thus have been enabled to conduct pilot work from their head and to reproduce the sea areas and associated charts from their memory. A final examination after the three year training period then certified the pilot as being qualified to pilot vessels of all types and all sizes through the relevant local sea area.
The pilot had carried with him in his papers his voyage planning based on this training, his experience and his knowledge of the waters. No individual planning had been carried out for the voyage of MV ROCKNES; an alternative route deviating from the passage through Vatlestraumen had not been considered. There had been no meeting with the vessel command prior to the start of the voyage to discuss and agree upon this and to properly pre-plan the forthcoming pilotage and to familiarize with the vessel. Only information about the vessel draft had been requested on leaving the loading station. Further information had been provided to the pilot in advance by his competent pilot station[8] from an internal Norwegian used database. Furthermore, it had been known in pilot circles that course changes with MV ROCKNES had to be started at an early stage and applying small rudder angles, since otherwise the absorption of the turning movement could lead to difficulties. During the first section of the voyage, after leaving the loading station, there had been a brief discussion with the Master about the planned course of the voyage. This discussion had referred among other factors to the current in Vatlestraumen, but had not dealt exhaustively with details. Nor had it been customary to carry out any detailed discussion and agreement with the command of vessels.

4.3.2 Vessel command

According to the specifications of the safety management system of the responsible company (ISM 1.1.2)[9], the vessel manager or charterer were to provide the Master with written voyage instructions. These were to include instructions regarding loading and discharge ports, cargo volumes, travel speed and fuel supply. After receiving the instructions the Master was to check whether the water depths in the loading and discharge ports and along the planned voyage route allowed him to implement the voyage instructions. In addition, the Chief Mate had to draw up his own loading plan, especially as regards the stowing of the cargo. Voyage instructions drawn up by the

[8] Kvitsøy Pilot Station
[9] here: CARGO VESSEL DECK and CARGO OPERATIONS MANUAL, Points 2.2 + 2.3 + 2.19 + 2.20

shore side had not been provided for the forthcoming voyage; however, the loading plan required on the ship's side had been produced.
According to the STCW Code[10] the Master of MV ROCKNES was obligated to ensure before starting a voyage that a voyage plan had been drawn up comprising precise, complete and updated information regarding the dangers for shipping that were significant for safe command of the vessel. There had been a voyage plan drawn up by the vessel command. The ship-side navigational voyage planning had consisted primarily in preparing the electronic sea chart with the planned courses and a printout of the voyage plan. The passage through Vatlestraumen was evidently not accorded any special significance on the grounds of increased danger here. Furthermore, the navigation officer had prepared a pilot information card with all the important details of the vessel that had been displayed next to the chart table and could be made available to the pilot in response to his request.

4.3.3 Electronic sea charts

The expression "electronic sea chart" comprises a large number of systems with the aid of which sea chart information is displayed on a computer screen on the bridge. A distinction is made between three basic types, ECDIS[11], ECS[12] and RCDS[13]. In addition to the main purpose for use of an electronic sea chart, to contributing to safe command of a vessel, substitution for the paper chart is a further concern for navigation. This is basically only admissible when the system used on board complies with the requirements as ECDIS[14] and when sufficient back-up facilities[15] are provided in the event that a system fails. The performance standards for electronic sea chart display and information systems (ECDIS) are regulated in the IMO Resolution A.817(19). Under Section 4.1 there it is stated that the cartographic data to be used should originate from the latest edition of an information medium that has been drawn up by a state-authorised hydrographic service and that it should correspond to the relevant IHO[16]-Standards. A cartographic database standardised in this way is termed an Electronic Navigational Chart (ENC). National hydrographic services are called upon to draw up ENC and provide the associated correction service for the sea area for which they are responsible. For the transitional period in which worldwide coverage with ENC is not achieved, and for sea areas in which there is no ENC, Annex 7 to Resolution A.817(19)[17] permits the use of a sea chart display and information system (ECDIS) in RCDS mode using official raster charts (RNC)[18]. Raster charts are produced by scanning the appropriate paper sea charts observing the relevant IHO Standards for this purpose. In Europe, official raster charts are drawn

[10] STCW Code, Section A-VIII/2, Part 2 Voyage Planning, No 5 Planning prior to each voyage
[11] Electronic Chart Display and Information System
[12] Electronic Chart System
[13] Raster Chart Display System
[14] SOLAS V/19, 2.1.4: "...; an electronic chart display and information system (ECDIS) may be accepted as meeting the chart carriage requirements of this subparagraph"
[15] Resolution MSC.64(67) as supplement to Resolution A.817(19), new Annex 6
[16] International Hydrographic Organization
[17] Resolution MSC.86(70) as a supplement to Resolution A.817(19), new Annex 7
[18] Raster Navigational Chart

up by the hydrographic service of the United Kingdom[19] as the Admiralty Raster Chart Service (ARCS). RNC are a digital reproduction of the current paper sea chart of a sea area as regards both scale and content.
Evidence that performance standards for electronic sea chart display and information systems are satisfied is furnished by type approval. Systems that are not type-approved are basically not counted as ECDIS, but instead as ECS. Some administrations specify a type test[20] for ECS too if such a system is to be used on board a vessel under their flag. However, even type-approved ECDIS that are used on board, not with existing ENC but instead with "non-official" cartographic data material or solely in the RCDS mode, are considered as ECS. ECS in contrast to ECDIS is not a complete substitute for the paper sea chart, however, but instead should be considered as a navigation aid and supplement to the paper chart.
SOLAS Chapter V lists ECDIS as a navigational equipment and system on board; as yet there is no obligation to install this, however. Accordingly it is a matter for the administration of the relevant flag State to decide whether and to what extent a system installed on board can replace paper sea charts, or what sufficient back-up facilities are necessary for this. It is also the task of the flag State to document this in the vessel papers, for example in the Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E).
MV ROCKNES had two electronic sea chart systems on board that were type-approved as ECS. One system runs using charts provided by the private supplier C-Map, and the second used ARCS charts. According to the Record of Equipment for the Cargo Ship Safety Equipment Certificate, only paper sea charts were noted under the section on navigation systems and equipment. The electronic sea chart was ECS type-approved, and thus did not satisfy the requirements of an ECDIS and was in so far not authorised as a primary navigation system. The ECS was to be considered as a navigation support; parallel use of an approved paper sea chart was necessary.

About one week before publication of the new Norwegian paper Sea Chart 21 in February - March 2003, the official electronic sea chart for the Vatlestraumen area had been issued. This ENC displayed the 10 m contour in the area of the Revskolten light beacon in agreement with the new paper sea chart (see also 4.8).

[19] United Kingdom Hydrographic Office (UKHO)
[20] an electronic sea chart can be both ECDIS and ECS type-approved, the relevant certificate must contain information about the relevant admission

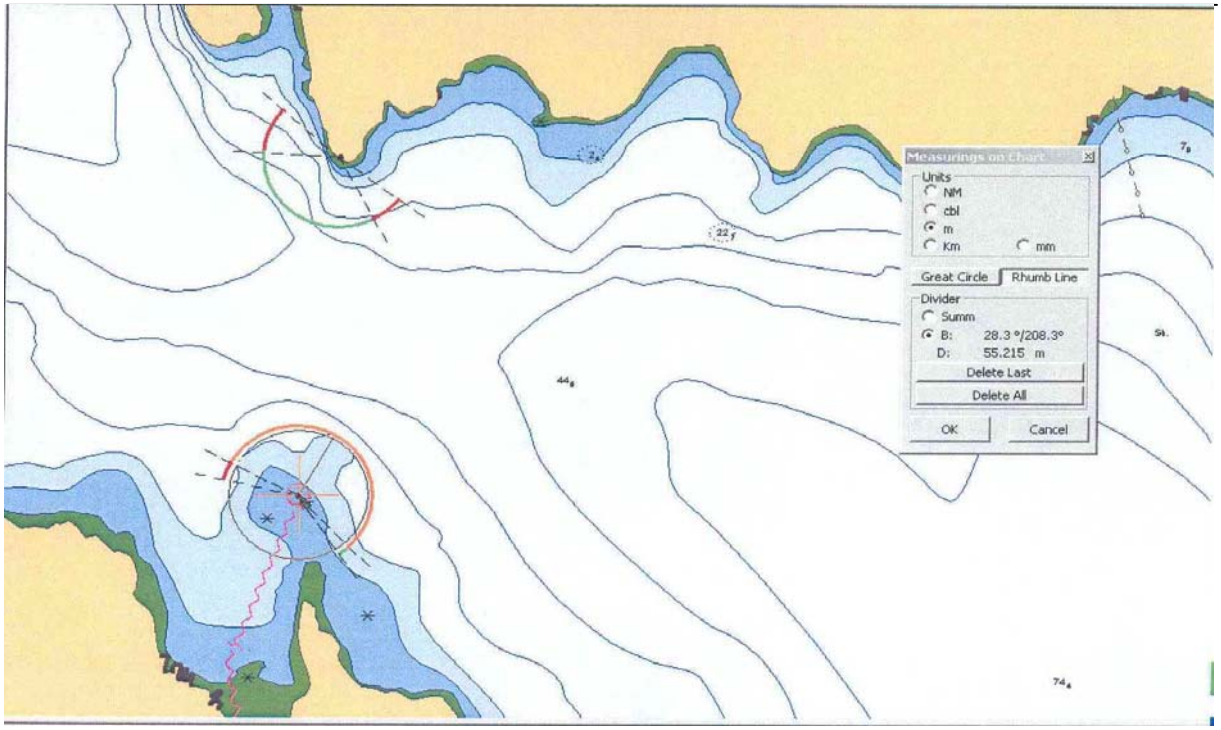
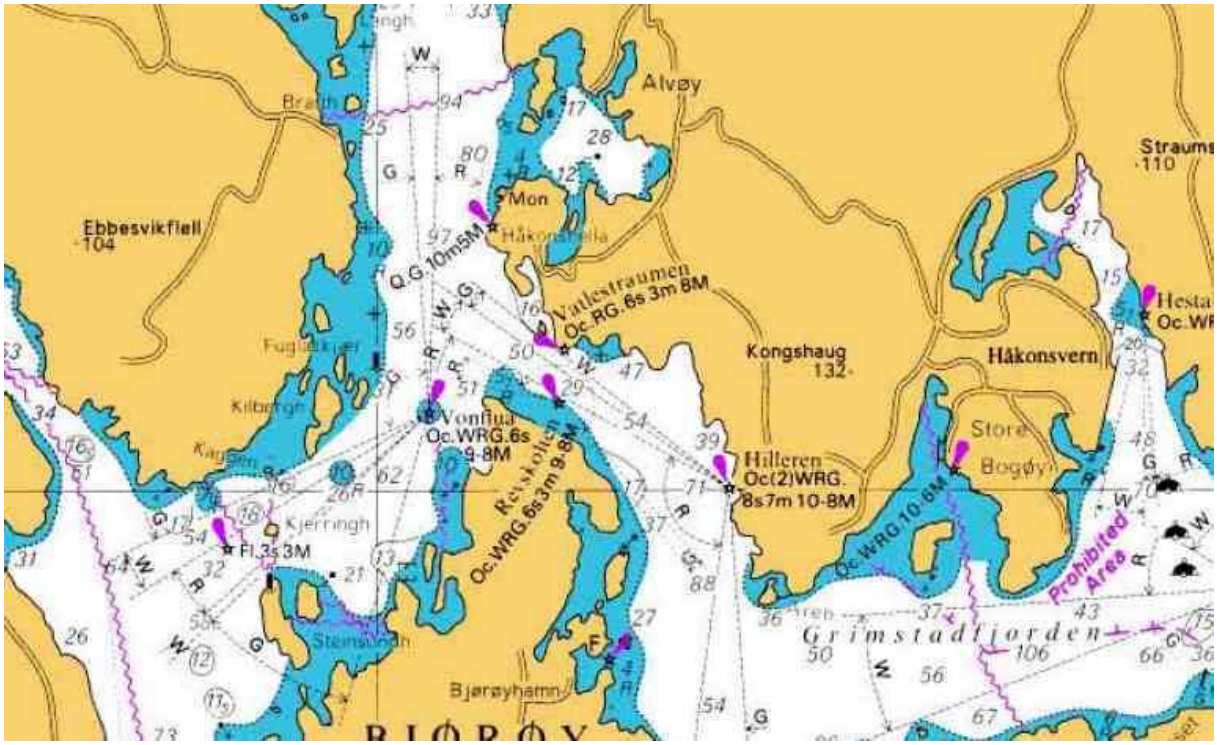


Figure 7: Excerpt from the Norwegian ENC

The C-Map available on board MV ROCKNES at the time of the accident and the ARCS chart, on the other hand, were still based on the presentation of the older edition of paper Sea Chart 21 and accordingly showed the 6 m shallow water danger line running close round the Revskolten light beacon together with the depth information 29 m north-east of the light beacon.

Figure 8: Excerpt from ARCS (up to April 2004)



The correction of the British ARCS showing the altered depth line was only carried out parallel with the correction of the BA 3009 with NtM[21] 1819/2004 in April 2004. In addition, the southern edge of the white sector of the Hilleren light beacon was shown close to the 6 m shallow water danger line in the older ARCS edition.
C-Map had issued an update of the chart in January 2004. In addition to its own electronic sea charts, C-Map as authorised enterprise also markets ENC of various hydrographic services, including those from Norway. ENC newly prepared by a hydrographic service are incorporated into the overall ENC database of C-Map every week and are then available to customers. The C-Map system on board MV ROCKNES had been installed for test purposes in the year 2001. The vessel operator had then decided not to use this system further, however. No correction by C-Map had been procured and so the chart material must in so far have been obsolete.

[21] Notice to Mariners

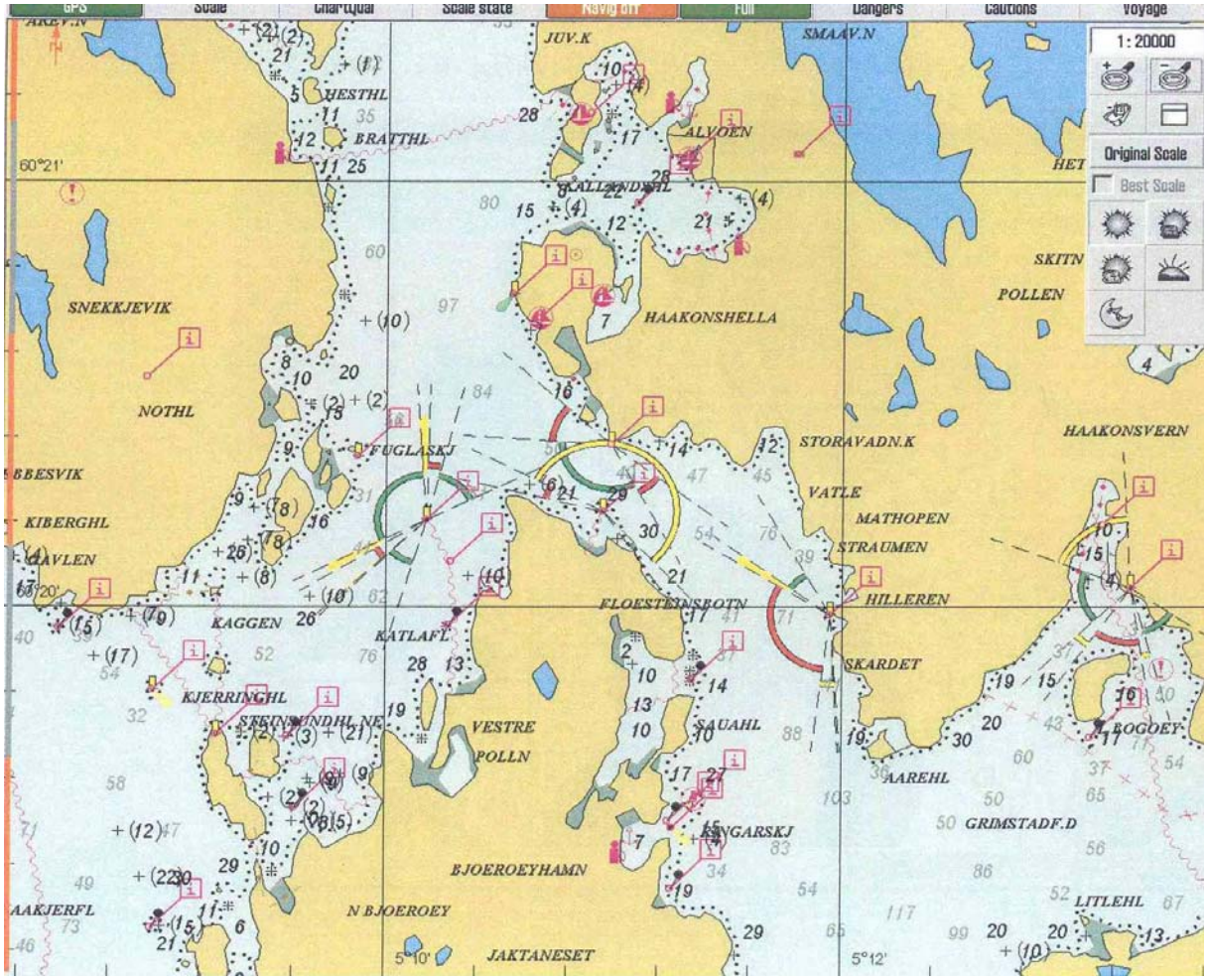


Figure 9: Excerpt from C-Map (up to January 2004)

The electronic sea chart systems present on board MV ROCKNES were only to be used as navigational aids. The datasets used did not contain any complete and updated information regarding the dangers for shipping.
The electronic sea chart system used by the pilot as an alternative to the paper sea chart to prepare the voyage was equally not an authorised electronic sea chart. With the publication of the official ENC in February/March 2003 it was absolutely necessary to provide the local pilots assigned in this area with the updated information regarding the dangers for shipping contained in the ENC. According to SOLAS[22] the use of non-authorised electronic sea charts on board is only admissible if an updated paper sea chart is used at the same time. The new edition of paper Sea Chart 21 should have been available to the pilot in any case.

[22] SOLAS Kap. V, Reg. 19, Ziff. 2.1.4

4.4 LOADING IN EIKEFET

The vessel was moored with its port side alongside the pier. Prior to the start of loading the vessel command had drawn up its loading plan on 17 January 2004 according to which altogether 23025 t gravel of different specification were to be loaded (see Table 1). The loading in Eikefet was carried out with the aid of a conveyor belt made available by the loading operator. On the basis of the speed of a wheel running along beneath the belt the weight of the cargo was permanently co-calculated on the shore side. The conveyor belt could be moved backwards and forwards over the breadth of the vessel, achieving a more uniform distribution of the cargo within the individual cargo holds. However, the belt was altogether too short, so that there were empty spaces in the individual cargo holds on the offshore side, in the case of MV ROCKNES on the starboard side. It was not possible to move the conveyor system lengthways along the vessel; instead MV ROCKNES had to shift each time to load the various hatches.
Loading commenced on Saturday, 17 January 2004, at 16:50 h; loading was completed on Sunday, 18 January 2004 at 20:40 h. The individual holds were loaded in accordance with the following schedule:

Date/Time/Cargo Hold	Cargo/ ∅	max. volume Capacity Plan	Proposed quantity/ loading plan	Loaded quantity/ Bill of Lading
17.01., 16:50 - 20:50 h / 1	0 – 32 mm	3060 t	3300 t	3037 t
17.01., 21:30 – 01:45 h / 6	2 – 8 mm	4657 t	3700 t	3794 t
18.01., 02:45 – 05:45 h / 3	8 – 16 mm	4647 t	4050 t	3897 t
18.01., 06:30 – 09:10 h / 2	2 – 8 mm	4067 t	3200t	3305 t
18.01., 09:25 – 13:00 h / 7	2 – 8 mm	4754 t	3800 t	4025 t
18.01., 13:45 – 20:40 h / 4	16 – 22 mm	6190 t	4975 t	5185 t
	∑:	27,375 t	23,025 t	23,243 t

Loaded quantity/ Bill of Lading	Spec. weight	Volume of cargo acc. to B/L	Cargo hold capacity
Hold 1: 3037 t	1,53 t / m³	1984.97 m³	2096 m³
Hold 6: 3794 t	1,37 t / m³	2769.34 m³	3046 m³
Hold 3: 3897 t	1,45 t / m³	2687.59 m³	3060 m³
Hold 2: 3305 t	1,37 t / m³	2412.41 m³	2689 m³
Hold 7: 4025 t	1,37 t / m³	2937.96 m³	3099 m³
Hold 4: 5185 t	1,44 t / m³	3600.69 m³	4077 m³
∑: 23,243 t		∑: 16,392.96 m³	∑: 18,067 m³

Table 1: Loading diagram for MV ROCKNES

During loading of cargo hold 4 as the last cargo hold, the crew stopped loading shortly before the end. After the crew had read off the draft measurement, a further 10 t of cargo were ordered, and after this the draft was read again; an additional 30 t were then requested. Following further reading of the draft the loading was then finally terminated. This procedure corresponded to the specification of the safety man

agement system of the vessel operator, according to which the Master had to ensure that the vessel took on a maximum of cargo[23].
Contrary to the 23025 t gravel to be loaded in accordance with the loading plan, only 21548 t were loaded according to the shore calculations. However, the draft readings by the vessel revealed loading with altogether 23243 t. In order to verify the difference of over 7%, the draft was checked again; after this the vessel command agreed with those responsible on shore on the quantity actually delivered of 23243 t. The difference of 218 t compared to the quantities planned in accordance with the loading plan was divided between the individual lots according to the Bill of Lading. MV ROCKNES was completely loaded at 20:40 h on Sunday, 18 January 2004. There was no final trimming of the cargo in the cargo holds.

4.5 PASSAGE FROM EIKEFET TO SKÅLEVIK

On Monday, 19 January 2004 at about 08:50 h, the pilot came on board; he reached the bridge at about 08:55 h. The Master, officer of the watch (OoW) and a helmsman were on the bridge, the vessel was ready to depart. The navigational equipment included two radar sets and two electronic sea chart systems; the paper sea chart of the area was lying on the chart table parallel with this. The Norwegian Master of MV ROCKNES cast off from Eikefet, and at about 09:10 h the pilot then took over. Since he had not checked the draft of the vessel himself on coming on board, the pilot asked the Master what the present draft was. The Master had said 10.4 m, the pilot had then made a mental note that MV ROCKNES had a draft above 10 m. The vessel was running at half speed ahead of approx. 8 kn until it left the Kjuasundet at about 09:40 h, after speed was increased to full ahead of approx. 13 kn. About quarter of an hour later MV ROCKNES passed the Bernestangen light beacon on the port side. In order to pass a known shallow there in safe distance, the pilot had ordered the rudder to port 5. This change in course corresponded to this type of vessel in the experience of other pilots too, whereby course changes were to be carried out early and with small rudder angles, since with larger rudder angles there was a danger that the turn in the vessel could not be stopped again in time. The pilot had checked the change in course with the aid of the electronic sea chart, and when the landmark Leknestangen was well ahead on starboard as next way point, the change in course had been terminated with the order to the helmsman “Steady”. During the change in course MV ROCKNES had shown a slight list to starboard, which the pilot considered to be certainly normal with a port rudder angle. However, it had been unusual that after terminating the course change the vessel did not return to even Keel on its own. However, since on the other hand the list did not appear to be threatening, the pilot turned his attention to his pilot tasks again, while the question of stability had been left to the Master and the relieve Master who was also on the bridge for familiarisation. The further passage to Skålevik had proceeded without incident. At about 11:40 h the Master had taken over MV ROCKNES and berthed the vessel with its port side alongside the bunker station.

[23] here: CARGO VESSEL DECK and CARGO OPERATIONS MANUAL, Point. 2.7

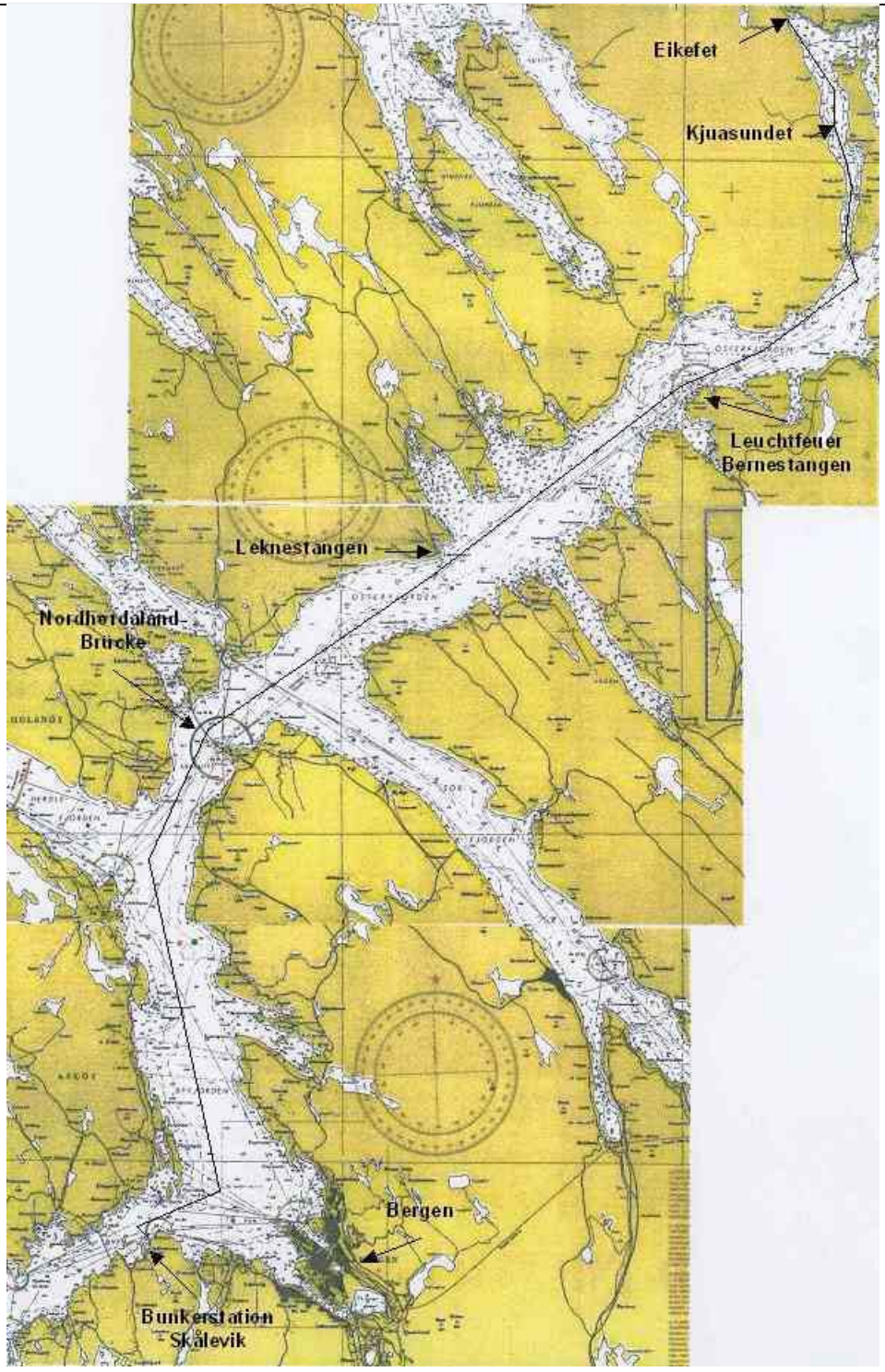


Figure 10: Vessel route ROCKNES from Eikefet to Skålevik
(Summary from Sea Chart 119, Statens Kartverk Sjø)

4.6 BUNKERING IN SKÅLEVIK

On arrival in Skålevik MV ROCKNES had only about 50 t heavy fuel oil in its service and settling tank and about 20 t diesel fuel in the service tank as remaining bunker on board.
Altogether 400 t heavy fuel oil were taken on board, bunkered half each in storage tank 1 on the port side and tank 2 on the starboard side. With a specific weight of about 0.95 t / m³ the 400 t correspond to approx. 420 m³ uniformly divided between the two storage tanks 1 and 2, with about 210 m³ per tank. With a tank volume of 491.2 m³ and tanks almost empty at the start of bunkering, the storage tanks were subsequently just under half full.
50 t diesel oil were taken over and bunkered in storage tank 11 on the starboard side. With a specific weight of about 0.85 t / m³, 50 t here correspond to about 59 m³. Tank 11 with a capacity of 87.8 m³ total volume and also almost empty at the start of bunkering was subsequently 2/3 full.
After taking over the first 40 t heavy fuel oil, the bunker station had noticed an unusual list to port for a vessel of this size but this had dissipated again in the course of further bunkering.
Parallel with taking on the fuel, the vessel discharged sludge and waste oil on shore in Skålevik. MV ROCKNES had a sludge tank, tank 55 on the starboard side with a volume of 34 m³, two waste oil tanks, tanks 56 and 68 on the starboard side with a volume of 21 m³ and 32.8 m³, and a bilge water holding tank, tank 59 midships with a volume of 14.8 m³. It was no longer possible to reconstruct what quantities were given off by which of these tanks; according to the records of the collection station the total quantity discharged was 25 m³.
Nor was it possible to reconstruct whether and if appropriate to what extent ballast water was pumped out at the bunker station Skålevik parallel to bunkering.
The activities in Skålevik were terminated at about 15:30 h. At this time the main engine of MV ROCKNES had already been started again and the engine control had been switched to the bridge.

4.7 ONWARD PASSAGE FROM SKÅLEVIK

The pilot, who had gone ashore briefly during bunkering in Skålevik, had been back on board since about 14:30 h. He did not ask about the quantities bunkered or any change in the draft after bunkering; the pilot had continued to work with his mental note that MV ROCKNES had a draft greater than 10 m.
Still as bridge team present were the Master, the OoW and a helmsman; the navigational equipment was still in operation. The relieve Master on board for familiarisation was also on the bridge, but according to the findings available did not intervene in the following sequence of events. At about 15:40 h MV ROCKNES cast off from Skålevik, with the Master carrying out the casting-off manoeuvre and the pilot taking over subsequently. With a course of about 250° the vessel steered towards the Askøy Bridge and the Hjelteskjer light beacon had been slightly starboard ahead. Halfway between Askøy Bridge and Hjelteskjer light beacon ROCKNES had called BALTIC TRADER proceeding about 1 mile ahead of it on VHF. Since the two vessels were proceeding along the same route southwards, the distance between them was not to be reduced any further and MV ROCKNES reduced speed to about 10 kn. The distance had been monitored with the aid of a variable range marked on the radar.

About five minutes before passing the Sotra Bridge, MV ROCKNES had issued a call on VHF Channel 16 to inform other traffic of its further passage. No other vessels answered this call. Below the Sotra Bridge there had been a slight change of course to port at about 16:05 h in order to take the Håkonshella light beacon dead ahead. Since the deck superstructure did not allow any direct visibility dead ahead, however, the pilot had been forced to change his position on the bridge constantly between port and starboard wing. At this time the Master of BALTIC TRADER travelling ahead observed MV ROCKNES, and while course and speed appeared to be in order, MV ROCKNES had given him the impression of "weak" stability[24]. During this change in course, on the other hand, no exceptional listing had been noted on board MV ROCKNES. Shortly after passing the Sotra Bridge, MV ROCKNES had issued a further call on VHF Channel 16 off Valen. At the same time the pilot had agreed with BALTIC TRADER that the latter would take the Kobbeleia Passage west of Bjorøyna and thus allow the larger vessel, MV ROCKNES, unimpeded passage through Vatlestraumen. With a small course correction to starboard, the Vonflua light beacon off Bjorøyna had been kept slightly to port, a position slightly to the right of the middle of the navigation channel had been steered and the turn into the Vatlestraumen passage had been prepared. At about 16:23 h the Håkonshella light beacon had been approximately abeam to port at a distance of a few cables and the pilot had initiated the turn towards Vatlestraumen with his order rudder port 5. With further rudder commands the pilot had corrected the turn in the direction of Vatlestraumen. He had intended to reach the middle of the passage best approach point.
The command and the pilot were called upon in accordance with the STCW Code[25] to keep each other informed of planned manoeuvres, local conditions, and the characteristics of the vessel. Against the background that he had already piloted MV ROCKNES prior to its conversion or a sister vessel and was supplied with the information from the database of the pilot station and the results of discussions between pilots about the manoeuvring characteristics of the vessel, the pilot felt sufficiently familiar with the characteristics of the vessel. The exchange of information with the vessel's command had been restricted to a brief discussion of the current in Vatlestraumen and the question as to the draft, whereby this question had not been repeated after bunkering. The passage through Vatlestraumen was quite evidently not considered to be a special danger. The necessary change of course for steering into the Vatlestraumen passage was about 55°, and the necessary new course in the white sector of the Hilleren light beacon was 123°. At this time MV ROCKNES was proceeding at a speed of about 11 kn, after having reduced speed previously so as not to run up against BALTIC TRADER running ahead. The change in course was initiated with angle position port 5, by analogous with the change in course at the Bernestangen shallow. The change in course to be carried out at the start of the voyage there was 20°, the speed 13 kn. Even if a much larger change in course at reduced speed was necessary to steer for Vatlestraumen, this manoeuvre was initiated with the same small rudder angle. The experience of the second regular captain of

[24] Excerpt from the English translation of the record of the official Norwegian hearing from 26 to 31 January 2004: "ROCKNES listed from side to side and seemed strange. The ship in the witness's terminology was „weak", i.e. had poor stability.... What he noticed was that ROCKNES listed so much it seemed abnormal. When asked he suggests that the list might have been 5-10 degrees,..."
[25] STCW Code, Section A-VIII/2, Part 3 Watchkeeping at Sea, No 49 Navigation with pilot on board

MV ROCKNES had been to initiate such a change in course with a larger rudder angle, however, and then ease to a smaller rudder angle. In his experience the vessel had a tendency to heel to starboard during changes of course to port.
As per the pilot's statement the change in course at the day of the casualty was terminated with the order "Steady" but without checking the course heading. The pilot had assessed the position of the vessel as slightly right of the middle of Vatlestraumen. This had not been in line with his original intention of taking MV ROCKNES into the middle of the passage. The Hilleren light beacon, still unlit at this time of day, ahead of ROCKNESS had been slightly to port. In the opinion of the pilot MV ROCKNES had been still in its white sector. In order to be able to better monitor the further passage and distance from the Revskolten light beacon, the pilot had left his position on the left of the centre of the bridge and moved over to starboard wing. He had considered the distance from the Revskolten light beacon on the starboard side to be sufficient. The Master had also come to starboard and both had talked briefly about a colleague of the pilot. When the Revskolten light beacon was approximately starboard abeam, MV ROCKNES had sustained two slight vibrations on its starboard side followed by heavier scraping. The Master and pilot had assumed ground contact, especially since the vessel was building up a list to starboard.
The reconstructed data from the electronic sea chart show that the change in course was started at about 16:23 h. Towards the minute 26 MV ROCKNES was in the white sector of the Hilleren light beacon. Its course at this time was 142° and thus almost 20° further south than the course of 123° necessary in order to proceed to Hilleren in the white sector. Already towards minute 27 the vessel had left the white sector southwards. At this time its course of 137° was still approximately 15° more southerly than the necessary 123°. Less than one minute later MV ROCKNES then touched bottom on its starboard side.
According to the STCW Code[26] the presence of the pilot does not relieve either the Master or the navigating officer on duty from their duties and obligations regarding the safety of the vessel. It could not be determined to what extent the vessel command intervened in the change of course before ground contact was made.
Immediately after ground contact the Master had set off the general alarm and ordered the closing of the water-tight doors. MV ROCKNES had issued an emergency call. The pilot had initially ordered "hard a starboard", a command that the helmsman had followed. As the vessel heeled further and more strongly to starboard, the pilot had then ordered "hard a port". The already enormous list had stopped briefly, but had then continued at increasing speed. MV ROCKNES had capsized within a very short space of time.

[26] STCW Code, Section A-VIII/2, Part 3 Watchkeeping at Sea, No 49 Navigation with pilot on board

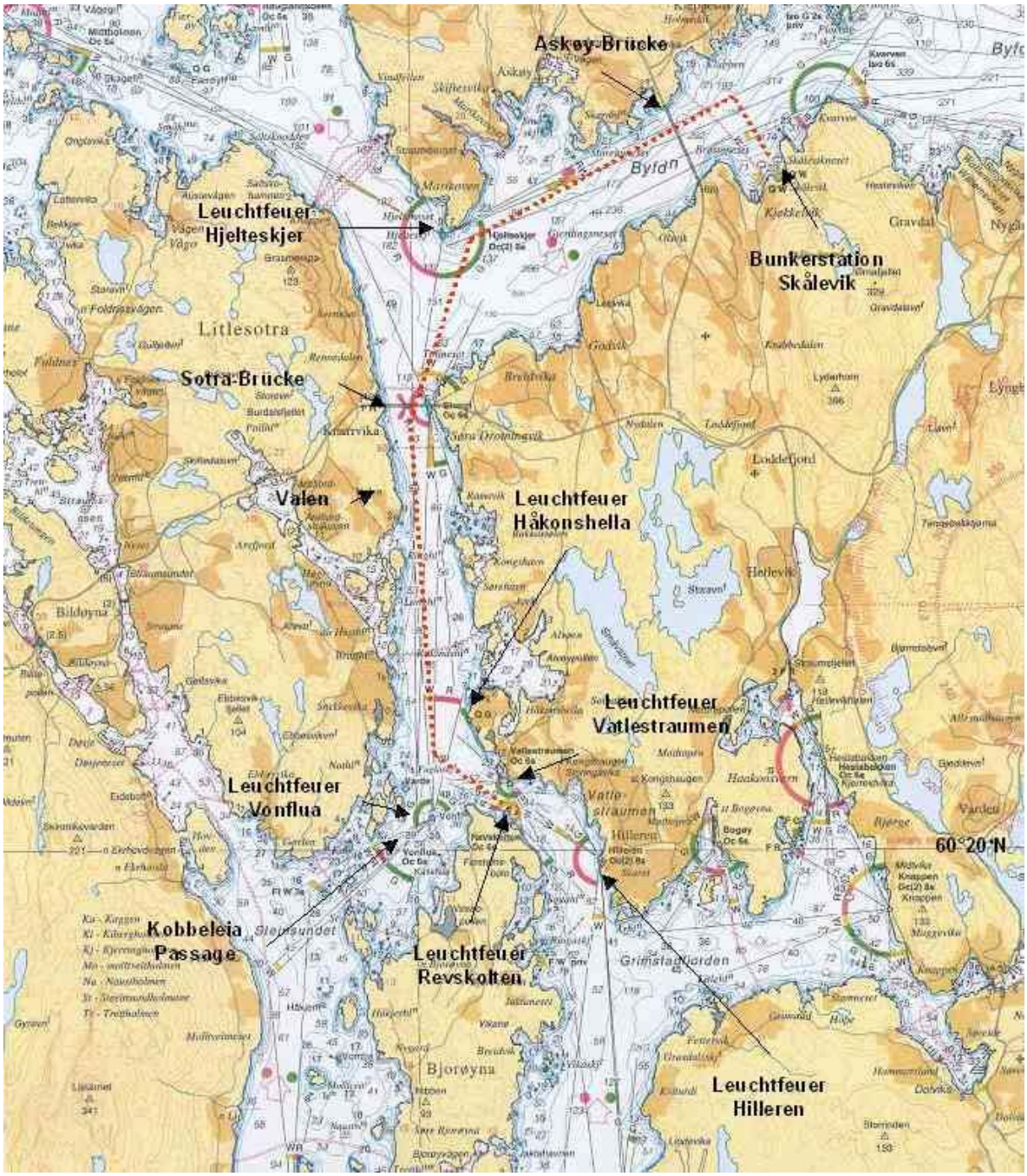


Figure 11: Voyage route ROCKNES after leaving Skålevik
(Excerpt from Sea Chart 21 , Statens Kartverk Sjø)

4.8 VATLESTRAUMEN PASSAGE

The passage through Vatlestraumen is one of the most important passages from and to Bergen and is used by large deep going vessels. The relevant sea area at the scene of the accident is shown in Norwegian Sea Chart No. 21 on a scale 1:50,000.
In the older edition of this chart a shallows danger line[27] was drawn around the Revskolten light beacon indicating that a water depth of less than 6 m could be expected within the area contained by the line. This line runs 33 m in front of the light beacon, corresponding to 0.66 mm on the chart. No 10 m contour had been drawn in this older edition, but there was a 29 m depth entered at a distance of 102 m, corresponding to 2.02 mm on the chart, off the light beacon Revskolten. It could be assumed that there was a uniform increase in depth from the 6 m line to this 29 m depth. Accordingly a water depth of 10 m could be expected from about 12 m of the 6 m line at a distance from the light beacon of then 45 m, corresponding to 0.9 mm on the chart. The boundary between the red and white sector of the Hilleren light beacon was at a distance of 90 m from the Revskolten light beacon, corresponding to 1.8 mm on the chart. Both the 6 m shallows danger line and the 10 m line to be assumed were thus in the red sector of the Hilleren light beacon.

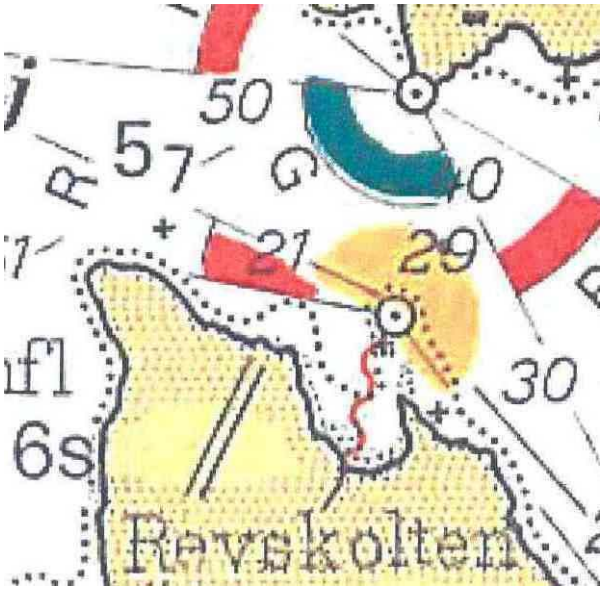


Figure 12: Depth data shown in Sea Chart 21 old
Enlargement of excerpt from Sea Chart 21, Statens Kartverk Sjø

[27] shallows danger line = slaggrunnslinje

In the years 1988 to 2001 the region of the Norwegian Sea Chart 21 was resurveyed by the Norwegian Hydrographic Service (NHS), and Vatlestraumen was sounded again in the year 1995. The horizontal accuracy of this sounding was 10 m. In February - March 2003 a new edition of the Norwegian Sea Chart 21, scale 1:50,000, was issued; the older issue became invalid. In the edition the shallow water area around the Revskolten light beacon is now marked with a 10 m contour line underlaid in blue, within which no water depth greater than 10 m can be expected. This 10 m shallow water area runs at its widest point for 55 m corresponding to 1.1 mm on the chart, north east of Revskolten light beacon, whereby the boundary between the red and white sector of the Hilleren light beacon continued to run at a distance of 90 m before the Revskolten light beacon[28]. The distance from the 10 m contour to the sector limit of the Hilleren light beacon was accordingly 35 m, corresponding to 0.7 mm on the chart. Accordingly this distance had been reduced by about 10 m compared to the old edition of the sea chart. However, the 10 m line still lay in the red sector of the Hilleren light beacon.

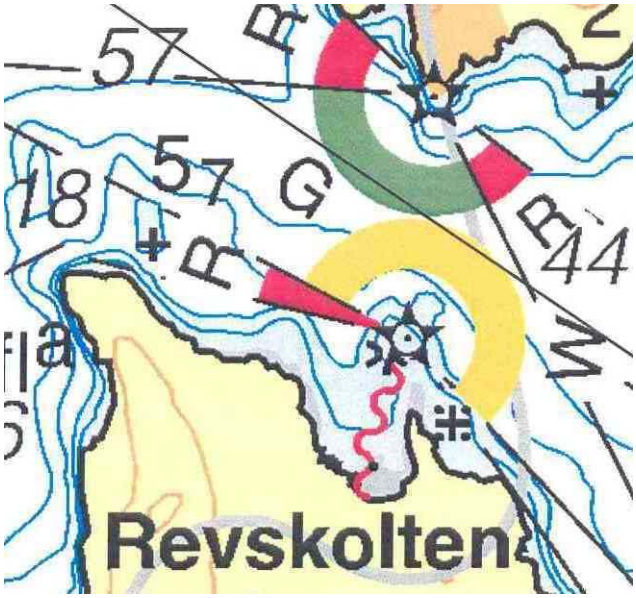


Figure 13: Depth data shown in Sea Chart 21 new
Enlargement of excerpt from Sea Chart 21, Statens Kartverk Sjø

[28] After capsizing of MV ROCKNES the sector limit was enlarged from 90 m to 110 m, but on the date of the accident the boundary was still at 90 m.

Even though the more recent examinations of the bottom topography of this area in the year 1995 did not produce any fundamental changes compared to the older examinations, there were now far more data available. Building on this larger data volume, a fundamentally changed presentation was selected for the new edition of paper Sea Chart 21. Instead of showing a 6 m shallows danger line as earlier, a presentation with a 10 m contour was now selected. In this respect the old and new edition of the chart can no longer be compared, especially as regards accuracy of the coastal contour and the bottom topography. This estimation that the new sea chart presented a completely different situation of the bottom topography in Vatlestraumen is plausible. The 29 m depth information in the old edition suggested that there was still sufficient water depth outside the white sector of the Hilleren light beacon and that accordingly it was unproblematic for vessels with large drafts to approach the Revskolten light beacon. However, the more precise 10 m contour in the new edition highlights the danger deep going vessels in this tight passage clear. To the northeast the 10 m contour still extends 55 m beyond the position of the light beacon. There was no additional sea marker to mark this endangered position. For vessels such as MV ROCKNES with drafts of more than 10 m, the distance from the red/white sector boundary of Hilleren light beacon up to reaching an insufficient water depth was less than 35 m. On leaving the white sector of the Hilleren light beacon abeam of Revskolten light beacon, MV ROCKNES had a safety distance of about one ship's breadth to starboard before reaching insufficient water depth. Accordingly, for a safe passage MV ROCKNES definitely had to remain in the white sector of Hilleren light beacon. This requirement was made more difficult in turn by the fact that the lighting of the beacon was controlled by a photoelectric cell. At the time of the accident the light beacon was not yet lit, so that it was more difficult to check visually whether MV ROCKNES was still moving in the right sector. Furthermore, the new Sea Chart 21 was still issued completely to scale 1:50,000. No separate plan with a larger scale to highlight the special hazards for the safety of navigation in Vatlestraumen had been inserted. In the original scale of the chart, the 10 m contour projected 1.1 mm beyond Revskolten light beacon position. The distance from there to the sector limit was 0.7 mm, and at this point the white sector itself was 1.5 mm wide. All relevant details for recognising the danger are present in the sea chart. However, they are of the order of magnitude of millimetres and are thus not evident at first glance to navigators using the sea chart.

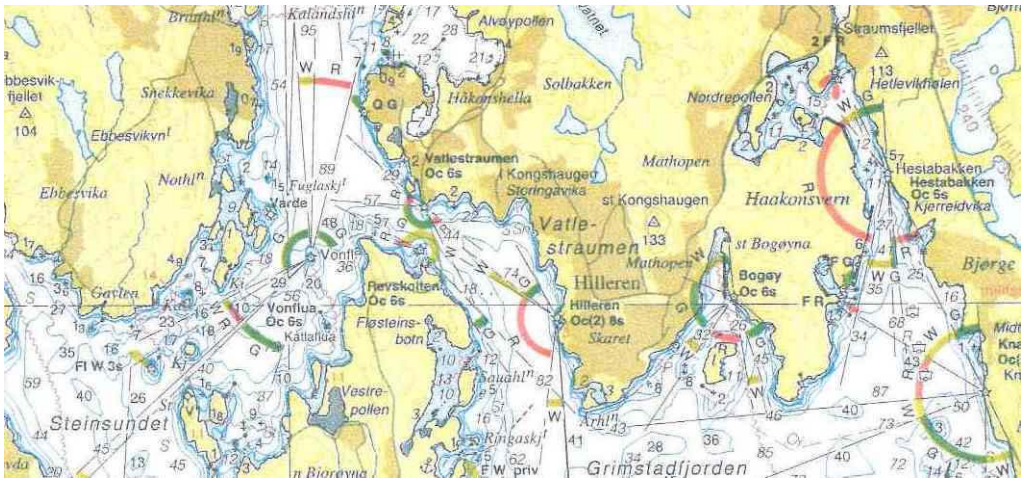


Figure 14: Original size Sea Chart 21, Statens Kartverk Sjø
(Excerpt)

The Norwegian Hydrographic Service[29] responsible for drawing up and issuing the chart also shared this opinion that the old and new edition of Sea Chart 21 were no longer comparable with one another. Despite this, the analysis by NHS came to the conclusion that there was no new information but instead an altered presentation of previously known information. In the year 1995 there had been 121 reported new shallows in the area of Norwegian Chart 21. These had been classified as dangers to shipping and published in the Norwegian Notice to Mariners. The shallow water area around the Revskolten light beacon had not belonged to these, since this was not an isolated newly discovered shallow, but instead an area close to the shore that was surrounded by a 10 m contour. Since the whole area had been located within the red sector of the Hilleren light beacon, this had not been published separately in the Notice to Mariners, nor had any additional buoys been considered necessary. Only a general notice to mariners on the new publication of Sea Chart 21 had been issued.

[29] NHS

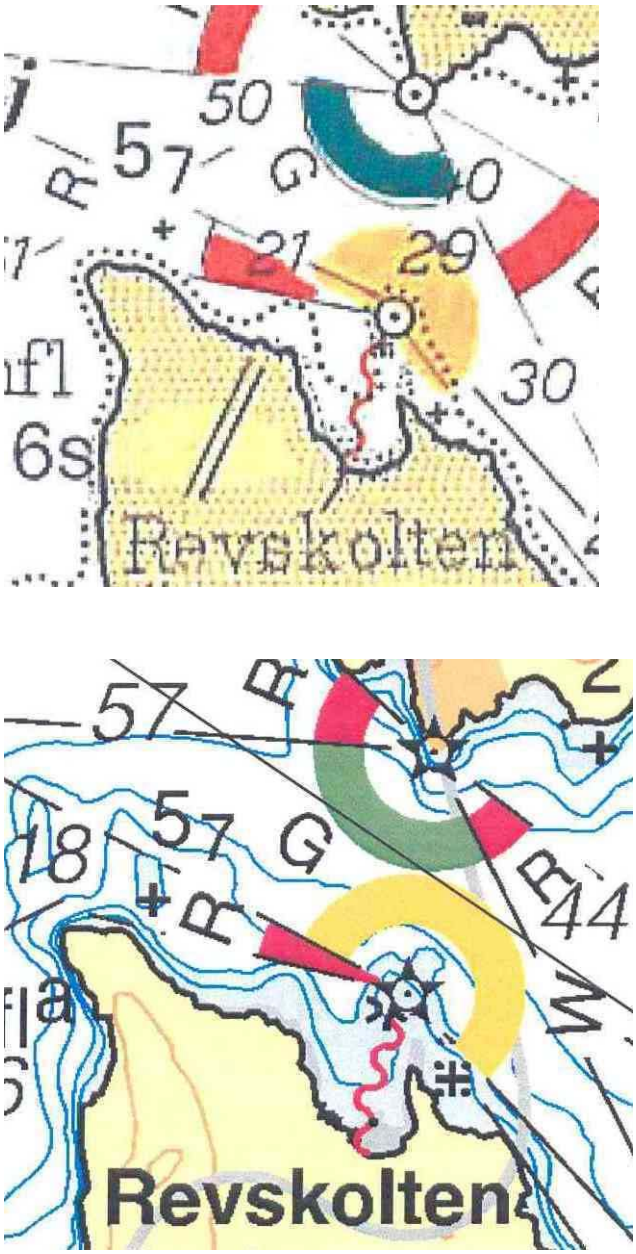


Figure 15: Comparison between Sea Chart 21 old (top) and new (bottom)
Enlargement of excerpt from Sea Chart 21 , Statens Kartverk Sjø

The differing assessment of the situation here between the Hydrographic Service and the coastal administration[30] was shown in the further shifting of the red/white sector limit of the Hilleren light beacon by the administration following capsizing of MV ROCKNES. The NCAW shifted the distance of the red/white sector boundary from Revskolten light beacon from 73 m to 90 m already in the course of retrofitting and converting the Hilleren light beacon in April 2002, thus after completion of the soundings by NHS in Vatlestraumen, but still before publication of the new edition of Chart 21. The distance of 73 m existing since 1919 had at this time not been considered up to date any more due to changes in ship dimensions. Directly after the accident of MV ROCKNES, still in January 2004, the distance was again increased to now 110 m. In the assessment of the NCAW, many mariners at this time had still assumed that it was uncritical to pass close by the Revskolten light beacon and only the renewed change in the sector boundary had ensured a sufficient horizontal safety reserve.

The coastal administration is also the body responsible for training pilots. Only after the ROCKNES accident NCAW was informed in detail of the findings of the Hydrographic Service. Accordingly, the local pilots were only able to familiarise themselves with these new findings after the accident. The marking of the exposed position of the 10 m contour north-east of the Revskolten light beacon by an additional sea marker was only carried out by the coastal authority responsible for this, after MV ROCKNES had capsized, on the basis of the thorough analysis then conducted of the sounding charts of NHS. This measure too documented the different assessments of the risk.

In addition to the Norwegian Sea Chart 21 this sea area is also displayed in the British chart BA 3009 on the same scale 1:50,000. Contrary to the Norwegian chart, no new edition of the BA chart was issued at the beginning of 2003, but the edition of February 1994 continued to remain valid. The changes contained in the new edition of the Norwegian chart, especially the changed presentation of the depth lines in Vatlestraumen around the Revskolten light beacon, were only published in April 2004 in the British Notices for Mariners in the form of a cover sheet to be inserted[31]. This cover sheet then showed the new red navigation channel buoy installed after the accident.

[30] Norwegian National Coastal Administration NNCA / Norwegian Coastal Authority West NCAW
[31] Admiralty NtM No 1819/2004

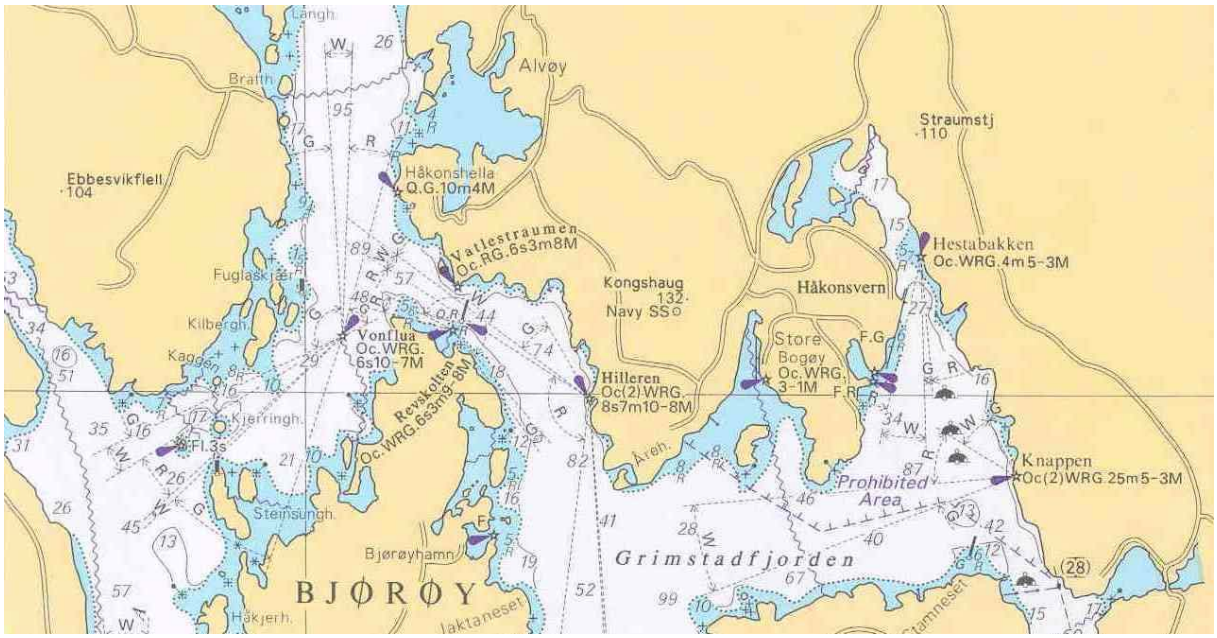


Figure 16: Cover sheet to Admiralty NtM No 1819, April 2004
(Excerpt)

The decision based on the safety analysis by the NHS of not drawing attention expressly to the changed presentation of the bottom topography in the new edition of Sea Chart 21 and the danger for passage of vessels with large drafts evident from this in the Vatlestraumen sea area in the form of a notice to mariners, especially in view of the scale of 1:50,000 of this chart, contributed to it being possible to misestimate the danger potential of this part of the passage. As a consequence neither the vessel command nor the local pilot appeared to be aware of the closeness to the hazard to shipping. The fact that the correction was only published in the British Notice to Mariners after the ROCKNES accident promoted the general unawareness of the danger potential in shipping circles.

4.9 BRIDGE MANAGEMENT

The principles of bridge management are contained in the STCW Code[32]. These state among other factors that tasks are to be allocated clearly and distinctly, all bridge facilities must function properly, and all essential information should be compiled, processed and interpreted. In addition to the pilot, at the time of the accident the Master, an Officer of the watch (OoW) and a helmsman of MV ROCKNES were on the bridge. Also the relieve Master travelling for familiarisation was on the bridge. Paper and electronic sea chart, one X-Band Radar and S-Band Radar and an echo sounder were available. The distance from BALTIC TRADER travelling ahead had been monitored with the aid of a variable range marker However, there are no indi

[32] STCW Code, Section B-VIII/2, Part 3 Watchkeeping at Sea, No 5 Bridge Resource Management

cations as to whether a safety distance from the Revskolten light beacon that must not be, had to be kept as minimum distance primarily and that was to be checked continuously by radar during the Vatlestraumen passage had been set out in the voyage plans of the vessel command or the pilot. Instead it was repeatedly emphasized that the passage had been a visual passage. The radar had only been running along with this. Not only the checking as to whether the vessel was still in the white sector of the Hilleren light beacon, but also the assessment of the distance of track from the Revskolten light beacon had been conducted visually and the results were considered to be sufficient. It appears that there had been no clear and distinct allocation of tasks within the bridge team, for example to the navigating officer, to continuously monitor the distance of track from Revskolten light beacon uninterruptedly on the radar. The course steered on passing the light beacon could not be remembered. The echo sounder was apparently not included actively in the decision-making processes on the bridge as a source of information for the water depth below the keel.

A further disadvantage was the sight obstruction by the deck superstructures. While at the start of the course change the Hilleren light beacon could still be observed well as the next steering point on the port side of the bridge, it then disappeared in the dead sector of the midships superstructure. Nor could the light beacon be visually monitored from navigation and monitoring workstations on the starboard side of the bridge where the radar screens were located. The pilot had instead felt that he had to change his position on the bridge constantly, which must have made it more difficult to assess whether ROCKNES was still proceeding in the white sector of the Hilleren light beacon that was not yet lit at this time of the day. Here too there appears to have been no further allocation of tasks or agreement with the other persons on the bridge.

5 Investigation

On Monday, 19 January 2004 at about 15:40 h the fully loaded MV ROCKNES continued its voyage, after completing an intermediate stop for bunkering, under the pilotage of a local pilot in the direction of the planned German port of unloading, Emden.
At about 16:23 h she changed course to port in order to enter the narrow Vatlestraumen passage. At about 16:26 h the vessel was in the narrow, white sector of the Hilleren light beacon, and at about 16:27 h had left this on its starboard side. Less than one minute later MV ROCKNES with a draft of more than 10 m had sustained ground contact, the ship's bottom was damaged. The list to starboard resulting immediately after this due to water ingress could no longer be stopped and MV ROCKNES had capsized completely within a few minutes.

Figure 17: Bottom damage to the capsized ROCKNES

As a result of the ground contact with subsequent capsizing 18 of the 30 persons on board met their death.
Spilling fuel polluted Vatlestraumen and the coast. The Norwegian Coastal Authority collected a total of 1.291 tons of emulsified sea water which has been determined to be equivalent to 227,5 tons IFO 380. The exact quantities of other oils and lubricants spilled are not known, nor is the amount of loss and damage resulting from this.

As a result of the capsizing the hatch covers and the boom arranged amidships for self-discharge of the vessel were ripped off, the entire cargo of gravel went down. This did not cause any additional environmental damage.

After the rescue measures had been ceased, the vessel was towed to a bay in Ågotnes. The vessel hull was examined and it was decided to upright MV ROCKNES again. From 17 March 2004 onwards the vessel was turned, and on 29 March 2004 it was lying upright again. On 5 April 2004 MV ROCKNES was towed to the Bergen Mekaniske Yard in Laksevaag near Bergen. The vessel was inspected and it was decided to reinstate it. For this purpose MV ROCKNES was towed to Poland. The necessary repair works were initially estimated at more than one-and-a-half years.
In the course of this reinstatement work a large number of conversions were carried out (see Section 7.1 below in the present report). In particular the findings of the technical commission of the affected coastal state, Norway, that had looked into questions of stability (see Section 6.1 below of the present report) were taken into account.
At the end of June 2005 the vessel, now renamed MV NORDNES, was recommissioned. The spectrum of assignment of the vessel in the offshore area too is unchanged.

6 Stability and Follow- Up Actions

6.1 STABILITY

Two central safety aspects result from the course of the accident described under Section 4 of this report. MV ROCKNES, loaded to maximum draft, proceeded too far to the south in Vatlestraumen and as a result sustained ground contact on its starboard side. The damage to the ship's bottom caused as a result of the ground contact led to water ingress, which led MV ROCKNES to capsize within a very short period.
The assessment of the stability issue was the main concern of a working group set up by the coastal State Norway to examine the capsizing. In its final report the working group comes to four conclusions.

1. ROCKNES was not loaded in accordance with the ship's approved stability calculations in respect of the quantity of cargo and ballast, which gave the ship too high centre of gravity.
2. The cargo was not trimmed as described in Chapter VI, Part B, Regulation 7 of the International Convention for the Safety of Life at Sea (SOLAS).
3. If ROCKNES had been loaded in accordance with approved stability calculations and the cargo had been trimmed, it would probably have capsized from the damage the ship suffered from running aground, but not as quickly.
4. The elapsed time under c) would have given the crew more time to undertake an evacuation, and lives might have been saved.

6.2 RELATED IMO SUBMISSIONS

The findings of the Norwegian Maritime Directorate (separate report issued) caused to Norway contains proposals submitted to IMO's 48th SLF sub-committee on subdivision, calculation of attained survivability index and the use of cargo computer. The complete report can be read under:
www.sjofartsdir.no/upload_attachment/Rocknes_report_NMD_working_group.doc

As this aspect is already dealt with, this report here does not consider the safety aspect of the stability and capsizing in further detail. The safety aspect of safe passage through Vatlestraumen is considered below.

7 Safe passage through Vatlestraumen

- Already since his training that began in 1998, it was expected of the pilot that he should be able to reproduce all details of this local sea area relevant for safe passage in his head (Section 4.3.1).
- The pilot's voyage plan was based on the C-Map Electronic Sea Chart System (Section 4.3.1).

- The official ENC had appeared in Spring 2003 (Section 4.3.3).
- ENC and the new issue of the paper sea chart contained the same representation of the bottom topography (Section 4.3.3).
- The pilot did not use the ENC (Section 4.3.3).
- A new issue of the paper chart was not available to the pilot for his voyage planning (Section 4.3.1).
- The voyage plan was not issued individually for the passage with MV ROCKNES (Section 4.3.1).
- Information on the vessel particulars were provided in advance from a database (Section 4.3.1).
- Information on the manoeuvring characteristics of the vessel were based on earlier experience and exchange of experience with other pilots (Section 4.3.1).
- There was no detailed discussion and agreement with the vessel command on the conduct of the pilotage (Sections 4.3.1 + 4.7).
- The only vessel detail checked on board was the draft, and the information that this was greater than 10 m was considered to be sufficient (Sections 4.3.1 + 4.5).
- The vessel was fully loaded in Eikefet (Section 4.4).
- With the 10.4 m stated, the vessel had already approximately reached its maximum draft (Sections 3.2 + 4.4).
- Possible changes resulting from bunkering were not queried (Section 4.7).
- The manoeuvring characteristics of the vessel were not queried on board (Section 4.3.1).
- The vessel's voyage plan was produced on the electronic C-Map sea chart. (Section 4.3.2).
- Vatlestraumen was apparently not considered to be an area requiring special consideration in the voyage plan (Section 4.3.2).
- The Cargo Ship Safety Equipment Certificate only provided for paper charts for navigation (Section 4.3.2).
- The electronic sea chart was type-approved as ECS (Section 4.3.2).
- The electronic sea chart on board was not admitted as primary navigation system (Section 4.3.3).
- The radar was used actively in order to monitor the distance from BALTIC TRADER travelling ahead (Section 4.7).
- The radar was apparently not used actively to monitor the distance from the Revskolten light beacon (Section 4.7)
- The turn into Vatlestraumen was initiated with rudder angle port 5 (Section 4.7).
- Experience of the second captain advised a different initiation of the turn (Section 4.7).

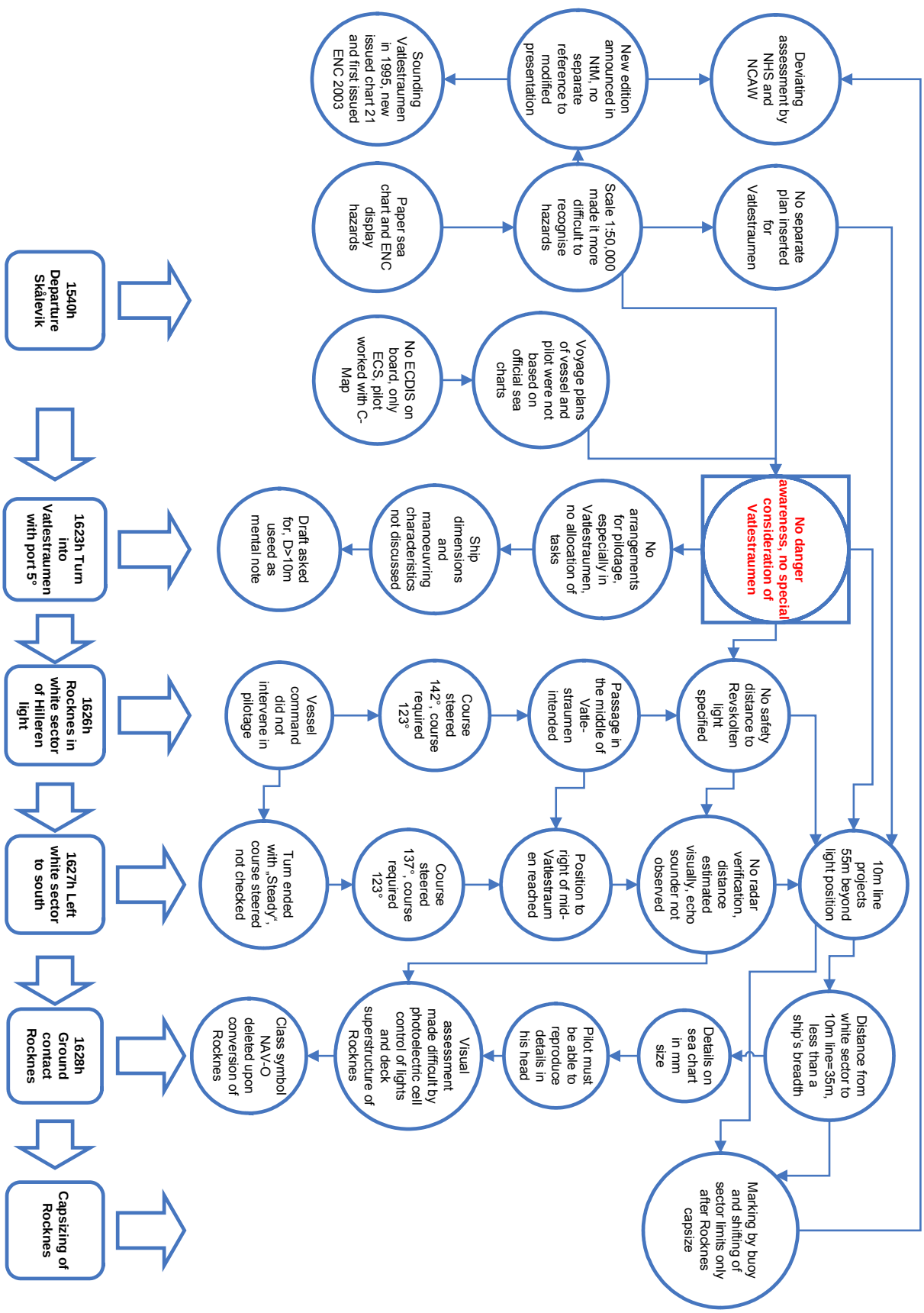
- The middle of Vatlestraumen should have been steered for safe passage (Section 4.7).
- The turn in was ended by the pilot with the order "Steady", but he did not remember the exact course steered (Section 4.7).
- The course on termination of the turn was more southerly than the course required to steer in the white sector of Hilleren (Section 4.7).
- MV ROCKNES was already slightly to the right of the middle of Vatlestraumen (Section 4.7).
- MV ROCKNES left the white sector to the south (Section 4.7).
- The distance from the Revskolten light beacon on starboard was estimated visually and considered to be sufficient (Section 4.7).
- On passing the light beacon MV ROCKNES sustained ground contact on the starboard side (Section 4.7).
- The sea area Vatlestraumen is shown on the paper sea chart in scale 1:50,000 (Section 4.8).
- The size of the chart details necessary for safe passage are in the millimetre range (Section 4.8).
- The findings gained since 1995 on the bottom topography of the area were not published separately (Section 4.8).
- A different presentation was selected for the new edition of the sea chart in Spring 2003 (Section 4.8).
- The scale was retained (Section 4.8).
- There was no separate notification about the changed presentation and supplementary information to be taken from this (Section 4.8).
- The horizontal safety reserve for MV ROCKNES with a draft greater than 10 m on leaving the white sector of Hilleren light beacon abeam of Revskolten Light was less than one ship's breadth (Section 4.8).
- The evaluation of the information sources available for making a decision on passing through Vatlestraumen was incomplete (Section 4.9).
- The assignment of the bridge team for monitoring the safe passage was insufficient (Section 4.9).

7.1 Environment

- A central point in pilot training was memorising and recalling precise knowledge of the estuary area (Section 4.2.1).
- At the time of the accident the light beacons controlled via photoelectric cells were not yet lit (Sections 4.2 + 4.8).
- The tidal current was setting in to the north and was observed at 2 to 3.5 kn (Section 4.2).
- Vatlestraumen was sounded again by NHS in 1995 (Section 4.8).
- The soundings provided more precise knowledge of the bottom topography (Section 4.8).
- The 10 m contour line around the Revskolten light beacon was projecting 55 m in north easterly direction beyond the light beacon position (Section 4.8)
- The administration responsible for training pilots only learned of the new findings concerning bottom topography in Vatlestraumen available with the Hydrographic Service since 1995 as a result of the ROCKNES accident (Section 4.8).
- After the accident the administration saw itself occasioned to shift the sector limits of the Hilleren light beacon as a result of its new knowledge and to lay out a buoy additionally (Section 4.8).

7.2 Visibility from the navigation bridge

- After conversion, the visibility requirements for NOV-O could no longer be fulfilled from the workstations for navigating and monitoring. The class notation NOV-O was consequently cancelled. (Section 4.1).
- On conversion of the vessel a further deck superstructure was built on the starboard side (Section 4.1).
- The new deck superstructure consisted of the lattice structure (Section 4.1).
- The new deck superstructure and that already present in the original structure did not represent inadmissible visibility restrictions from the point of view of the classification society (Section 4.1).
- No new line of sight plan was drawn up (Section 4.1).
- The superstructures on deck forced the pilot to change his location on the bridge constantly in order to have visibility ahead (Section 4.7).


1540h Departure Skålevik
1623h Turn into Vatlestraumen with port 5°
1626h Rocknes in white sector of Hillerøn light
1627h Left white sector to south
1628h Ground contact Rocknes
Capsizing of Rocknes
No danger awareness, no special consideration of Vatlestraumen
Deviating assessment by NHS and NCAW
New edition announced in NtM, no separate reference to modified presentation
Sounding Vatlestraumen in 1995, new issued chart 21 and first issued ENC 2003
No separate plan inserted for Vatlestraumen
Scale 1:50,000 made it more difficult to recognise hazards
Paper sea chart and ENC display hazards
Voyage plans of vessel and pilot were not based on official sea charts
No ECDIS on board, only ECS, pilot worked with C-Map
No arrangements for pilotage, especially in Vatlestraumen, no allocation of tasks
Ship dimensions and manoeuvring characteristics not discussed
Draft asked for, D>10m used as mental note
No safety distance to Revskolten light specified
Passage in the middle of Vatle-straumen intended
Course steered 142°, course required 123°
Vessel command did not intervene in pilotage
10m line projects 55m beyond light position
No radar verification, distance estimated visually, echo sounder not observed
Position to right of mid-Vatlestraumen reached
Course steered 137°, course required 123°
Turn ended with „Steady", course steered not checked
Distance from white sector to 10m line=35m, less than a ship's breadth
Details on sea chart in mm size
Pilot must be able to reproduce details in his head
Visual assessment made difficult by photoelectric cell control of lights and deck superstructure of Rocknes
Class symbol NAV-O deleted upon conversion of Rocknes
Marking by buoy and shifting of sector limits only after Rocknes capsize

8 Action taken

8.1 MODIFICATIONS DURING REPAIR OF ROCKNES

During reconstruction of MV ROCKNES, subsequently renamed MV NORDNES, a large number of modifications compared to the original design and the findings of the technical group of the Norwegian Maritime Directorate were implemented in consultation with all parties involved.
Mainly the following modifications were carried out:

- Two wing tank (Sponsons) each 750 mm wide were installed on the hull on the outside to improve the stability.
- The wing ballast tanks Nos. 1 and 2 were divided horizontally into bottom and top tanks to improve the damage stability.
- The bridge wings and bridge were widened on each side by 750 mm to improve bridge visibility.
- Two fire emergency exits from the accommodations to the lifeboat station were installed on each deck.
- A further emergency exit from the mess room was installed.
- A skeg was fitted to improve the rudder effect.
- The rudder angle and propeller pitch indicators were installed in the bridge wing control stations.
- Manual sounding pipes were installed in all tanks.
- Four additional 25-person life rafts were placed at the forward edge of the accommodation.
- Approved electronic sea charts were installed.

9. Sources

- Documents of the Norwegian Investigation Commission:
- Report from the maritime inquiry
- Witness statements
- Report from the working group charged with considering the ship-technical aspects of the capsizing of Rocknes
- (http://www.sjofartsdir.no/upload_attachment/Rocknes_report_NMD_working_group.doc)

- Investigations by the Norwegian Maritime Directorate:
  - Evaluations of the electronic sea chart ROCKNES
  - Fig.2: ROCKNES at the bunker station Skålevik on the date of the accident
  - Fig.17: Bottom damage to the capsized ROCKNES

- Conversion plans of NORDNES to reinstate and recommission the vessel

- Comments by the owner and operator on the conversion measures performed.

- Investigations by the Flag State Administration Antigua and Barbuda W.I.:
  - On-Scene Investigation by the Chief Casualty Investigator and one Sworn Shipping Expert.
  - Statements taken from survivors (human evidence),
  - Analysis of fact findings
- BSU:
  - New building file KVITNES
  - Drawings ROCKNES
  - Excerpts from the safety management system of the operator of MV ROCKNES
  - Sea charts

ATTACHMENTS

Human Evidence – Protocols of Principal Witnesses (translated)
Human Evidence – Protocols of Eyewitnesses (translated)
Norwegian Maritime Directorate - Report from the Working Group
Rocknes Modification Team – Comments by the Owner and Operator
Rocknes Documents – Checklist of Certificates, Surveys & Validity

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