Reference and file no
(Norway) 227/2000
Reference and file no
(Finland) 1/2001J

Joint Norwegian/Finnish
Marine Casualty Report
May 2001

MARINE CASUALTY REPORT

On the cargo ship *ULSUND* - LHNW - which went down off Lista, Norway on 27 February 1998 and whose entire crew of 7 lost their lives in the casualty.

This report contains the following:

This marine casualty report is a joint Norwegian/Finnish report prepared by the Maritime Investigator in Oslo and Accident Investigation Board Finland, Helsinki.

The investigation of the casualty is mainly based on the following:

- Following the loss of the ship, a maritime inquiry was held in Skien and Porsgrunn City Court from 16 March to 25 March 1998.
- The Norwegian royal navy vessel *TYR* located the sunken ship and examined it by ROV (remote operated vehicle) from 28 April to 30 April 1998.
- During 1998 and 1999, Finnish seafarers who have served on board were questioned.
- Dacon Marine Operation AS examined the sunken ship by ROV in the summer of 1999 in connection with the salvaging of aluminium cargo from the sunken ship.

Short summary

ULSUND loaded 2,404 metric tons of aluminium in St. Petersburg, Russia in the period from 14 February to 17 February 1998. The ship sailed from St. Petersburg on 17 February 1998 at 1915 hrs, heading for Høyanger, Norway. There was ice in the innermost part of the Bay of Finland and the ship had to wait for about two and a half days for icebreaker assistance. The ship arrived at Copenhagen in the morning of 25 February 1998 after being slightly delayed in the Baltic Sea due to bad weather. The captain was replaced in Copenhagen. The cargo and the excavator were checked and found to be in order and bunker oil, fresh water and provisions were brought on board. In the afternoon of 25 February 1998, the voyage to Høyanger continued. In the Skagerrak, the ship encountered SW/W winds, varying between near gale and gale, and heavy sea, 5 to 6 m. The ship's speed was reduced to 3 to 4 knots. The master called the shipping company in Finland both on 26 February and on 27 February 1998 without giving any information about problems related to the seaworthiness of the ship. On 27 February 1998 at 2125 hrs the ship transmitted the distress alert MAYDAY on VHF radio channel 16 from the position N 57-57.8 E 006-12.6. Farsund Radio answered the ship immediately and after roughly 70 seconds the captain told them that: a) the ship made water, b) its port bulwark and deck were submerged, c) it listed approx. 6 degrees (to port), d) they were trying to pump, e) they needed immediate assistance, f) there were 7 people on board. It is assumed that the ship went down in the course of about 10 to 15 minutes, as no other vessel observed any clear radar echo in the indicated casualty position. The first vessel reached the indicated casualty position about one hour later, at which time there was only wreckage left. The whole crew of seven lost their lives. (In Figure n:o 6, the position of the accident)

1. Information on the ship/matters relating to the ship

Name of ship	: *ULSUND* (List of Sources No 1)
Home port	: Brevik, Norway
IMO no.	: 7123461
Signal letters	: LHNW
Ship register	: Norwegian Ordinary Ship Register (NOR)
Type of ship	: Cargo ship
Year of build	: 1971
Construction yard	: Fredrikshavn Værft & Tørdok, Denmark
Conversion	: 1987
Tonnage	: 1,572 grt
Propulsion power	: 920 kW
Hatch covers	: MacGREGOR, single pull hatch covers
Excavator	: Åkerman H16C, mounted on longitudinal transverse above the hatch to the hold
Crew	: 7
Company/Owner	: Trond A. Kittilsen Shipping A/S, Frøyasvei 9, 3960 STATHELLE
Class	: Norwegian Maritime Directorate (unclassed)
Bareboat charterer	: Rofera OY Ltd., Valtakatu 10, SF-26 100 Rauma, Finland
Representative of bareboat charterer	: Hannu Norrgård, c/o Oy Nord Shipping AB Valtakatu 10, SF-26 100 Rauma, Finland
Comprehensive and P&I insurance	: Sev. Dahl Stavanger AS, P.O. Box 190, 4001 STAVANGER
Former name(s) of ship	: *EIDSVÅG*, *MINA*, *EVA*, etc.
Former owner of ship	: Arnesen of Farsund, and others

Life-saving appliances:

1 open lifeboat with an engine. The lifeboat was located on the port side and had a capacity for 16 people.
2 life rafts, (capacity for 2 x 8 people), with a total capacity for 16 people.
8 lifebuoys.
8 life jackets.
7 survival suits.

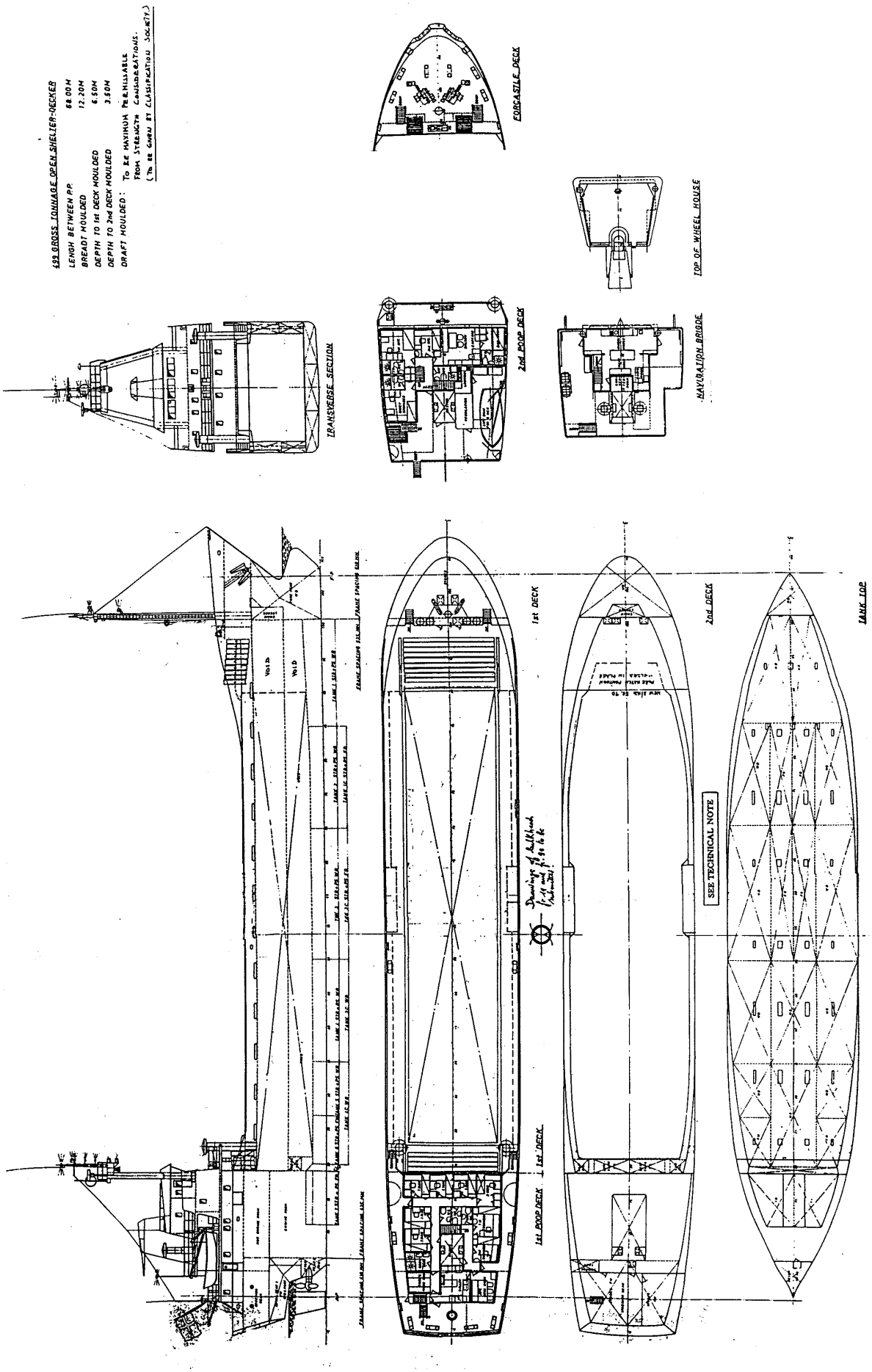
Radio equipment for life-saving appliances:

1 portable radio for life-saving appliances.
3 two-way radiotelephones.
1 EPIRB (121.5 MHz and 243.0 MHz).

1.1 General information.

ULSUND was originally a ship with an intermediate deck and two holds, supplied by Fredrikshavn Værft & Tørdok AS in 1971 as Bureau Veritas class.

In 1987, the vessel was modified and the intermediate deck was removed, the hold was boxed in at the same time as a mast and several booms were removed and one large cargo hatch was installed instead of two. Rails were installed, as were a traverse beam and an excavator, and the vessel became a so-called self-loader.


139 GROSS TONNAGE OPEN SHELTER-DECKER
LENGH BETWEEN PP. 68.00M
BREADT MOULDED 12.20M
DEPTH TO 1st DECK MOULDED 6.50M
DEPTH TO 2nd DECK MOULDED 3.50M
DRAFT MOULDED: TO BE MAXIMUM PER MISSABLE FROM STRENGTH CONSIDERATIONS. (TO BE GIVEN BY CLASSIFICATION SOCIETY)
FORCASTLE DECK
TOP OF WHEEL HOUSE
NAVIGATION BRIDGE
2nd POOP DECK
TRANSVERSE SECTION
1st DECK
2nd DECK
TANK TOP
1st POOP DECK
1st DECK
SEE TECHNICAL NOTE

The vessel was assessed for classification purposes as an ordinary dry-cargo ship and not as a bulk carrier.
The main features of the periodic inspections are as follows:

	Date of inspection	Valid until
Main class (BV)	09/90	09/95
Full renewal of certification by Norwegian Ship Control (i.e. main class)	08/91	08/96
Main class (conducted before the end of the period) DnV authorised pva SK)	04/95	04/00

1.2 Class-related matters etc. in 1987.

Registered in NOR (Norwegian Ordinary Ship Register) and rebuilt.

The ship was purchased from Malta and registered in NOR in 1987.

The original intermediate deck was removed, a steel wearing-deck was laid on the inner base (tank top) and steel plates were laid on the dunnage so that the hold was boxed in. The boxing-in of the hold rendered inspection of the inner skin of the side and double-bottom of the hull impossible.

The ship was originally equipped with two hold hatches, but these were modified in 1987 to form one large hatch. Since the ship was classed in Bureau Veritas until 1991, it must be assumed that the company took care of all strength and safety matters in connection with the rebuilding of the vessel.

Later, five starboard and port double-bottom tanks were converted from ballast tanks to freshwater tanks.

1.2 Class-related matters etc. in 1991.

24 April 1991: Change of name from EVA to MINA.

Full renewal of certification (main class) and transfer from Bureau Veritas to Norwegian Ship Control in August 1991.

According to a status report prepared by Bureau Veritas, the ship underwent full main class classification in September 1990.

In a letter to Bureau Veritas, Arnesen Shipbrokers AS requested a transcript of the ship’s status, and received on 8 June 1991 a transcript showing which engine components would fall due for control within the next six months.

The report of 5 August 1991 issued by Norwegian Ship Control generally confirms that all the above-mentioned engine components/equipment were inspected and that a number of tanks and pipes were also inspected. Furthermore, a number of tanks were tested for pressure and the

thickness of the skip's sides and decks was measured, as were two cross-sections of the skip's half-length amidships.

A total of 25 orders were issued, and these were confirmed by Norwegian Ship Control on 15 January 1992 as having been complied with.

Safety certificates for equipment and construction and a load-line certificate were initially issued on a short-term basis and subsequently with full validity, i.e. in the case of the Construction Safety Certificate until 31 August 1996, and in the case of the Load-Line Certificate until 31 July 1996.

1.4 Class-related matters etc. in 1993.

31 August 1993: Change of name from MINA to EVA.

A name certificate was issued to Farsund Mini Bulk AS, Farsund, on 31 August 1993. Operations were managed by Arnesen Management AS.

22 October 1993: Grounding Vierow Piers, Germany.

Captain X characterised the contact as "not noticeable onboard" and reported that "no visible damage/leaks were discovered after the ship was pulled off".

A "diver's survey" prepared by X, Karlshamn, mentions only trifling damage.

4 December 1992: Grounding Halskov, Denmark.
The ship was ran aground on two occasions on its seaward approach to Halskov and had to be pulled off by T/B Ysselstroom at the same time as a small passenger boat "pushed from the port side".

A subsequent diver's survey prepared by Inshore Marine-Service A/S mentions damage that is both relatively comprehensive (on the port-side flat-bottom just inside the apparent horizon from stem to stern), and with relatively deep indentations (varying between 30–100 mm).

The matter also resulted in an order issued by Norwegian Ship Control to dock for inspection.

1.5 Class-related matters etc. in 1995.

13 March 1995: Change of name from NIS-registered (Norwegian International Ships Register) EVA to ULSUND pva Trond Kittilsen A/S.

April 1995: Renewal of all certificates (HSSC) by Det norske Veritas, Klaipeda.
The ship owner informed the Norwegian Maritime Directorate that it wished to renew all certificates during the vessel's call at Klaipeda, in spite of the fact that the Construction Safety Certificate and the Load-Line Certificate were valid until 31 August 1996 and 31 July 1996, respectively.

In a fax dated 3 April 1995, the Norwegian Maritime Directorate assigned Det Norske Veritas with responsibility for coordinating the issuing of certification pursuant to the Harmonized System of Survey and Certification.

Det Norske Veritas issued complete checklists as mentioned below.

As regards measurements of thickness, the assessment was conducted on the basis of random tests of the documentation available.

According to an invoice dated 21 April 1995 issued by the wharf in Klaipeda, 1,817 measurements were taken, which would appear to be a good figure for such a relatively small ship.

An unusually large number of measurements were taken of the bottom of the ship, while few measurements have been taken of the ship's casing, and no measurements were taken of the deck on either side of the hatch.

Most of the thickness measurements are well within the requirements, but a number of them were marked as being "questionable" on the report pages selected for control.

28 August 1995: Contact with quayside Rostock.

According to the inspection survey, minor damage was incurred on the starboard bow above the waterline. Det Norske Veritas was appointed the task of adjudging the seaworthiness of the vessel after provisional repairs had been carried out.

Installation of new excavator type ÅKERMAN H16C in 1995.

An excavator of the type ÅKERMAN H16C was, after it had been installed, tested by the company Brevik Construction AS on 11 May 1995. On the test certificate, the above-mentioned company wrote: (List of Sources No 1A)

1. Situation and description of crane:
   An excavator type ÅKERMAN H16C erected on a transverse beam which can run fore and aft by chain drive above cargo hold. The excavator can move transversly on the beam by the excavator's steel belts. **During voyage the transverse beam shall be parked on aft end of cargo hatch and locked.**
   The excavator to be parked in center on the beam and locked by the locking bolts.

2. Maximum radius at which the test load was applied:
   Max Radius.

3. Test load applied:
   5 tons

4. Safe working load:
   4 tons.

Information (excerpt from the maritime inquiry) from ship owner Trond A. Kittilsen concerning the excavator, Åkerman H16C:

Mr Kittilsen estimated the weight of the excavator and the traverse beam to be approx. 45 tonnes in total, and stated that the excavator was attached to the traverse beam by four bolts with a diameter of 100 millimetres, two on each side, that chains and turnbuckles were also used, and that the traverse beam was secured by means of two bolts, each of which was 100 millimetres in diameter, one on each side, at one end of the steel rails, and that chains and turnbuckles were also used.

Mr Kittilsen explained that the system for parking and locking the excavator and the traverse beam was manufactured by Einar Øgrey's Mek. Verksted in Farsund, though he was the one who had added the chain and turnbuckles.

Mr Kittilsen explained that he was unaware of whether anyone had approved the above system for parking and locking the excavator and traverse beam. (List of Sources No 1B).

1.6 Class-related matters etc. in 1996.

2–9 September 1996: Annual inspection.

The annual inspection included the load line, safety equipment and construction certificate.

1.7 Class-related matters etc. in 1997.

24–26 February 1997: Unannounced inspection.

The Norwegian Ship Control in Horten inspected ULSUND at the request of the Inspection Division of the Norwegian Maritime Directorate. A hosing test revealed major leaks in several places on the hatches owing to deficient gaskets and wedges. These deficiencies were remedied.

Approx. 24 March–25 April 1997: At Porsgrunn Verksted AS.

Time spent at the wharf due to the ship running aground at Læsø, Denmark.

The Norwegian Ship Control marked the extent of the damage on the bilge plate on the port side between frames 35 and 44, frames 54–57 and frames 96–98. Approx. 10m2 of plate, 3,000 kg of steel, was replaced. A crack on the port side of the engine room was repaired and a bilge keel on the port side was replaced.

In addition, the propeller axle was withdrawn, the rudder was lifted and the steering engine was inspected.

This work was carried out and checked internally and externally by the Norwegian Ship Control on 18 April 1997.

1 September–5 September 1997: Annual inspection.

A total of 15 orders were issued, covering such matters as hatches, doublings on the side of the vessel, indentations in skin plates, and crew conditions. Work was carried out during weeks 35 and 36 at Porsgrunn Verksted AS and all orders were complied with before departure.

Telenor inspected the radio appliances and endorsed the Radio Safety Certificate on 19 August 1997.

1.8 Information (excerpts from the maritime inquiry) from ship owner Trond A. Kittelsen concerning matters relating to the ship in 1997.

Mr Kittelsen explained that in March/April 1997 the ship had run aground at Læsø in Denmark, after which it had sailed to Fredrikshavn where a diving survey was made, at which point no leak was found. From there, the ship sailed to Rostock and was unloaded, and was then sailed to Porsgrunn Verksted and was put into dock.

Mr Kittilsen explained that, at the instructions of the Norwegian Ship Control, the ship was then the subject of various repairs, including the removal and inspection of the propeller axle, the replacement of bilge plates on the port side, the installation of new anodes, and the sand-blasting and painting of the bottom of the vessel.

Mr Kittilsen assumes that the bottom valves were not then checked.

Mr Kittilsen explained that while the ship was in dock he inspected the outside of the hull, which looked good, and that the wharf employees announced that steel hull was in good condition.

Mr Kittilsen explained that the principal went into compulsory liquidation at the same time, and the vessel remained in port at Porsgrunn Verksted after the above-mentioned docking, i.e. from 24 April 1997.

Mr Kittilsen explained that representatives of Rofera OY Ltd. in Finland, among them Rolf Cederberg, arrived in Porsgrunn at the end of July 1997, i.e. while the ship was in dock at Porsgrunn Verksted, in order to arrange practical aspects regarding maintenance in connection with the forthcoming bareboat charter.

Fig. 1: Ulsund in dry dock at Porsgrunn, July 1997 (B. Cederberg)

Fig. 2: Ulsund in dry dock at Porsgrunn, July 1997 (B Cederberg)

Mr Kittilsen explained that the Finns then cleaned and checked the ballast tanks and the ballast lines, and carried out cosmetic improvements such as painting the deck, the superstructure and the hull.

Mr Kittilsen explained that the Finns then changed the flat bar iron and gaskets on the MacGregor hatches, and some of the flat bar steel on the bearings along the hatch sills.

Mr Kittilsen explained that the Norwegian Ship Control then tested for leaks on the MacGregor hatches, which were approved.

Mr Kittilsen explained that he was satisfied with the work of the Finnish labourers on the MacGregor hatches and that they were scrupulous and did a good job.

Mr Kittilsen explained that on 21 August 1997 he purchased a new Zodiac life raft with capacity for eight people, and that the raft's hydrostatic releasing device was checked.

Mr Kittilsen explained that on approx. 1 September 1997 Porsgrunn Verksted replaced three plates on the port side of the vessel approx. 70 cm from the top plate to the deck.

Mr Kittilsen explained that he only saw this work from the quayside and that it looked good.

Mr Kittilsen explained that at the same time two new portable VHF radios were purchased.

Mr Kittilsen explained that at the same time Televerket, the Norwegian telecommunications company, represented by Mr Kirkelid, checked that the radio certificate had been renewed. Mr Kittilsen is unaware, however, of whether the free-floating satellite emergency beacon had been checked.

Mr Kittilsen explained that he could not remember which type of emergency beacon was on board the vessel.

Mr Kittilsen explained that all the ship's certificates were endorsed as of 5 September 1997.

Mr Kittilsen explained that after this there were no outstanding orders, and that the last order complied with concerned the crew, which was rectified when the Finnish seafarers arrived, though with a Norwegian captain.

Mr Kittilsen explained that the ship sailed from Porsgrunn at 18.00 hours on 5 September 1997 with a Norwegian captain and Finnish crew,

1.9 Overview of valid certificates for ULSUND at the time of the loss.

Certificate	Issued / By	Date of expiry
Disp. Certificate pursuant to work	29.05.1995 / BEM	29.05.1999
Radiotelephone Certificate	03.05.1995 / TD	29.04.2000
Internal Load Line Certificate	06.09.1995 / HTN	29.04.2000
Equipment Safety Certificate	06.09,1995 / HTN	29.04.2000
Construction Safety Certificate	06.09.1995 / HTN	29.04.2000
IOPP MARPOL annex I Int.	06.09.1995 / HTN	29.04.2000
Statement of Inspection 220V	07.08.1996 / ET	31.08.2001

1.10 Bareboat charter of ULSUND on 15 August 1997.

As of 15 August 1997, ULSUND was on bareboat charter. The charterer was Rofera OY Ltd., Valtakatu 10, 26100 Rauma, Finland, and a Standard Bareboat Charter was signed by Hannu Norrgård on behalf of the above-mentioned Finnish company and by ship owner Trond A. Kittilsen, Frøyas vei 9, N-3960 Stathelle, Norway.

1.11 Voyage Charter Party, 6 February 1998.

On 6 February 1998, OY Nord Shipping AB, Rauma (bareboat charterer represented by OY Nord Shipping AB) and Hydro Aluminium AS, Oslo signed a Voyage Charter Party for a voyage from St. Petersburg, Russia to Karmøy, or Husnes, or Høyanger, or Sunndalsøra, Norway. The cargo was to be Aluminium ingots and T-bars, approx. 2,500 metric tonnes.

1.12 Ship detained/released by the Danish Maritime Authority in an inspection by the port authorities in Aalborg, Denmark 4 February–6 February 1998.

The Danish Maritime Authority wrote the following in its reports of 4 February and 6 February 1998 to the Norwegian Directorate of Shipping and Navigation:

The Danish Maritime Authority (DMA) have on 4 February 1998 at Aalborg, Denmark, carried out an inspection of the above ship.

The ship was detained at 14.30 hrs due to following deficiencies:

1. Master holding certificate as chief officer.
2. Chief Officer holding STCW II/4 certificate.
3. Chief Engineer holding STCW III/e certificate.
4. Only one member holding STCW II/6 certificate.
5. Vessel holding 7 parachute flares only.
6. Line throwing appliance in poor condition and out dated.
7. One smoke/light signal missing.
8. Fireman's outfit - the following missing:
   - 1 pair of boots
   - 2 safety lamps
   - 1 set of lifelines and belt
   - 1 axe
9. Four crew members not holding medical certificate.
10. Flammable products kept in empty cabin in accommodations.

ULSUND - Norway - IMO no. 7123461 - From detention.

The Danish Maritime Authority (DMA) have on 4 February 1998 at Aaalborg, Denmark, carried out an inspection of the above ship.

The deficiencies have been rectified and the detention has been lifted.

The ship was released on 6 February 1998 at 17.00 hrs.

2 Information on the total constructive loss/distress alert/crew

Nature of the casualty	:	Shipwreck
Location of casualty	:	The ship issued the distress call MAY-DAY when in position N 57–57.8 E 006–12.6 (Measurement Lista Lighthouse 053º, 15 nautical miles.) The ULSUND wreck was located on the seabed in position: N 57–57.86 E 006–11.93, approx. 650 metres W-NW of the MAY-DAY position.
Time of casualty	:	Friday 27 February 1998 approx. 21.25 hours local time.
Deceased	:	The entire crew of seven lost their lives. (Six from Finland and one from Estonia).
The deceased are	:	1. Captain, from Finland. 2. Chief officer, from Finland. 3. Second mate, from Finland. 4. Chief engineer, from Finland. 5. Able-bodied seaman/Cook, from Finland. 6. Crane operator/Ordinary seaman, from Finland. 7. Able-bodied seaman, from Estonia.
Found dead in the sea by a rescue helicopter at around midnight on 27 February 1998	:	Able-bodied seaman/cook, from Finland and able-bodied seaman from Estonia (The other five crew members are still missing/not yet found.)

3 The sequence of events

On 20 March 1998, Captain X, born 12 June 1954, a Finnish citizen, wrote the following report about a ballast voyage from Västerås to St. Petersburg, loading in St. Petersburg, voyage from St. Petersburg to Copenhagen, etc., in February 1998, where he was captain of ULSUND:

3.1 Ballast voyage to St. Petersburg, according to captain X.

MV ULSUND, sailing under a Norwegian flag, home district Brevik, Norway, ship owner Trond A. Kittilsen Shipping A/S, Norway, bareboat charterer Rofera Oy Ltd., Raumo, Finland, departed under the command of me, chief officer X, carrying ballast from Västerås to St. Petersburg on 12 January 1998 and was assisted by a Russian pilot at 19.55 hours local time to St. Petersburg's quayside no. 1, to load aluminium bound for Høyanger in Norway.

I had received information about the cargo of aluminium that was to be loaded in St. Petersburg by Oy Nord Shipping Ab two weeks before we arrived in St. Petersburg.

3.2 Cleaning and inspection of the hold before the vessel arrived in St. Petersburg, according to captain X.

Before the vessel arrived in St. Petersburg, the hold was cleaned of the previous cargo and the bilges were cleaned under the command of chief officer X. In conjunction with the cleaning of the hold, chief officer X and I inspected the hold. The tank top was in good condition. The captain and chief officer noted that the hold was in all respects ready for loading. MV ULSUND was in all respects fully seaworthy.

The vessel's agent in St. Petersburg was Gangut Marine Agency Ltd.

3.3 Preparation for loading in St. Petersburg, according to Captain X.

During our voyage to St. Petersburg, chief officer X and I had planned how the cargo of aluminium should be loaded in St. Petersburg. When the ship arrived in St. Petersburg, the Russian representative for the vessel's charterers Norsk Hydro A/S, acting as Supercargo and Cargo Surveyor, came aboard. Norsk Hydro's Russian representative had planned the loading of the vessel and had drawn up a Cargo Plan for the ship. Chief officer X and I arranged with Supercargo that the loading should begin from the stern of the vessel and that the cargo should be loaded as evenly as possible. It was also agreed that one should begin from the stern in order to remove all ballast. Norsk Hydro's Russian Supercargo required that the vessel be loaded according to the Preliminary Cargo Plan, which is drawn on the basis of the bill of lading. I approved the Supercargo's Cargo Plan and loading plan. According to the plan, approx. 2,404 tonnes were to be loaded. When I negotiated with the supervisor of the Russian stevedores, I told him that the loading should begin from the stern and that everything should be loaded as evenly as possible. All the ballast tanks were full when the vessel arrived in St. Petersburg.

The hold hatches on the weather deck were opened fully before loading. The hatch gaskets were in good condition. During my time on board the ship, there was never a leak through the hatches. The hatches were opened using the ship's excavator/crane. All the fastenings on the excavator were

loosened so that the excavator could be moved backwards and forwards and turned. The excavator was moved during loading as required. The vessel was ready for loading.

3.4 Loading in St. Petersburg, according to captain X.

The loading of aluminium was begun on 14 February 1998 at 00.00 hours. Chief officer X supervised the loading. The cargo consisted of whole aluminium ingots and bundled aluminium sheets. The aluminium ingots were all the same size. The aluminium packs were also the same size and were well packed. The packs of aluminium sheets were approx. 0.80 metre long, approx. 0.80 metre wide and approx. 1.00 metre high and were tied with wire with a diameter of approx. 10 mm. No loose sheets were loaded. The chief officer supervised that the dunnage was correct and properly placed. The dunnage was placed abeam on the tank top, spaced so that the packs lay steady on the dunnage. The stevedores began the loading process by loading the bundles from the foremost section of the room astern. A fork-lift truck was used in connection with the loading. I myself monitored the loading by carrying out inspections from deck and I noted that the loading was carried out correctly. The cargo was placed as closely together as possible by filling up from the foremost room astern and forwards from the stern. The loading process used the land-based crane to lift the cargo into the hold and the fork-lift truck was used to lift the bundles and place them closely together. The bundles stowed very well and there was no free space at the sides. The cargo was loaded right up to the sides of the vessel. Loading of the packs of aluminium sheets then began. Boards had already been placed crosswise on the tank top under the cargo.

The same procedure was employed when loading the packages of aluminium sheeting as had been used when loading the aluminium ingots, i.e. the cargo was packed as closely together as possible so that there was no free space between each unit. Even when the packs were stacked on top of one another, boards were used. The chief officer monitored the ship’s draft and regularly went to read the draft from the quayside. I also read the draft from the quayside. Loading was completed at the first quayside at 14.20 hours on 14 February, 1998 and we remained there while we waited to move to quay no. 38. I noted together with the chief officer that the cargo was properly loaded from side to side in the hold.

During loading, water was pumped out of each of the ballast tanks in turn, beginning in the fore peak and ending up astern. The chief engineer emptied the ballast tanks in accordance with instructions issued by the captain and chief officer. The level of each of the ballast tanks was checked under the supervision of the chief officer after they had been emptied. The chief engineer noted this in the chief engineer’s log. Chief officer X informed me during the loading process which ballast tanks were being emptied and checked.

At 21.10 hours on 15 February 1998, the ship moved to dock no. 38, and loading of the vessel continued at 08.00 hours on 16 February 1998 with the loading of the bundles from the foremost hold astern. The method of loading was the same as the one outlined above. I now lodged a written protest against the loading, since Norsk Hydro’s Cargo Surveyor and the stevedore had not followed my instructions and those of the chief officer and the ship. By means of protest, the matter was resolved later. The method of loading was modified and the loading was carried out in the manner as the chief officer and I had requested. A copy of the protest is enclosed. Attachment 2.

Once the ingots had been loaded, loading of the aluminium sheet packs was begun on the bottom, with bundles placed towards the front astern. In the hold, the aluminium ingots and the packs of

aluminium sheeting were placed flush with the tank top. The cargo was then loaded so that it was wedged between both sides of the hold. At the same time, a stevedore began to shore up the packs in the front section of the hold.

For the purpose of shoring up the cargo, dunnage material was taken from land, containing planks measuring approx. 4" x 4" and approx. 4" x 7". In connection with the shoring up of the cargo, a chainsaw, hammers and nails were used, among other tools. The shoring up was done under my supervision and that of chief officer, and chief officer X and I noted that the shoring up, lashing and the placement, fastening and tensioning of the belts had been done properly.

Once the vessel had been loaded at 14.40 hours on 17 February 1998, the work of battening and lashing down the cargo was continued by a stevedore and the ship's crew. All possible openings were battened down. Any fronts in the cargo were supported by planks in a cross, around which a strong lashing belt with buckles had been placed. Forty-five pairs of lashings and buckles had been obtained in Västerås, approx. 100 mm in width and approx. 8 mm thick. In addition, rope was also used to lash down the topmost packs of aluminium sheeting to each other by guiding the rope through the strong wire shrouds with which they were wrapped. The final lashing work was continued by the crew when the stevedore had continued securing the cargo. The stevedore also left plenty of planks in the hold in case they were needed.

Chief officer X, the stevedores' foreman and I noted that the vessel was properly and securely loaded. I enclose drawings of the loading of the vessel. List of Sources Nos 3, 4, 5 and 6.

The ship had a permissible draft and a proper aft trim. The vessel's draft was aft = approx. 5.9 metres. The draft could not be read at the bow because the figures were covered with ice. The draft figures were difficult to read accurately, since there was a lot of ice surrounding them. The ship largely had a winter freeboard. I assessed the stability of the ship based on previous cargoes. Stability was good. There was 10–15 m3 of drinking water on board.

Once the cargo had been secured, chief officer X battened down the hatches. The excavator operator moved the excavator to its position astern, where it was secured properly with chains and fastened with shroud screws. The grab and arm were lowered at the front onto the hatch and locked in place. 4"x4" planks were placed between the grab and the hatch, and these were fastened with chains and shroud screws.

I inspected the excavator together with the chief officer and we noted that the excavator was secured properly. I enclose a description of the way in which the excavator was secured.
List of Sources No 7.

Chief officer X prepared the vessel for sailing and ensured that the ship was in a fully seaworthy state before the voyage from St. Petersburg to Høyanger. Mr X then informed me that everything was in order. I myself inspected the vessel for seaworthiness and noted together with the chief officer that ULSUND was ready to sail, properly loaded and that all parts of the vessel were seaworthy.

3.5 The voyage from St. Petersburg to Copenhagen, according to captain X.

According to the planned route, the route was as follows: List of Sources No 8.

The charts used on the voyage were current Finnish charts, the British Admiralty's Danish charts and Norwegian charts.

Under the direction of a pilot and towed by ice-breakers, MV ULSUND departed at 19.15 hours on 17 February 1998 to await more vessels so that a convoy could be formed.

Our watches were as follows:

- Chief officer X 00.00–06.00 / 12.00–18.00
- Captain X 06.00–12.00 / 18.00–24.00

When we left port, ballast was still being discharged. We arrived in the late evening on 17 February 1998 at a place approx. 2.5 nautical miles from the west side of the pilot buoy to wait in the ice for a convoy to form so that we could continue on our voyage. The ballast was discharged completely, the tank levels were checked with a dipstick and it was noted that all the ballast tanks were empty. I was informed that the ballast tanks were empty and I noted from the quayside that the vessel was on an even keel.

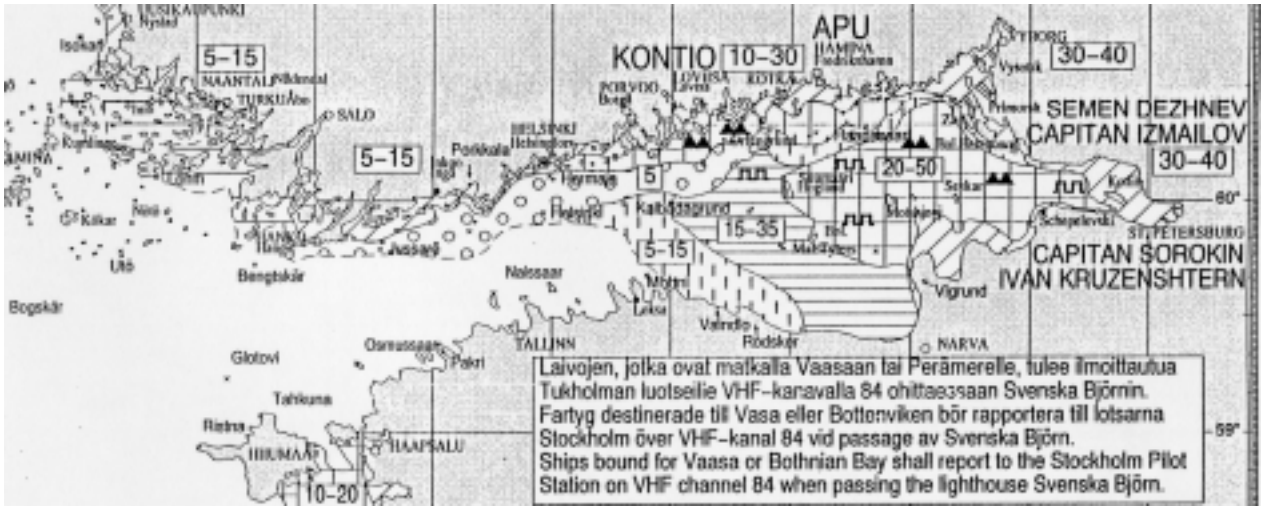


Fig. 3: Ice situation in Gulf of Finland 17.02.1998 (Finnish Institute of Marine Research)

When we departed from St. Petersburg, the weather was clear and ice conditions were such that we required the assistance of an icebreaker. The weather report forecast a hard westerly wind. We were ordered by the icebreaker to remain in the channel and await better weather. We waited in the ice for approx. two and a half days in accordance with the icebreaker's instructions before we continued on our voyage with the assistance of an icebreaker. While we were waiting in the ice, we made sure that the ship was not crushed by the ice. This was avoided.

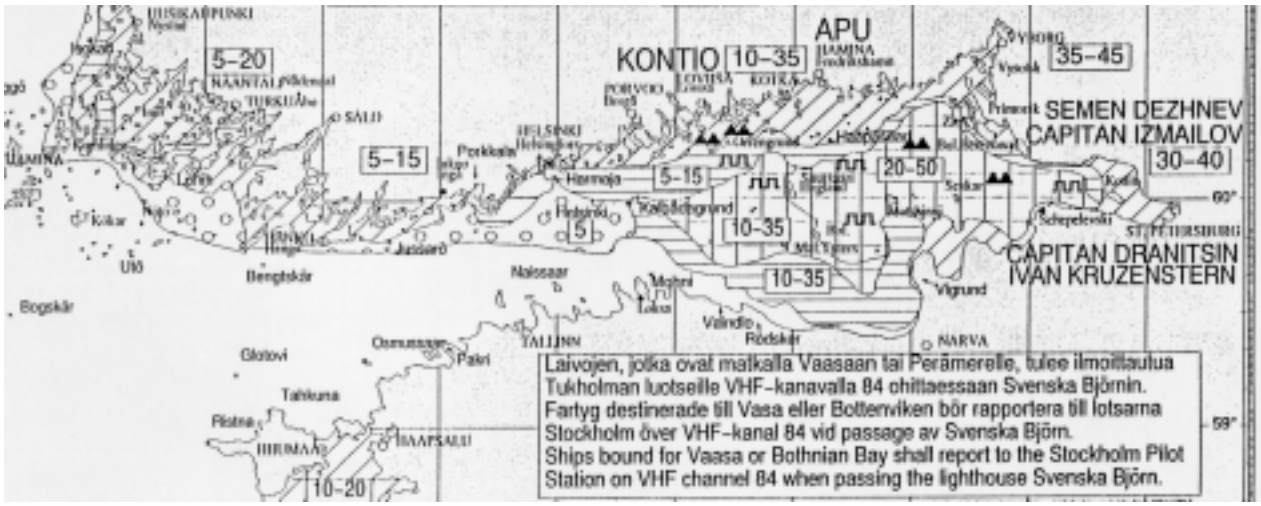


Fig. 4: Ice situation in Gulf of Finland 20.02.1998 (Finnish Institute of Marine Research)

At 04.00 hours Finnish time on 22 February 1998, we left the ice for open waters. The wind was moderate, west to southwest. In the afternoon of that day, we arrived at Russarö redd, where we set our course for Fårö. The weather forecast for the next day said there would be a stiff westerly wind, which began already that same evening.

Explanations of the symbols in the ice charts presented in figures 3 and 4.

3.6 The section of the voyage in harsh weather (in the Baltic Sea), according to captain X.

On Monday morning, the wind direction was W-SW and, by my reckoning, the wind speed was approx. 20 metres per second and the waves were approx. 5 metres high. We changed from automatic steering to manual steering. At times, I took the helm. I sailed into the waves at reduced

speed. Everything functioned normally. Our speed was 2–3 knots. The ship moved well in the rough sea. We arrived on the eastern side of Fårö on the evening of 23 February 1998, at approx. 20.00 hours Finnish time. On the morning of 24 February 1998, we passed Hoburg. The weather had become calm. No changes were noted in the vessel's condition. The vessel was on an even keel. The excavator and cargo were in their proper places and the cargo had not been displaced.

I was able to follow this on the bridge's clinometer. After our voyage through rough weather, chief officer X went to the hold to check that the cargo was stowed properly. During this check, the chief officer noted that the cargo was in the same good condition as it had been when we departed from St. Petersburg and informed me of this. One could see from the bridge that the excavator was in its proper place. Chief officer X also went to check that the excavator was parked securely. The chief officer tightened all the wires against the excavator's counterweight. The chief officer informed me that the excavator was properly secured.

3.7 Lifeboat drill, according to captain X.

On 24 February 1998, in accordance with normal ship routines, I held a lifeboat and fire drill on board in which life rafts, survival suits, SARTS (search and radar transponders), distress signal rockets and flares, alarms, fire extinguishers, smoke helmets and all related matters were reviewed. In addition, I informed the crew of the use of these appliances in emergencies.

3.8 The rest of the voyage to Copenhagen, according to captain X.

In the late morning of 25 February 1998, we arrived in Copenhagen, where the new captain, X, and chief officer X came aboard. Approx. 20m3 of drinking water, and provisions were also taken aboard, and we tanked approx. 30 m3 of bunker oil. I ordered an investigation of whether the cargo and excavator were securely fastened, a task that mate X assumed responsibility for carrying out with the crew.

Since the forecast was for bad weather for the rest of the week, I told the captain and the mate that they could stop, for example lee side of Skagen and await better weather. If the wind is strong, it is not necessary to battle against the sea without making any real progress, burning bunker oil unnecessarily. Together with the captain, I conducted a normal handover by familiarising him with the bridge, its instruments and ships documents, certificates and cargo documents, and explained to him how the cargo had been loaded. I also demonstrated for him the vessel's fire and lifesaving appliances and their location. Chief officer X, who had served on board the vessel for a long time, remained onboard ship. The ship was still in dock when I left.

I telephoned the ship from Kastrup Airport late that afternoon and was informed that they had departed. The captain wished me a pleasant holiday and said that everything on board was in order.

3.9 Loading in St. Petersburg, Russia, according the company North-East Maritime Corporation.

According to the "Statement of facts" and the loading plans from North-East Maritime Corporation, St. Petersburg, written by inspector P. Kononov, ULSUND loaded the following in St. Petersburg, Russia in the period 14–17 February 1998.

Aluminium, type “T bars” loaded in the front of the hold, a total of 1,046 bars. Aluminium, type “pack” loaded astern and in the middle of the hold, a total of 1,467 packs. Total amount of aluminium loaded in St. Petersburg = 2,404.371 MT, consisting of a total of 2,513 units.

3.10 Departure from St. Petersburg, Russia for Høyanger, Norway.

According to the “Statement of facts” and the agent’s fax to OY Nord Shipping, Rauma, ULSUND sailed from St. Petersburg for Høyanger, Norway at 19.15 hours on 17 February 1998.

3.11 Statements and estimates of ULSUND’s load condition on the casualty voyage, carried out by DI J. Lybeck in the company Shiptech, Finland.

M/S ULSUND – Loss of ship 27 February 1998.
Estimate of the load condition before the casualty voyage.
Cargo on departure from St. Petersburg 17 February 1998 and Copenhagen 25 February 1998.

At the request of Rofera OY Ltd, I have investigated M/S Ulsund’s load condition during the casualty voyage and have prepared estimates concerning the condition of the load in St. Petersburg and Copenhagen. List of Sources No 9.

My estimates are based on the following actions and information:

a) Hydrostatic and residual stability tables produced 14 March 1988 by Polarkonsult A/S (for M.S. Eikvaag)
b) Load case example, booklet “Stabilitet ökt djupgående 5,33 m” (Stability increased draft 5.33 metres), Polarkonsult 21 March 1988
c) International Load Line Certificate issued in Hortenissa 6 September 1995.
d) Tank plan no. 308/9120.1 A (for the vessel before conversion)
e) Capacity plan no. 308/9120-4 (for the vessel before conversion)
f) Bill of lading, 6 pieces.
g) Amount of fluid in ballast tanks based on information supplied by Rofera OY Ltd.

Copies of documents a) and b) did not have approval by the authorities.

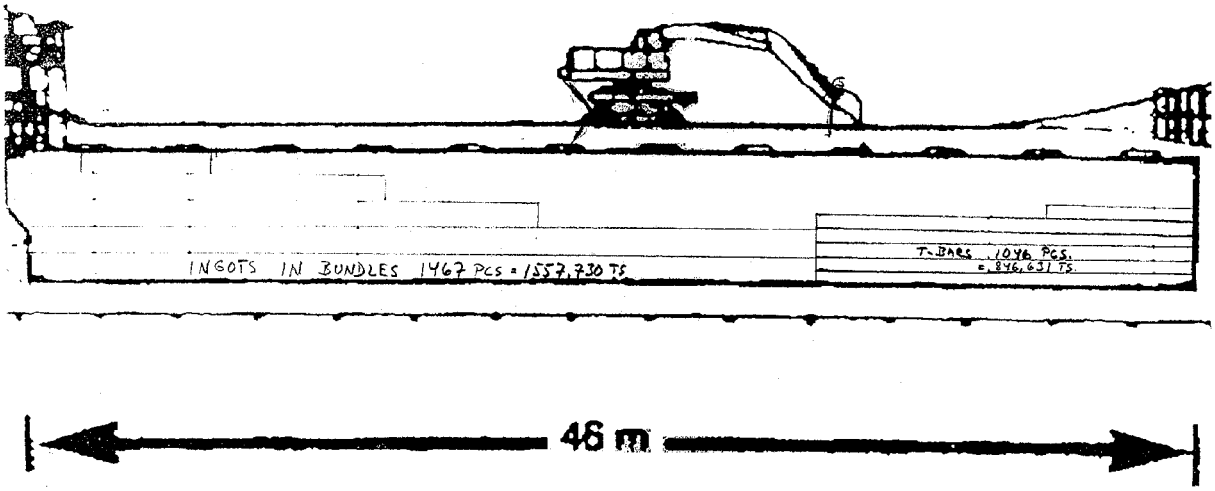


Fig. 5: Ulsund's cargo plan.

The ship's net weight.

It would appear from the original capacity plan that the vessel's net weight was 801 tonnes before the conversion carried out in 1988 and that the centre of gravity was 5.07 metres over the base line. According to the current data, the corresponding figures would now be 945 tonnes and 5.44 metres. The conversion has thus increased the vessel's net weight by 144 tonnes. The weight of the excavator installed on the deck is included in the net weight. A weight increase of this magnitude cannot solely arise from the weight of the inner hold bulkheads and supporting constructions as well as the hold hatches and the hatch arms/frames amidships, particularly since the intermediate deck, its hatch, part of the main deck amidships and masts and booms have been excluded from this calculation. The vertical shift in the centre of gravity would also indicate that the excavator and the traverse beam and rails have been included in the vessel's net weight.
The commanding officers should also be able to trust that the vessel's fixed equipment and appliances are stated in the net weight indicated in the stability information, in cases where the weights of these are not listed separately in the cargo case example.

Evaluation of the loading.

The ship had been loaded with a stern trim so that one could retain a greater dead weight. Displacement increases with the vessel's trim (astern). For example, displacement is 28.6 tonnes greater with a one metre stern trim than with zero trim when the mean draft is 5.3 metres.

Displacement and dead weight also increase within the framework for permitted draft relative to the freeboard mark when the vessel is loaded in a hogging condition. Captain X of Trond A. Kittelsen Shipping A/S has explained that under his command the ship had a cat-back of 50 cm when the cargo consisted of 2,300 tonnes of loose gravel distributed into two equally large loads, one in the front and the other in the stern end of the hold. This distribution of cargo can be compared with the distribution on the casualty voyage.

Captain X has reported that on 13 December 1997 in Ingå the vessel had 17 cm hogging when the cargo consisted of 2,407 tonnes of gravel distributed into three piles.

Displacement increases when the ship's stern hangs down, whereupon the draft amidships is reduced. One can estimate the "effective" draft to ($T_{fore} + T_{stern} + 4 \times T_{mid}$)/6. Since $T_{mid} = 5.33$ metres and the fore and aft draft is 5.53 metres, the "effective" mean draft is 5,40 metres. Consequently, the dead weight has increased by 7 cm x 7.835 tonnes per cm ~ 55 tonnes without the load line sinking below the surface.

According to these estimates, the vessel was loaded correctly. There was no overload at the time of departure from St. Petersburg, not even if the hogging went unnoticed.

In the calculation of the load condition on departure from Copenhagen, a hogging of 20 cm was taken into account. The mean draft was thus approx. 5.23 cm and the permitted draft in brackish water with a density of 1.01 tonnes per m3 was 5.26 metres.

The vessel's initial stability was good, and even too great. When the meta centre height was 1.2 metres, the rolling period was short and rolling caused by cross ship acceleration was high.

3.12 Loading Condition - Departure St. Petersburg 17.02.98

WEIGHT ITEM	**Weight** (t)	**KG** (m)	**KG*W** (t m)	**LCG** (m)	**LCG*W** (t m)	(m^4)
Crew+stores	**15.0**	7.00	105.000	25.00	375.000	
Fuel:						
No.1 C SB/BB	**0.0**					
No.2 C SB/BB	**0.0**					
No. 7 SB/BB	**14.8**	0.40	5.920	9.70	143.560	35.75
Settling t. SB/BB	**8.0**	2.90	23.200	12.55	100.400	
Day tank	**2.6**	6.46	16.796	8.79	22.854	
Fresh Water						
No. 5 SB/BB	**0.0**					
No. 6 SB/BB	**9.0**	0.45	4.050	19.10	171.900	11.75
L.oil SB/BB	**0.6**	2.50	1.500	12.58	7.548	
Sewagee tank	**0.0**	6.20	0.000	3.06	0.000	
Case 1825	**1.4**	2.60	3.640	62.50	87.500	
Cargo	**1557.7**	3.60	5607.828	23.00	35827.790	
	846.6	3.70	3132.531	51.75	43813.103	
Deadweight	**2455.8**	3.62	8900.465	32.80	80549.655	
Light ship	**945.0**	5.44	5140.800	31.77	30022.650	
Displacement	**3400.8**	4.13	14041.27	32.51	110572.30	47.5

From page 15 of vessel's Hydrostatic Data booklet the following data for 1.0 m aft trim can be fund and displacement in FW calculated:

Draught m	Displ.(SW)	T/i t/cm	MT 1 tm/cm	LCB m	LCF m	Displ. (FW)
5.3	3456.47	8.099	45.02	-1.28	-3.58	3372.17
5.4	3538.01	8.129	45.32	-1.33	-3.53	3451.72

LBC = (34 - LBC) = 32.70
LCG = 32.51
Trim moment = (LGC - LCB) x DISPL. = 639.44
Trim = 1.0 m + E42/45.14*100 = 1.14

The following figures for 1.14 m stern trim are obtained by interpolation between the hydrostatic data for 1.0 m and 1.5 m stern trim:

Draught m	Displ.(SW)	T/i t/cm	MT1 tm/cm	LCB m	LCF m	KMT m	Displ. FW
5.3	3462.13	8.047	43.98	-1.46	-3.46	5.34	3377.69
5.329		**8.074**	**44.78**	**-1.41**	**-3.47**	**5.35**	**3400.8**
5.4	3543.03	8.065	44.18	-1.50	-3.34	5.36	3456.61

The departure displacement corresponds to a meandraught of 5.329 m and 1.14 trim by the stern. Correction for hogging not considered. The allowable draught is 5.331 m.
(Winter freeboard and correction for fresh water.)

KM	5.35
KG	4.13
GG' = 47.5/3403	0.014
KG'	4.14
GM'	1.21

GZ = KY - KG'* SIN(phi)

phi	0	10	20	30	40	50	60
KY	0	0.93	1.75	2.49	3.16	3.69	4.07
KG'x SIN(phi)m	0	0.72	1.42	2.07	2.66	3.17	3.59
GZ	0	0.21	0.33	0.42	0.50	0.52	0.48
SUM h (phi)mrad	0	0.0184	0.0658	0.1314	0.2113	0.2998	0.3869

GZ max at deg.
h(phi) 0-30 0.1314
h(phi) 0-40 0.2113
h(phi) 30-40 0.0799

3.13 Loading Condition - Departure Copenhagen 25.02.1998.

WEIGHT ITEM	**Weight** (t)	**KG** (m)	**KG*W** (t m)	**LCG** (m)	**LCG*W** (t m)	(m^4)
Crew+stores	**15.0**	7.00	105.000	25.00	375.000	

Fuel:						
No.1 C SB/BB	**0.0**					
No.2 C SB/BB	**0.0**					
No. 7 SB/BB	**20.1**	0.45	9.045	9.70	194.970	35.75
Settling t. SB/BB	**8.0**	2.90	23.200	12.55	100.400	
Day tank	**2.6**	6.46	16.796	8.79	22.854	
Fresh Water						
No. 5 SB/BB	**0.0**					
No. 6 SB/BB	**19.2**	0.71	13.632	19.10	366.720	0
L.oil SB/BB	**0.5**	2.50	1.250	12.58	6.290	
Sewagee tank	**0.0**	6.20	0.000	3.06	0.000	
Case 1825	**1.4**	2.60	3.640	62.50	87.500	
Cargo	**1557.7**	3.60	5607.828	23.00	35827.790	
	846.6	3.70	3132.531	51.75	43813.103	
Deadweight	**2471.2**	3.61	8912.922	32.70	80794.627	
Light ship	**945.0**	5.44	5140.800	31.77	30022.650	
Displacement	**3416.2**	4.11	14053.72	32.44	110817.28	35.75

From page 15 of vessel's Hydrostatic Data booklet the following data for 1.0 m aft trim can be found and displacement in water density 1.01 calculated:

Draught m	Displ.(SW)	T/i t/cm	MT 1 tm/cm	LCB m	LCF m	D.ro=1.010
5.2	3375.22	7.979	43.49	-1.23	-3.32	3341.80
5.3	3456.47	8.099	45.02	-1.28	-3.58	3422.25

LBC = 34 - LBC =	32.72
LCG =	32.44
Trim moment = (LCB- LCG) x Displ. =	972.4
Trim = 1.0 m + Trim mom/MTI =	1.22

The following figures for 1.22 m stern trim are obtained by interpolation between the hydrostatic data for 1.0 m and 1.5 m stern trim:

Draught m	Displ.(SW)	T/i t/cm	MT1 tm/cm	LCB m	LCF m	KMT m	D.ro=1.010
5.2	3384.69	7.987	43.59	-1.52	-3.38	5.33	3351.18
5.281		**8.034**	**43.79**	**-1.41**	**-3.42**	**5.34**	**3416.2**
5.3	3465.37	8.021	43.39	-1.56	-3.39	5.34	3431.06

The departure displacement corresponds to a mean draught of 5.281 m without correction for hogging.

Correction for Hogging

From service experience it has been found that the vessel has 8 cm hogging in empty condition, 17 cm hogging fully loaded with gravel distributed in 3 piles and up to 50 m hogging fully loaded with gravel in two piles at the forward and aft ends of the cargo hold.
The hogging during the casualty voyage was accordingly larger than 17 cm. Draught readings are not available. A 20 cm hogging gives the following approximate correction on draught amidships, when the fore- and aft ship are immersed deeper than the midship area:

Correction on draught amidships = (4xT+2(T+0.2))/6 = 0.053
The vessel's departure draught amidships was approximately= 5.228
The allowable draught is = 5.331 - 0.111 x (1-0.01/0.025) = 5.264

KM	5.34
KG	4.11
GG' = 47.5/3403	0.010
KG'	4.12
GM'	1.22

GZ = KY - KG'* SIN(phi)

phi		0	10	20	30	40	50	60
KY	m	0	0.93	1.75	2.49	3.16	3.69	4.06
KG'x SIN(phi)	m	0	0.72	1.41	2.06	2.65	3.16	3.57
GZ	m	0	0.21	0.34	0.43	0.51	0.53	0.49
SUM h (phi)	mrad	0	0.0187	0.0669	0.1339	0.2156	0.3063	0.3952

GZ max at deg.	45
h(phi) 0-30	0.1339
h(phi) 0-40	0.2156
h(phi) 30-40	0.0817

3.14 Statements of 20 July 1998 made by the Norwegian Maritime Directorate, Cargo Ship Division concerning ULSUND's stability etc.

Case: Ulsund – Stability.

Estimates received from the Finnish authorities (Accident Investigation Board of 29 May 1998) have been reviewed and appear to be satisfactory. The Cargo Ship Division has the following comments:

- In a tilting test carried out 9 June 1987, the self-propelling excavator was used as a tilting weight, i.e. the weight of the excavator and the traverse beam were included in the light ship.

- The comments regarding any overload would appear to be correct.
- As commented on earlier by the Cargo Ship Division, the stability of the vessel appears to have been good on the voyage in question.

3.15 In the Maritime Investigation in Skien and Porsgrunn Municipal Court, the Finnish captain, X, made the following comments in his evidence, in March 1998:

X explained that he has sailed since 1970, that he became a chief officer in 1978, that he has sailed with both dry cargo and tankers, and that he was employed by Rofera OY Ltd. on 21 October 1997, where he is still employed.

X explained that the first time he boarded MS ULSUND was on 21 October 1997, that he had his Christmas holiday and was on land from approx. 14 December 1997 until 7 January 1998, and that he was then on board the ship until he went ashore in 25 December 1998 in Copenhagen to begin his holidays.

X explained that on the voyage from St. Petersburg to Copenhagen MS Ulsund did not suffer any damage as a result of running aground, collision or ice, and that nothing occurred that could have affected the ship's seaworthiness.

X explained, and referred to his report of 20 March 1998 concerning the fact that MS Ulsund took on approx. 30 m3 of bunker oil and approx. 20 m3 of fresh water, that he could not say anything further about the ship's weights when it departed from Copenhagen, which was not his responsibility, as this responsibility had been assumed by captain X. Furthermore, his handover to captain X occurred while the ship was taking on bunker oil, fresh water and provisions.

X explained that the cargo from St. Petersburg was on board MS Ulsund when the ship departed from Copenhagen; that is, as far as he knows.

In response to questions, X explained that he had not acted negligently during the loading in St. Petersburg, nor during the voyage from St. Petersburg to Copenhagen.

In response to questioning, X explained that the ship's condition in respect of the strength of the hull was in order when he went ashore in Copenhagen on 25 February 1998.

X explained that captain X, who took over as master in Copenhagen on 25 February 1998, had not been on board MS Ulsund earlier.

As regards his handover to captain X, X referred to his report of 25 March 1998, and to chief officer X, who remained on board ship from Copenhagen as one who knows the locality.

X explained that the survival suits were in the glass fibre bench on the captain's deck.

X explained that so long as he was on board MS Ulsund there were no leaks through the loading hatches.

X explained that no hard-weather damage was sustained during the voyage from St. Petersburg to Copenhagen.

X explained that he has no theory concerning the cause of the casualty.

X explained that there was no documentation that the Finnish crew had taken any safety courses, including safety certificates, but that he assumes that some of crew had taken this in connection with their maritime education and maritime experience.

X explained that the Finnish crew had a basic seafarers' education, though this did not apply to the operator of the excavator.

X explained that the lifesaving appliances on board complied with the relevant equipment safety certificates.

As regards the lifeboat drill mentioned in his report of 20 March 1998, X explained that it took place in the open sea off the Swedish coast, that the routines were reviewed but that the lifeboat was not swung out or lowered. Further, he cannot remember when the lifeboat was last on the sea. In addition, the davit winches were tested in Ålborg in the beginning of February 1998, in connection with checks made by the Danish Maritime Authority. These winches were found to be in order.

3.16 Hannu Norrgård, representing bareboat charterer Rofera OY Ltd., wrote on 23 March 1998 the following report concerning conditions under the bareboat charter, and concerning the last contact with the ship before it was lost.

In connection with the loss of MS ULSUND, the bareboat charterer's representative issued a report concerning events during the vessel's charter period.

On 15 August 1997, a bareboat charter agreement was signed between Trond A. Kittilsen Shipping A/S and Rofera Oy Ltd.

MV ULSUND was handed over to the bareboat charterer in a fully seaworthy condition and all the ship's certificates were valid.

When we approved and received the ship, the Norwegian maritime authorities and the class procedure ascertained that all parts of MV ULSUND were seaworthy.

Subsequently, we carried various cargoes on the ship in the Baltic Sea area and to Norway, and once we made a voyage to England.

Everything went well.

As Rofera Oy Ltd.'s executive director, I was responsible for chartering the vessel and I booked cargoes that were suitable for the vessel, e.g. tarmac, cement, corn, pig-iron, logs, aluminium, turf, feed etc. The voyages were unproblematic. There was no leakage through the hatches, nor was there any damage to the cargo. I supervised the servicing and condition of the ship. On board the vessel, the captain and chief engineer were responsible for servicing the ship and for ordering through various ports' brokers materials and necessary provisions for maintaining the ship. If the seafarers noticed that they needed materials or repairmen, they would inform me and I would make the necessary orders with the brokers in the next port.

I stressed for the captains and the chief engineers that they should ensure that the ship was always in good technical and seaworthy condition and that they should always report to me any matter concerning operation of the vessel.

At no time during the charter period did we hear anything in the office that would have made me suspect that the vessel was not seaworthy.

MS ULSUND was in a fully seaworthy condition.

Small, so-called hidden faults appeared on the vessel. For example, there was a problem with the radar (magnetron), which was repaired in Eurajoki, and the gyro-compass broke and was sent to Södertälje in Sweden for repair. We received it two weeks later in Lidköping. In addition, the fuel separator was replaced by a new one in the Port of Ålborg. Similarly, the fuel pump was renewed in Sweden. In Pärnu, two side vents were replaced, since they had stuck and were impossible to open. In Ålborg, a new ballast pump was purchased, since one of the old pumps was worn out. This was also installed in Ålborg.

A lot of time and money was spent on maintenance of the vessel and on service when in port, as can be seen from the accounts.

With reference to what has been stated above, attempts were constantly made, according to the information I have, to maintain the vessel in a good technical and seaworthy condition, which I also required that the crew should ensure.

As regards the casualty voyage, I booked a cargo for the ship from St. Petersburg to Norway. Before I finally decided to accept this cargo on 6 February 1998, I asked the agent in St. Petersburg, Ganut Maritime Agency Ltd., whether MV ULSUND's ice class IC, approx. 1500 HP, was sufficient to call at St. Petersburg, to which they replied that the ship could be approved and I therefore booked the vessel for the voyage. The ship called at St. Petersburg on 13 February 1998 in a convoy with 7 other vessels under the assistance of an icebreaker.

We had daily contact with the ship's brokers and captains, and according to the information we received no problems were encountered.

The ship departed from St. Petersburg on 17 February 1998. We estimated that the vessel would arrive in Norway on 23–24 February 1998 and decided together with the captain that the new chief officer and the captain should be replaced once they reached their port of destination. The voyage was slow, however, as the ship waited for an icebreaker for two and a half days owing to a headwind in the storm in the Baltic Sea. It was therefore decided on Monday 23 February 1998 that the exchange should take place in Copenhagen. I gave the order to the captain and the chief officer that one of them should remain onboard until the ship reached Norway, since I did not wish to change the entire command during the voyage, without having one person who was familiar with the vessel and the cargo remain on board until the ship had reached its port of destination.

I sent captain X and chief officer X to Copenhagen on the morning of Tuesday 24 February 1998, since I assumed that the ship would arrive in Copenhagen that same day. Due to the storm,

however, the ship was delayed and it did not arrive in Copenhagen until Wednesday 25 February 1998. Lodgings were arranged for the new crew members in Copenhagen.

Captain X and chief officer X had decided between them that the chief officer would remain onboard the ship until it reached its destination in Høyanger.

When the vessel departed from Copenhagen the new captain X called in the afternoon and said that they had departed and that everything was fine onboard.

On Thursday 26th February 1998, the captain called the office again and said that they had passed Skagen and that owing to the strong storm progress was slow, approx 3–4 knots, but that all else was well. The chief engineer wanted to speak with me and asked me to order a pipe repairman for the ship. I asked him why and he said that the condensation water pipe to one of the auxiliary engines had sprung a leak, which he had already repaired temporarily.

I asked whether it was serious and he said that there was no question of anything of that matter. I asked whether everything else onboard was all right and he replied that everything was in order except for the fact that the voyage was slow and that it was rough. I asked him to let me speak to the captain again, whom I spoke with for a while, and I asked them to take particular care, since the sea around the Norwegian coast, as was known, was rough. When the conversation was over, I booked a pipe company by telex through the ship's agent in Høyanger. This was my last contact with the ship, as I was travelling on Friday 27th February 1998. I was informed in the early hours of Saturday that ULSUND had been lost, whereupon I quickly returned to Rauma.

On Friday 27th February 1998, my accountant/secretary had been in contact with ULSUND on three occasions, which she has given an account of separately. Captain X had also been in contact with the vessel on Friday, and he has given an account of this.

I have always encouraged the captains on ships chartered by me to keep in daily contact with the office and, if necessary, several times a day. If necessary, I have been available at weekends as well. This is because I always want to keep abreast of what is happening on board the ships.

3.17 Weather report from the Norwegian Meteorological Institute for the casualty area on 26–27 February 1998.

The weather conditions in the Skagerrak on 26th February 1998 were characterised by SW-W winds of variable strength. Below is a list of representative wind readings for the area together with the significant wave height measured on Ekofisk, which in the relevant situation must be assumed to give a realistic estimate of the wave height in open sea off the coast on the first part of the specified route. On the last part of the route, the wave data was obtained from the Yme field, whose position is 57.8 degrees N 4.5 degrees E.

26 February 1998

	Skagerrak		Ekofisk Field	
	Wind direction	**Wind speed**	**Sign. wave height**	**Period (Tz)**
00 UTC	SW	10–15 knots	1.5 metres	5 seconds
03 UTC	SW	20 knots	2.0 metres	5 seconds
06 UTC	SW	20–25 knots	2.5 metres	5 seconds
09 UTC	SW	25 knots	3.0 metres	6 seconds
12 UTC	SW-W	20 knots	3.0 metres	6 seconds
15 UTC	SW-W	15–20 knots	2.5 metres	6 seconds
18 UTC	W-SW	20 knots	3.0 metres	6 seconds
21 UTC	SW	30 knots	3.0 metres	6 seconds

27 February 1998

	Skagerrak Wind direction	**Wind speed**	**Ekofisk Field Sign. wave height**	**Period (Tz)**	
00 UTC	SW	30–40 knots	N/A		
03 UTC	SW	30–35knots	5.0 metres	7 seconds	
06 UTC	SW	35 knots	6 metres	8 seconds	
09 UTC	SW	45 knots	5.5 metres	8 seconds	Front passes Skagerrak, strong winds follow the front.
12 UTC	W	20–30 knots	6.0 metres	8 seconds	New front passes Southern Norway and there is a great deal of variation in wind observations at coastal stations.
15 UTC	SW-W	20–30 knots	5.5 metres	9 seconds	NB. Wave measurements here taken from the Yme field.

27 February 1998

	Lindesnes-Lista		Yme Field	
	Wind direction	**Wind speed**	**Sign. wave height**	**Period (Tz)**
18 UTC	W-SW	35 knots	6.0 metres	9 seconds
21 UTC	W-NW	30 knots	5.0 metres	8 seconds

28 February 1998

	Lindesnes-Lista		Yme Field	
	Wind direction	**Wind speed**	**Sign. wave height**	**Period (Tz)**
00 UTC	W	25 knots	5.5 metres	8 seconds

3.18 The distress signal "MAY-DAY" sent from ULSUND on VHF channel 16 at 21.25 on 27th February 1998, and the ship's radio contact with Farsund Radio after the distress signal was sent.

The following is a transcript from Farsund Radio's tape recording of the distress signal/radio contact, lasting a total of 70 seconds:

"MAYDAY MAYDAY MAYDAY"
This is ULSUND ULSUND ULSUND
Call sign LHNW LHNW
Mayday my position
57 degrees 57 point 8 minutes north 6 degrees 12 point 6 minutes east.
I am making water have a list of about, about ah 6 degrees.
Port railing under water.
I have 7 persons onboard – over"

(Farsund Radio replied as follows in its first response to ULSUND).

"Yes Mayday LHNW this is Farsund Radio Farsund Radio.
I received your Mayday".

(ULSUND gives the following information in its second message, which was then to Farsund Radio):

"Yes Farsund Radio I require immediate assistance port railing and deck under water. We are making water, pump, we are trying to pump – over".

(Farsund Radio issues the following message, in its second reply to ULSUND):

"Yes LHNW that is well understood, we will send help to you".

(From ULSUND the following reply was given to Farsund Radio at 21.27 hours on 27 February 1998):

"Thank you". (This was the last transmission from ULSUND).

("Another" ship then called up with the following message):

"Can you repeat your position please".

(ULSUND never replied to the above call from "another" ship).

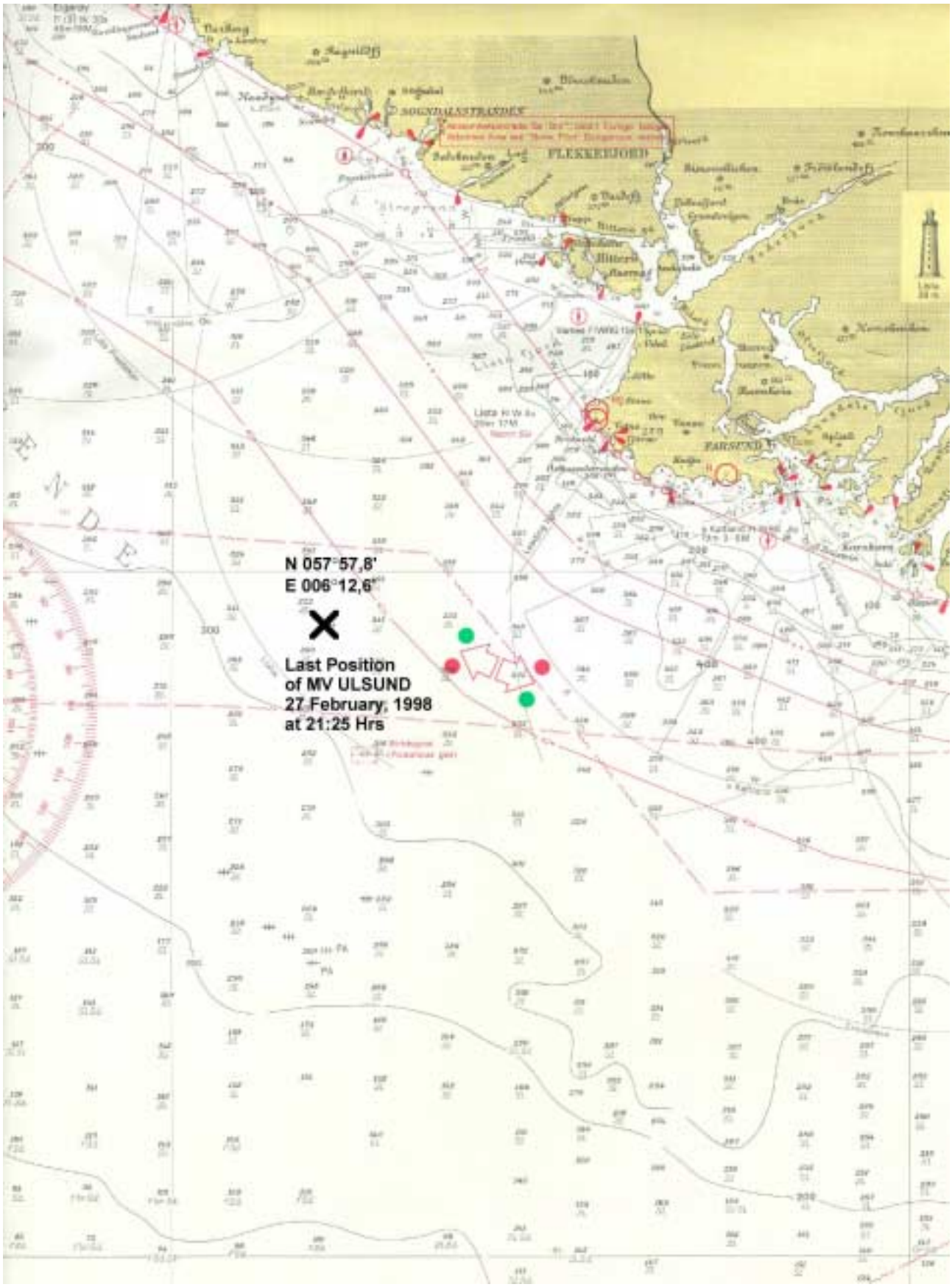


Fig. 6: Chart, accident area. (Sjøkartverket, Norge)

3.19 What radio officer X of Farsund Radio explained during the maritime inquiry on 16 March 1998 as regards the distress signal/radio contact with ULSUND on 27 February 1998:

X explained that he was on duty at Farsund Radio on the evening of 27 February 1998 and that at approx. 21.25 hours he had radio contact with MS "Ulsund" on VHF radio channel 16, that he received a MAYDAY transmission, and notification of the ship's call sign LHNW, position N 57 degrees 57.8 minutes E 6 degrees 12.6 minutes, that the ship was making water and that there were seven persons on board. X replied that he had received the MAYDAY distress call, whereupon he was again called up by the same call sign with notification that "Port railing in water, please send help", whereupon he replied that help would be sent.

X explained that he had not had contact with MS "Ulsund" before or after the above-mentioned contact, which lasted for 1–2 minutes, and that after this contact he attempted to make contact again, but was unsuccessful.

X explained that no information was given about where the ship was taking in water.

X explained that the person on MS "Ulsund" was not panicking, but that he was clearly showing signs of the gravity of the situation.

X explained that he did not receive distress signals from the ship's free floating satellite emergency beacon, as there was no reason to do so, since such signals are received by others.

X explained that he immediately transmitted MAYDAY RELAY to all vessels in the vicinity, and that he received replies from several vessels, which were in positions approx. one hour from the stated position, and that 6–7 vessels immediately headed for the stated position.

X explained that at approx. 21.27 hours he called up the Main Rescue Coordination Centre and stated the call sign, stated position, number of persons on board, the vessel was taking in water, that the weather was bad, that several vessels were on their way to the stated position, and that the situation was dramatic. In addition, he suggested an immediate helicopter rescue.

X explained that he immediately attempted to call up MS "Ulsund" again, but was unsuccessful, and that he again transmitted MAYDAY RELAY.

X explained that "Gard Way", whose call sign was LAWG4, came on the radio at 21.37 hours and stated that he had picked up a radar echo at the relevant position, and that his ETA was 1 hour 10 minutes later.

X explained that "Alrek", whose call sign was V2CX, came on the radio at 21.43 hours and gave his position as N 58 degrees 00 minutes E 005 degrees 58.8 minutes and had registered neither a radar signal nor a sighting. Further, that "Alrek" came on the radio at approx. 21.47 hours and stated that he was 6 nautical miles from the stated position with a heading 100 degrees and that nothing was registered on the radar. Further, that "Alrek" came on the radio at 22.04 hours and stated that he was 3.6 nautical miles from the stated position with a heading of 115 and that there was nothing visible on the radar. Further, that "Alrek" came on the radio at 22.17 hours and stated that he had seen flashing lights approx. 8 cable lengths ahead. Further, that "Alrek" came on the

radio at 22.22 hours and stated that he was two cable lengths from the stated position. Furthermore, "Alrek" came on the radio at 22.26 hours and gave his position as N 57 degrees 58.3' E 006 degrees 13.7'. Furthermore, "Alrek" came on the radio at 22.29 and stated that he could not see whether there was anyone on board the raft, and that he had problems manoeuvring in the poor weather. Furthermore, "Alrek" came on the radio at 22.34 hours and stated that he had retrieved an empty life jacket. Further that "Alrek" came on the radio at 22.39 hours and stated that a fresh attempt would be made to get close to the raft, which was closed, and that he did not think there was anyone on board.

X explained that "Tornes" came on the radio at 22.17 hours and reported seeing flashing lights.

X explained that "Gard Way" came on the radio at 22.42 and reported seeing wreckage and a flashing lifebuoy, but that no survivors were visible.

X explained that "Gard Way" and "Tornes" came on the radio at 22.52 hours and reported seeing a capsized raft.

X explained that "Alrek" came on the radio at 22.59 hours and reported that the raft observed at 22.29 hours was empty.

X explained that "Zeus", whose call sign was OJHB, came on the radio at 23.38 hours and reported that he had discovered a survival suit, but that he could not see whether there was anyone inside it, which he would check. Furthermore, "Zeus" came on the radio at 23.41 hours and reported that there was one person in a survival suit who was dead. Furthermore, "Zeus" came on the radio at 23.58 hours and reported seeing another dead person in a survival suit.

X explained that "Alrek" stated that winds in the area were gale force from the west or southwest.

X explained that several of the participating vessels reported experiencing problems due to poor weather, including problems manoeuvring and problems with their cargoes, and that "Alrek" stated that he was having major problems and had to seek shelter and that "Gard" stated that it was having problems with its cargo and requested permission to be dismissed.

X explained that the fishing vessel "Sildøy", whose call sign was LGMS, had earlier that same day reported poor weather, and that there was no point in continuing fishing.

X explained that "Alrek" was first appointed "On Scene Coordinator" and that "Zeus" took over this role when "Alrek" was dismissed at 10 minutes past midnight.

X explained that he perceived the message from MS "Ulsund", which was in good English, as being clear, comprehensible and with a relevant content.

3.20 What Rescue Chief X, Main Rescue Co ordination Centre, Stavanger, explained during the maritime inquiry on 16 March 1998 as regards the search for survivors from ULSUND:

Mr X explained that at 21.27 hours on 27 February 1998 he received notification from Farsund Radio of MAYDAY LHNW in position N 57 degrees 57.8' E 006 degrees 12.6', listing to port,

railing under water and seven persons on board, and confirmation that Farsund Radio had transmitted MAYDAY RELAY and that the nearest vessel was approx. 9 nautical miles away.

Mr X explained that he informed the stand-by helicopter, which was in Bergen; that he contacted the marines to enquire whether they had any ships nearby; that he checked with 330 Squadron at Sola to see whether it was possible to obtain a helicopter from there and that he checked with the Rescue Centre in Aarhus whether it was possible to obtain a helicopter from there.

Mr X explained that at 21.50 hours Farsund Radio reported that no further contact had been made with MS "Ulsund", that several vessels were on their way to the stated position, which was 45 minutes and more away, and that nothing could be seen on radar.

Mr X explained that the stand-by helicopter, which had been in Bergen, arrived in position at 23.05 hours.

Mr X explained that at 23.10 hours Farsund Radio reported that there were seven vessels and one helicopter in position and that two empty life rafts had been found.

Mr X explained that at 23.42 hours Farsund Radio reported that one lifeless person had been found in a survival suit.

Mr X explained that at 00.05 hours Farsund Radio reported that the helicopter had picked up two persons in survival suits, both of whom were dead, and that one of the two persons was wearing the survival suit properly and that the other person had the hood off and there was water inside his suit.

Mr X explained that the weather was bad, and that shortly after the first message he received confirmation from Farsund Radio that there were gale force westerly winds (force 8 – 40 knots), and the sea was rough. In addition, the weather was so bad that the vessels in the area were unable to pick up the two deceased persons, who were retrieved by the helicopter.

Mr X explained that at 21.45 hours the coast guard reported that from departure in Kristiansand it would require 6 hours to reach the stated position.

Mr X explained that the Main Rescue Co ordination Centre registered no signals from the free-floating satellite emergency beacon.

3.21 Explanation given by Mr X, the chief pilot on the rescue helicopter, at the maritime accident investigation on 16 March 1998 with regard to the search for survivors where two non-survivors were retrieved from the sea.

Mr X explained that he has been flying rescue helicopters since the autumn of 1991.

Mr X explained that during the flight the helicopter had a crew of seven, including two pilots, one system operator (navigator), one flight engineer, one doctor, one rescuer and one person under training.

Mr X explained that the helicopter arrived on the scene at 23.10 hours, and that the stated position at which MS "Ulsund" transmitted its MAYDAY message to Farsund Radio was N 57 degrees

57.8' E 006 degrees 12.6', and that the position where the helicopter retrieved the two bodies was at N 57 degrees 58.9' E 006 degrees 13.6' and N 57 degrees 59.13' E 006 degrees 13.9', respectively.

Mr X explained that that the helicopter searched in this area, including the area between these two positions.

Mr X explained that at 23.45 hours the helicopter picked up the first person and at 00.05 hours it picked up the second person, that both were wearing survival suits, that the suit of one person was not properly sealed around the neck and that there was water inside the suit, and that both persons were noted as being dead. Furthermore, the first person, whom he believes was the one who had water inside his suit, was lying on his back and that the other person, whom he believes was the person without water inside his suit, was lying on his stomach in the water.

Mr X explained that the helicopter flew down to two life rafts and noted that there was no one in them, and that one of them was punctured by the rescuer and that the other one was already punctured.

Mr X explained that the helicopter flew down to – and retrieved – a lifebuoy with flashing lights.

Mr X explained that the sea was high, dark, that the wind was estimated to be westerly, that the height of the waves was estimated to be 8 metres, and that visibility was originally estimated to be approx. 5 km and that this later worsened due to showers.

Mr X explained that "Zeus" reported that the weather conditions were so bad that it was unable to pick up people, rafts or survival suits.

Mr X explained that at approx. 12.00 hours on the next day the coastguard's ship "Nordsjøbas" discovered at position N 57 degrees 54' E 006 degrees 17.00' some wreckage and that the helicopter on its way from the position where MS "Ulsund" sent its MAYDAY signal to Farsund Radio to the above-mentioned position, i.e. N 57 degrees 54' E 0006 degrees 17.00', discovered scattered oil deposits and wreckage from half-way between these positions to approx. two nautical miles past where "Nordsjøbas" lay.

Mr X explained that the wreckage consisted of, among other things, bits of planks.

Mr X, the chief pilot on the rescue helicopter, sent the following fax to Skien and Porsgrunn Municipal Court on 17 March 1998 in order to clarify matters mentioned in the maritime inquiry on 16 March 1998 concerning the two deceased persons and the life raft.

"The loss of MS 'Ulsund'.

With reference to yesterday's telephone conversation, what I said about the two deceased individuals was correct. The first individual had water inside his suit and he was lying on his back. The survival suit of the second individual was sealed properly, but he was lying on his stomach.

However, I do have one correction to make as regards my statement concerning the life rafts. The rescuer was not down on the punctured raft. We checked it visually from the helicopter."

4 Further investigation/information.

Request for localisation, and investigation of the ULSUND wreck by a mini-submarine with a video camera mounted on it (ROV investigation).

On 24 April 1998, the Norwegian Maritime Directorate sent the following fax to the Ministry of Trade and Industry:

ROV investigation (mini-submarine with video camera) of the wreck of MS Ulsund.

For the ministry's information, we are able to say the following:

During the maritime inquiry, Trond A. Kittelsen, the owner of "Ulsund", gave his consent to the investigation of the wreck, cf. p. 93 of the records of the proceedings.

The Maritime Investigator in Oslo has requested that the Norwegian Maritime Directorate implement measures to investigate the wreck. In this connection, the Directorate contacted the Royal Norwegian Navy and requested assistance, and they have said they are willing to locate and film the wreck on video. KNM "Tyr" will begin the investigations on Tuesday 28 April 1998. The Norwegian Maritime Directorate will take part in this together with the Maritime Investigator. The Finnish authorities have been invited to take part, and a representative for the ship owner will be present.

The Royal Norwegian Navy have said that KNM "Tyr" is in possession of equipment that can retrieve the deceased from the seabed. To the extent permitted by the weather and other conditions, we will during this search also retrieve the bodies of any deceased persons outside the ship.

4.1 Brief summary of observations of the ULSUND wreck made using the mini-submarine and video camera on the night of 30 April 1998 (memorandum from the Maritime Investigator in Oslo to Director General of Shipping and Navigation Ivar A. Manum):

The wreck of ULSUND was found just before midnight on 29 April 1998, after a 36-hour search by KNM "TYR".

The five missing seafarers from the ship were not found.

During the search for the wreck, ROV (mini-submarine with a video camera) and sonar were used. Video photography of the wreck was carried out between 00.00 and 06.00 hours on 30 April 1998.

The wreck was located in position N 57–57.86 E 006-11.93, which is 650 metres W/NW of the position where the MAYDAY distress signal was transmitted on the evening of 27 February 1998.

The ULSUND wreck is located at a depth of 310 metres. The seabed in this area is flat and even, and consists of mud.

The fore ship is lying deeply embedded in the muddy seabed, while the rudder, for example, is not touching the seabed.

ULSUND is lying on a rather even keel, with almost no list. It would appear that that the wreck is lying a little deeper in the muddy seabed on the starboard side, since eight scuppers are visible on the starboard bulwark, while eleven scuppers are visible on the port side. The wreck is lying with the fore ship pointing westwards, at an estimated 250 degrees.

The bow has been ripped off and is virtually submerged in mud, on the port side of the wreck, at a distance of approx. 10–15 metres, somewhat to the stern of amidships. (It is not possible to ascertain with any certainty how much of the bow has been ripped off, since the remainder of the fore ship is buried in mud).

The entire stern, everything above the poop-deck, has been ripped off and is “parked” on the seabed on the port side of the stern, at a distance of approx. 20 metres. Observations of the above-mentioned stern show relatively little damage, since the funnel, bridge, bridge wings, signal mast with, among other things, the radar antennae were found. The lifeboat was in place on the stern, and the blue tarpaulin still covered the boat. (It would appear that no attempt has been made to swing out the lifeboat.) The free-floating emergency beacon was not observed on the stern.

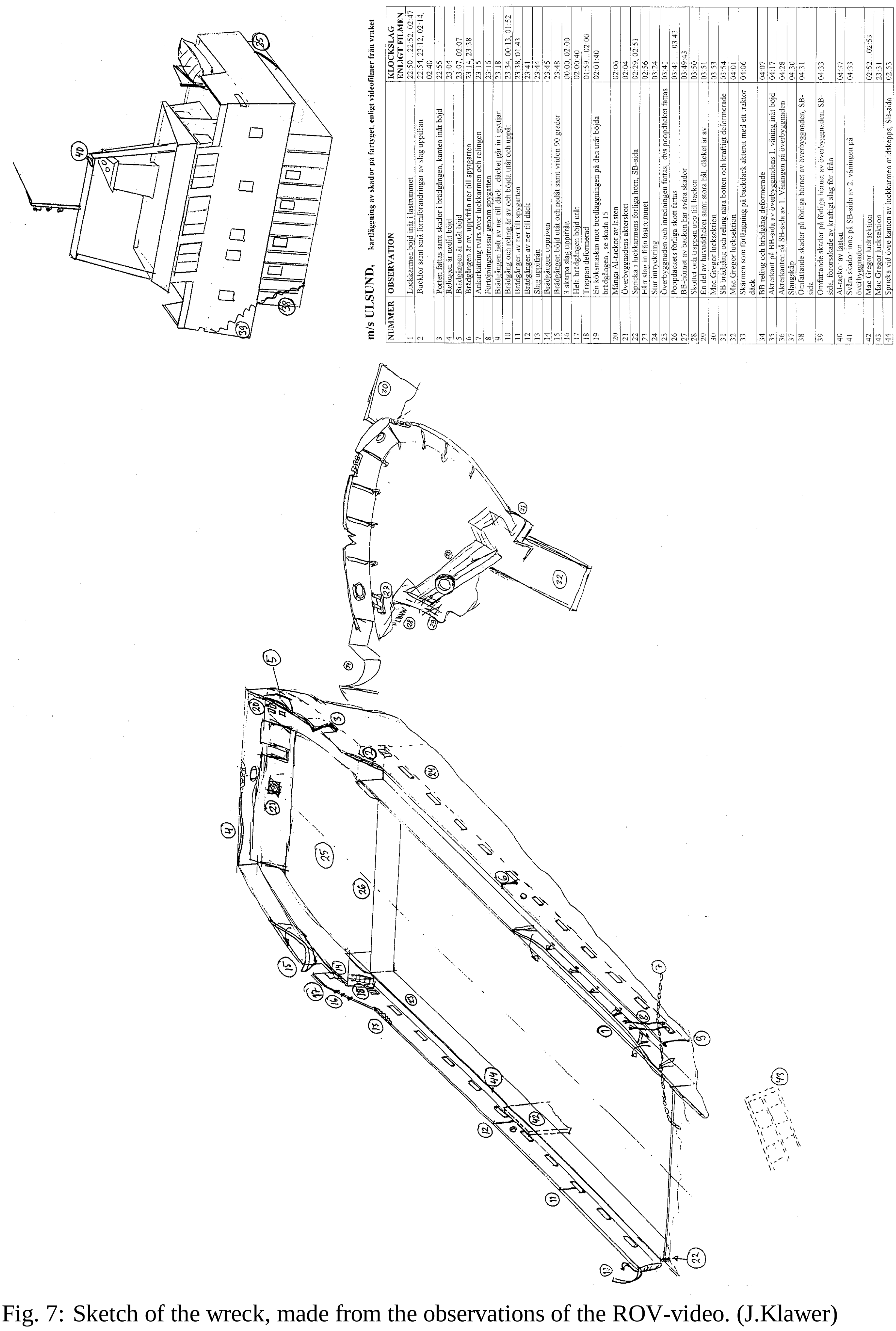
The starboard bulwark/ship’s side on the stern shows considerable deformation.

All the McGregor hatches have been ripped off, some of these can be observed more or less submerged in the mud outside the ship.

The foremost section of the port side hatch arm is bent considerably in towards the hold, and the starboard hatch arm displays a large crack. The hatch arms otherwise display no major deformations.

The aluminium cargo observed amidships, and in the foremost section of the hold, appears to be undamaged. Similarly, it was well stowed, and no shift had occurred. Lying outside the ship, on the main deck and on the mooring deck astern were aluminium bars, of the smaller type, gathered in bundles. One of these was even found high up on the signal mast. It is estimated that approx. two-thirds of the aluminium cargo remains in the hold of the wrecked ship.

It is believed that crack formations can be observed on the port side of the hull. It should be noted, however, that the side of the hull cannot be seen due to mud. It is possible to see crack formations in the starboard bulwark on the main deck, in scuppers no. 7 and no. 8, and in scupper no. 5 on the port bulwark. The numbering of these scuppers is from the stern.



m/s ULSUND, kartläggning av skador på fartyget, enligt videofilmer från vraket

NUMMER	OBSERVATION	KLOCKSLAG ENLIGT FILMEN
1	Luckkarmen böjd inåt i lastrummet	22:50…22:52, 02:47
2	Bucklor samt små formförändringar av slag uppifrån	22:54, 23:12, 02:14, 02:40
3	Porten fattas samt skador i brädgången, kanten inåt böjd	22:55
4	Relingen är nedåt böjd	23:04
5	Brädgången är utåt böjd	23:07, 02:07
6	Brädgången är av, uppifrån ner till spytgatten	23:14, 23:38
7	Ankarkätting tvärs över luckkarmen och relingen	23:15
8	Förtöjningstrossar genom spygatten	23:16
9	Brädgången helt av ner till däck , däcket går in i gyttjan	23:18
10	Brädgång och reling är av och böjda utåt och uppåt	23:34, 00:13, 01:52
11	Brädgången av ner till spygatten	23:38, 01:43
12	Brädgången av ner till däck	23:41
13	Slag uppifrån	23:44
14	Brädgången uppriven	23:45
15	Brädgången böjd utåt och nedåt samt vriden 90 grader	23:48
16	3 skarpa slag uppifrån	00:00, 02:00
17	Hela brädgången böjd utåt	02:00:40
18	Trappan deformerad	01:59…02:00
19	En köksmaskin mot bordläggningen på den utåt böjda brädgången , se skada 15	02:01:40
20	Många Al-tackor av lasten	02:06
21	Överbyggnadens akterskott	02:04
22	Spricka i luckkarmens förliga hörn, SB-sida	02:29, 02:51
23	Hårt slag in från lastrummet	02:56
24	Stor intryckning	03:24
25	Överbyggnaden och inredningen fattas, dvs poopdäcket fattas	03:41
26	Poopdäckets förliga skott fattas	03:41 … 03:43
27	BB-hörnet av backen har svåra skador	03:49:43
28	Skottet och trappan upp till backen	03:50
29	En del av huvuddäcket samt stora hål, däcket är av	03:51
30	Mac Gregor lucksektion	03 53
31	SB brädgång och reling nära botten och kraftigt deformerade	03:54
32	Mac Gregor lucksektion	04:01
33	Skärmen som förlängning på backdäck akterut med ett traktor däck	04:06
34	BB reling och brädgång deformerade	04:07
35	Akterkant på BB-sida av överbyggnadens 1. våning inåt böjd	04:17
36	Akterkanten på SB-sida av 1. Våningen på överbyggnaden	04:28
37	Slangskåp	04:30
38	Omfattande skador på förliga hörnet av överbyggnaden, SB-sida	04:31
39	Omfattande skador på förliga hörnet av överbyggnaden, SB-sida, förorsakade av kraftigt slag för ifrån	04:33
40	Al-tackor av lasten	04:37
41	Svåra skador inne på SB-sida av 2. våningen på överbyggnaden	04:33
42	Mac Gregor lucksektion	02:52…02:53
43	Mac Gregor lucksektion	23:31
44	Spricka vid övre kanten av luckkarmen midskepps, SB-sida	02:53

Fig. 7: Sketch of the wreck, made from the observations of the ROV-video. (J.Klawer)

Conclusion (Maritime Investigator, Oslo).

The investigation of the wreck with a video camera (30 April 1998) gave no answer as to the cause of the casualty.

The bow and the superstructure must have been torn away from the ship when the ship collided with the seabed, since these sections are located right next to the hull.

The excavator was not observed on or by the hull. (The area around the wreck should have been investigated more closely by video camera. However, since the mini-submarine's cable was damaged in the wreck's signal mast, the search was called to a halt at approx. 06.00 hours on 30 April 1998. At the time the search was concluded, approx. 95 per cent of the investigation had been completed.)

4.2 Witness no. 16 in Skien and Porsgrunn Municipal Court in March 1998, captain X, wrote on 19 June 1998 the following letter to the Maritime Investigator in Oslo regarding leaks in a ballast tank:

With reference to my telephone conversation with you on 18 June 1998, I hereby enclose a written account of a telephone conversation I had onboard M/S "Ulsund" in Aalborg on 19 February 1998 with acting captain X, who was Finnish.

When I reviewed with captain X all the orders the ship had received by the Danish Maritime Authorities, **I asked captain X whether there was anything else about the vessel that I should know. To this he replied:**

"We have a leak in the port side ballast tank"

I asked him if they emptied it often, and he replied:

"Not very often".

I am not quite sure whether he mentioned the port side, but he was speaking about the ship's ballast tanks.

We continued the review of orders and the leak in the ballast tank was not mentioned.

As I understand, seawater seeped into the ship's ballast tank, perhaps through the hide plate or the base plate and seawater had to be pumped out of the tank using the ballast pump. How often this happened I do not know.

The reason why I am giving this statement now is that one month ago I was on board M/T "Team Tellus" where I am captain and I was reading an article in the magazine *Navigaren* about the loss of M/S "Ulsund". Later, I remembered what acting captain X, from Finland, had mentioned to me in passing when we reviewed the orders imposed on the ship.

4.3 Contractor X, who served as excavator operator/junior seaman/repairman onboard in the autumn of 1997 and in January 1998, explained, among other things, the following in a statement to the police in Finland on 31 August 1998, concerning water in the hold, leaks in the ballast tank, and the possible cause of the casualty etc.:

There was sometimes water in the hold. During my first period of work on board, there was no water in the hold, but there was water during the second period. The second period began on 12 December 1997 and finished on 17 January 1998. In my opinion, in the rear of the hold there was approx. 50 cm of water in a 120 m2 area, totalling approx. 30 m3.
During the last voyage, there was even more water in the hold.

As regards my last voyage with ULSUND, we started from Riga at 11.30 hours on 15 January 1998 on a journey to Västerås, where we arrived on 16 January 1998. At that time we were carrying iron. Once the loading was completed, the vessel was OK. Four hours later, the ship had a two-degree list to port. Mate X said to me that the ship had been loaded incorrectly. I informed him that this was not the case, since I had followed the loading of the ship. I had checked the vessel's list with the aid of the ship's "measuring devices". I did not go down into the hold to see whether there was any water in the hold, and if so how much.

The weather was bad this time, and the voyage took longer than we had anticipated.
At around 20.00 hours, Mr X came to me and said that: "there's so much water in the hold that it's over the top of my boots." I checked the port and starboard side load-line marks, but I couldn't see them.

I could at least estimate where the marks were, and according to this estimate, I noted that the vessel was approx. a half metre deeper than normal. Furthermore, the last three scuppers at the stern end of the main deck were no longer drawing out water. According to the metre-measure astern, I could note that the vessel was lying approx. 50 centimetres deeper in the water than normal.

Judging by Mr X's boots, there could have been approx. 60 centimetres of water in the hold on this occasion.

On Friday 16 January at around 01.00 hours, I heard that the fire pump was being carried down to the hold. I also went down there to help. We had a pilot onboard, and only the captain, pilot, Mr X, and the chief engineer were on the bridge, while everyone else was down in the hold. I saw that there was approx. 20–30 centimetres of water in the front part of the hold, while there was approx. one metre of water in the stern section of the hold. We had already had problems with this water earlier, and it should be mentioned that both "bilge pumps" were not working. The bilge sumps were clean.
The fire pump had a capacity of approx. 50 m3 per hour, and I remember that the pump ran until 05.30 hours when the petrol ran out. The pump had then been operating for two and a half hours. At that time, there was still a lot of water remaining in the hold. Later during the voyage, this water was pumped out. In the hold at that time was Mr X, captain X, and the Estonian Mr X. I kept watch at the door of the hold, since there was gas in the hold that could have caused concern for those people who were in there. When we arrived at Västerås at 16.30 hours, all the water had been pumped out of the hold. The petrol was also used up by that time.
While we were in the hold pumping, water also leaked in through the hold hatches. However, there were not large amounts of water.

During the time we repaired the vessel in Porsgrunn, the hatches rubber seals were partially repaired. In addition, the rail along which the hatch wheels run was also repaired.

I suspect that the water that was almost always present in the hold probably got there via broken and leaking sounding pipes and air pipes.

The ballast tank centre 4 was leaking seawater. Almost everyone knew this. I had checked that the surface of the water in the sounding pipe was at the same level as the seawater level. The tank could be kept relatively dry if it was pumped every 5–6 hours.
I had warned captain X during this voyage, because when I was in the helm room, I heard bangs that sounded like pistol shots. Captain X had said that this could be caused by cracks in the hull or in the welds.
Mr X told me that with a cargo of this sort, it was perfectly normal to hear bangs of this type.

I did not travel with ULSUND after this voyage.

In my opinion, the cause of the casualty may be the following. First, the hold may have slowly filled with water via centre 4, or via the sounding pipe or air pipe.
A second possibility may be that the hatches were not properly sealed, i.e. correctly closed and battened down.
A third possibility may be that the excavator began to move, and has pulled the entire hatch with it.
A fourth possibility may be that the hull has collapsed due to the amount of water that has leaked into the hold now and on previous voyages. (Overload.)

When I left the ship after my first period of work that finished on 24 October 1997, I presented captain X with a list of faults on the vessel that should be repaired immediately.

Among other things, I mentioned the leak in the centre 4, and any possible leak in the air pipe and sounding pipe to the centre 4 and to other tanks as well.
There was a small leak in the stern wall of the forepeak, fairly high up, and a small leak directly to the sea in the after peak. The leak in the after peak should have been mended, because when the ship was loaded, approx. 1 m3 of seawater a day leaked into the after peak.

There was also a leak in the second starboard or port ballast top.

4.4 Seaman X, who in the autumn of 1997 served as a deck hand/excavator operator on board, explained the following in a statement to the police in Finland on 25 August 1998, concerning water in the hold, leaks in the ballast tank, and a possible cause of the casualty etc.:

I took part in the work in the hold when both loading and unloading. Sometimes there was water in the hold, but this was nothing special, since the amount of water was not great. I assume that it was hose water. I remember that a ballast tank, the fourth centre tank “played us up”. It didn’t always leak, only now and again. The reason for this was not checked while I was on board, but I suspect that there was a leaky valve.

All the ballast pumps worked perfectly even in rough seas. It was not possible to empty the ballast tanks with a fore trim.

The battening of the hatches was OK. All the defect rubber seals were replaced in Porsgrunn before departure, and if necessary during the course of the autumn.

It is possible that in difficult conditions the hatches could open, but I cannot remember this happening.

In my opinion, the cause of the casualty was that when the vessel passed an area where the seabed rises approx. 200 metres and the wind comes from the front, there was an enormously high sea. In turn, this high sea caused the excavator's fastening device (chains) to stretch, with the result that the excavator began to move. Subsequently, the mechanical locking device and the excavator began to move from side to side. The result of this was that the excavator's traverse beam, which should have been attached securely to the cargo hatch, pulled the hatch off at the same time as the excavator either fully or in part loosened along with the "traverse beam".

4.5 Chief engineer X, who served as chief engineer onboard during Christmas 1997, explained the following in a police statement in Finland on 30 November 1998, concerning water in the hold, pumps/pipe system, and a possible cause of the casualty etc.:

There were occasionally small amounts of water in the hold, though never any great amount. When we had an aft trim, there was sometimes water, around 15 cm, in the stern section of the hold. The water was around four metres from the rear wall of the hold. The amount of water would depend, among other things, on the weather etc.

I assume that the water got into the hold through the hold hatches. When I boarded the vessel at the beginning of the year, the pump used as a fire, ballast and bilge pump was not very powerful. The pump was worn.
There was another pump on board, which worked fairly well. It wasn't possible to empty the hold bilge with this pump either, however, because the pipeline was obstructed.

During the time I worked on board the ship, a new pump was acquired. It was installed in Denmark, and when I left the vessel in Västerås, the pipes in the hold were being cleaned. Furthermore, the entire hold was hosed down. All the water was removed and the pipes were working properly. At the same time, the bilge sump was cleaned. At the time, the new chief engineer was already in place.

The ballast pumps were not used at sea and the pumps worked well in all trim conditions. This was the situation when I left the ship.

I consider the cause of the casualty to be that the excavator may possibly have worked loose. If this was the case, it is possible, that the excavator's fittings ("the runners") and perhaps also the hold hatches may have loosened.

4.6 Engine watchman X, who in the autumn of 1997 served as engine watchman/able seaman on board, explained, among other things, in a statement to the police in Finland on 17 December 1998, about the excavator that came loose in bad weather, water in the hold, and a possible cause of the casualty etc.

On the way to Liverpool, the excavator's locking device came loose in a heavy storm. We were at least able to fix the locking device. The vessel had reached lee west of Scotland, and Mr. X and I inspected the hold. I observed damp inside the carvel. Water had penetrated through the mid-section of the carvel, to the inside of the seal, through the scupper when the sea had crashed over the deck from the side, and there was no lash in the scupper.

In Liverpool, the excavator's locking device was strengthened and welded by increasing the number of "ears" on the machine and the "traverse beam".

In response to the question of the possible cause of the casualty, my reply is that I believe that the excavator came loose and drew with it the hold hatch. It is possible that two of the crew were busy securing the excavator, and that they had put on their survival suits.

4.7 Chief engineer X, who in the autumn of 1997 served as chief engineer on board, explained, among other things, the following in a statement to the police in Finland on 19 August 1998, concerning leaks in the ballast tanks, water in the hold, holes in the main deck due to stone cargoes, and the possible cause of the casualty etc.

In response to the question of whether we encountered difficulties on the aluminium voyage, my reply is yes, we did once. When the vessel was loaded in Ventspils, I noticed that two ballast tanks filled up again by themselves after they had been emptied. As far as I can remember, base tanks 1 and 4 filled up, and both tanks were on the starboard side. I concluded that water had leaked into these tanks from outside, since the other tanks remained empty and there was no water in the hold. I reported this matter to the ship's captain, X, and also to the vessel's part owner, X. Nothing was done about this matter, and I remember that during the remainder of my time on board the vessel, two pumps continuously pumped water from the above-mentioned tanks.

In connection with the cleaning of the hold, it was my task to pump out the bilge water. Apart from that, I was not involved in work in the hold.

Occasionally when ballast tank no. 2 was filled, water seeped into the hold from a leaking air or sounding pipe. This happened several times, but since the cause of this was known, the tank was no longer filled completely after that.

Both ballast pumps worked well in all conditions.

As far as M/S ULSUND's condition is concerned, I should mention that the plates on the weather deck felt worn, for when loading stones of around 30 cm in length, holes appeared in the deck when the stones fell. I patched these up by welding them, and the welding was always successful.

Holes of this kind usually appeared at the front of the cargo deck, on the port side.

I think the vessel was in a fairly good condition. Below deck, things were good and the engine room was in a good condition, as were the berths.

I think that one of the reasons why M/S ULSUND sank was the leaking tanks that I mentioned earlier. I left the ship on 29 October 1997.

4.8 Captain X, who in the autumn of 1997, for approx. one month, served as captain on board, explained the following, among other things, in a statement to the police in Finland on 4 August 1998, about water in the hold, water in the ballast tanks, the pumps, survival suits/life-saving drills, and the possible cause of the casualty etc.

When I was working on board ULSUND, I actually took part in all types of work. I remember that there was occasionally water in the hold after loading, but that there was, at most, no more than a few tonnes. Since we were transporting icy and snow-laden logs, it is possible that the snow melted during the voyage and that this was the cause of the water.

I also remember a voyage; we were on our way from Pärnu to Sweden with a cargo of timber when I noticed that the vessel's draft had increased. I found the situation worrying, since the vessel behaved quite differently, despite the fact that the weather was relatively good.

The ship became very heavy, and was no longer "riding the waves".

I went to look at the depth marker astern and noted that the vessel was lying too deep in the water.

I assume that the ship's base valves had been open, and water can then seep into, for example, the hold via the bilge. Being drunk, chief engineer X had mistakenly pumped water into the ballast tanks. I noted this and ordered X to rest for a couple of hours, before he could perform his duties, in this case the ballast pumps.

After a couple of hours, I woke up X, and commanded him to go to the engine room in order to start the bilge pumps. The pumps were started and the water was removed.

I am absolutely certain that the ballast pumps were in working order. They worked in all conditions, even during sailing.

The hatch battens worked sufficiently well. The battens did not open a single time during the voyage, at least not during my period as captain.

The forepeak's doors were secured with "clinch bolts". The doors were always closed during the voyage, and did not open during the voyage.

The mooring lines were always kept in the forepeak, and they were loaded through a hatch in the stern. This hatch was closed with four "clinch handles" that were locked shut.

The survival suits were stored on the bridge, inside. When I came on board, I moved the suits to the place I mentioned, the suits were previously stored in a box on the port side.

Rescue drills were always held when the crew was changed. Some of the crew tried on their survival suits in connection with the drill.

In my opinion, the reason why the ship sank was to do with the fact that the vessel's hull construction was weakened after the ship was rebuilt. I don't think such vessels are seaworthy any longer, unless the hull is inspected very carefully.

4.9 Mate X, who in the autumn of 1997 served as a mate on board, explained, among other things, the following during a statement to the police in Finland on 22 September 1998, about water in the hold, the tank top, survival suits, lifeboat drills, etc.:

On a couple of occasions, I worked in the hold after unloading. There was some water in the hold on occasions. When the ship had an aft trim, there was about 20 centimetres of water in the stern section of the hold. The water reached 5–6 metres from the rear wall of the hold towards the front. I remember our cargo was woodchips at that time.

I was not present when the cargo of logs was unloaded.

I don't know where the water that came into the hold came from, but I have found no other rational explanation than that the water came through the ballast tanks or an air pipe.

As far as I remember, the survival suits were stored in a box on the boat deck. It is possible that two suits were kept on the bridge.

No lifeboat drill was held during my time on board. I don't remember whether we put on the suits as practice or not.

The general condition of the vessel was not praiseworthy, perhaps satisfactory. I did feel, however, that the ship was usable.

I think that the "tank top" was poorly repaired. The boards were covered over with sheets of metal and it was impossible to know the precise condition of the "tank top".

I cannot neither say nor assume what the cause of the lamentable casualty could be.

4.10 Chief engineer X, who for two months and two weeks in the autumn of 1997 until around the middle of January 1998 served as chief engineer on board, explained, among other things, in his statement to the police in Finland on 17 September 1998, about water in the hold, leaks in the ballast tank, pumps/pipe systems, holes in the deck, fire and lifeboat drills, and the possible cause of the casualty etc.:

I did not work in the hold after unloading. I did sometimes go to inspect the hold when the bilge sumps had got blocked.
I noticed that there was always water in the vessel's hold. The water leaked through the bilge sumps. In addition, ballast tank 4-centre filled up by itself, and had to be emptied by pump three times a day. I assume that around 10 m3 of water a day leaked in via the bilge sumps.
Ballast tank 4-centre would fill up completely in the space of one day. The leak in the bilge sump got steadily worse during my time on board.

During my last voyage on board the vessel, the situation remained such that when the vessel had a 10-degree stern trim, there was around a metre of water in the aft section of the hold. Water also seeped into the hold through the hatch seals, they were not watertight, and the closing carvel had become twisted so that it was crooked. In addition, I discovered a hole in the deck.

The fore peak could never fill up completely, since there was a hole in the front wall of the tank from where the water ran into the sea. Water also leaked into the space between the hold's "boxing" and the outer wall.

The ballast pumps functioned poorly, but I managed to get them to work, by taking in a side-stream of seawater, in order to get the vacuum to rise sufficiently.
In certain situations, when the filters in the bilge sumps were blocked, I had to momentarily force water in the direction of the hold in order to get the blockage cleared.

There were also leaks in the pipes in the engine room.

No rescue or fire drills of any kind were held during my time on board. I know nothing about survival suits, I never saw any.

The general condition of the vessel was very poor. I have never seen anything like it. There was a hole in the deck, which I noticed when I was in the hold. The hole had been patched up with "plastic padding" and when I tried to repair the deck by welding it, I noticed that the metal sheet was so thin that new holes would always appear.
It is likely that the vessel was never properly serviced. It was not maintained.
In the engine room log, there were no notes whatsoever indicating that the engine room had been serviced.

The ship's condition had been allowed to deteriorate so much that it would hardly have been possible to get it into proper shape in any way.
This was also true of the engine room; on my own, I was unable to get it into a proper condition.

During my time on the vessel, X and X were captains on board. X and X worked as chief officers, X and X were able-bodied seamen. X and X did all sorts of work. X was a cook.

I remember there was once an awkward situation in port, either in Sweden or in Norway. X was busy loading a cargo of wood chips with the excavator shovel, when the vessel suddenly tipped over, listed, resting only on the mooring lines. We managed to right the vessel again by pumping. The excavator had slid towards the "stoppers".

I think the casualty may be due to the poor condition of the ship and to all the leaks.

In addition, the fore peak hatch may have been open, and water may have seeped in through there and into the hold.
A third reason I have thought of is too great a cargo.

4.11 Cook X, who in the autumn of 1997, for a period of approx. one month, served as a cook on board, explained, among other things, in a statement to the police in Finland on 19 August 1998, about the location of the survival suits, rescue drills, and the possible cause of the casualty, etc.:

The survival suits were stored in the "funnel box" on the port side and everyone knew where this place was. During my time on board, I think one rescue drill was held as well as a fire drill, but no one put on the survival suits.

In response to the question of what caused the casualty, I have reached the conclusion that the excavator grab on the ship's deck must have come loose, and at the same time the hold hatch must have come loose, whereupon water was able to leak into the hold.

4.12 Accident Investigation of M/S ULSUND, Research Report VAL33-980807, from the Accident Investigation Board, Finland, of 6 October 1998:

The above report contains the following «summary»:

The mid ship section modulus was checked according to the rules of Det Norske Veritas and Bureau Veritas. According to the calculations the mid ship section of M/S ULSUND fulfilled the demands of both Classification Societies. Unfortunately any steel drawings were not available. The repair yard made in 1995 among other things measurements of plate thickness in the hull structure of the ship. The strength evaluations of this report are based on these measured thicknesses.
The calculated shear force at frame 90 was significantly smaller than the maximum permissible shear force calculated according to Bureau Veritas rules.
Stresses induced by torsion were not investigated but in principal the torsion may be dangerous for open ships.
The primary reason of the sinking would seem to be the damage of the hatch covers in heavy head seas. A wave collapsed to the forecastle has disconnected parts of the hatch covers situated in the fore part of the ship. On the basis of the calculations it is very quite likely that the bow has dived deeply into waves. A lot of water has flowed into the cargo hold. The ship has heeled over more and taken a bow trim. The list and the bow trim has increased when more water has flowed into the hold and the ship has begun to sink.

4.13 Statement from ship owner Trond A. Kittilsen Shipping A/S on 21 September 1999 concerning the fastening of the excavator (traverse beam) and the location of this when the ship was underway:

"We confirm that "Ulsund" also had brackets for securing the traverse beam at the rear of the ramp, directly in front of the hold. These were of the same type as those found at the front of the wheelhouse. Following a conversation with several members of the crew, I was informed that the traverse was rarely extended. It was only used on shorter voyages with ballast, in order to improve the trim of the vessel."

4.14 Dacon Marine Operation AS, represented by Dag Ammerud, wrote, among other things, the following "Report – The sinking of M/S ULSUND, of 14 October 1999:

This document is based on general information regarding the cargo-ship M/S "Ulsund", observations and findings during our preliminary project in July/August –99 for the salvage of the aluminium cargo, specific information regarding the last voyage of the ship and interviews with the ship-owner and earlier crewmembers of M/S "Ulsund".

Findings (Dacon company).

Area on the seabed around the main sections of the wreck:

- The Mc.Gregor cargo-hold hatches were found in an area on starboard side and aft of the wreck, covering an area of approximately 200 m. – 200 m. in square. Different items which belong to the outside of the hull and super-structure was also spread, within about the same area as the hatches. The hatches had different positions on the seabed, standing vertically on the edge half way into the mud, laying flat upside or upside down, etc. Two of the hatches which were found and inspected have severe damages, that is the one laying in the cargo-hold and the other in position 10-15 m. out on the port side of the front part of the cargo hold.
- Single small aluminium bars were spread out in the area, not in concentration or in bundles.
- Items or details from inside of the superstructure were found close to the aft of the ship and close to the separated superstructure/wheelhouse.

Main hull – cargo.hold:

- The hull is in one piece from aft to the bow bulkhead. The stern is buried into the seabed to approximately 3,40 m. marking. The depth into the seabed in the front of the cargo-hold, on starboard side, would be approximately the depth of the ship + 1 m. (the seabed 1 m. above the main deck level in mid frame).
- Both Port and Starboard side of hull and reeling, close to bow bulkhead have destruction caused by a heavy sudden impact in the bow. In the mid section of the hull/cargo-hold the following damages are observed. Starboard and Port side, from inside of the cargo hold, in the middle of the forward half of the longship bulkhead (modification/rebuild), a clean vertical cut possibly in a vertical weld from under the main deck to the bottom of the cargo-hold are observed (details in the video) on both sides. The welds against the bottom of the hold are open in a distance of approximately 0.7 m. the bulkhead is locally pressed out towards inside of the ship hull. Apart from local plate and construction damages in the aft section of the ship, typical implosion damages are observed above and under the main deck level in the area of the engine room and crew quarters.

Mc.Gregor hatch-system including rails for hatch-covers and excavator:

- On starboard side, mid ship, on top of the foundation for the Mc.Gregor hatch-covers, the foundation is separated and apparently bent out of line. On port side, the foundations for the hatch-covers and the excavator which are incorporated, are bent towards the cargo hold opening, the ribs which hold the two rails together and fix them to the main deck are torn off in the weld against the main deck. A piece of deck steel is attached to a number of ribs in the area. The hatch-cover rail is separated in the middle of the first half of the cargo hold.

The superstructure.

- The wheelhouse and the superstructure are separated from the hull and located in an upright position on the seabed approximately 10-15 m. out on port side of the ships stern. The superstructure is separated in the front of the first upper deck level, the aft cross-wall between

first and second deck is still attached to the first deck, bending out towards the stern of the ship. The front of the superstructure has significant structural damages.

The bow and foredeck.

- A section or the complete bow/fore part is separated from the hull, it rests in a position approximately 15 m. out on the port side of mid ship. Out of a heap of sediments it is observed the missing part from starboard reeling to port reeling, fore-deck with anchor winch etc., storage and hydraulic machinery facilities under the fore-deck upper (on the main deck). The rest of the bow under the main deck including bulb and forepeak is not visible either in this area or in the large heap of sediments in front of the cargo hold.

The Excavator – Åkermann.

- The Åkermann was according to the loading document dated: 17.03.98, secured in a position over the lowest loading area in the hold – forward of the cargo hold mid section. Details regarding the securing of the excavator are given in Enclosure 1B. According to the loading documents and our findings, the Åkermann was not secured in a position in front of or aft of the cargo-hold, which is normal during transport in open waters. In both these positions at the end of the rail for the excavator/ramp, special locking devices/brackets are welded in order to secure the excavator/ramp in a proper manner.

Fig. 8: Åkerman excavator, July 1997. (B Cederberg)

- The Åkermann is not found in an area of approximately 150 m. radius from centre of the cargo hold. Several of our findings conclude that the excavator had a main role in the disaster. We have not surveyed the area from the position of distress to the location of the wreck. If the excavator/ramp and the excavator itself were separated during the accident, this could result in two positions for such equipment.

Conclusions (Dacon company).

Findings – discussions.
Referring to the findings – above listed. The development, which led to the disaster, seems from our point of view to have its origin in the lack of a rigid sea fastening of the excavator and its ramp/traverse. Other elements might be introduced as secondary in the development, such as; overload, the actual stowage, construction collapse or material fatigue, the general conditions of the ship, the conditions of specific ships installations, faults in the rebuild design of the ship and the actual position of the excavator. The secondary elements could delay the sinking or give another result of the disaster but could not prevent it.

Development of the disaster (Dacon company).

Critical facts related to the last voyage.
- The Excavator and the ramp were not secured in a position or in a way described as normal procedure prior to transport in open water. The loading documents and our ROV-inspections confirm this scenario.
- The stowage-plan for the ship, which is preferable in a situation when unloading the vessel, might be the main objective for the decision to position the excavator in amidships of the cargo-hold. This position of the excavator could improve the sailing properties under normal circumstances.
- According to statements by the former crew-members; even when the excavator/ramp was secured in a position, locked against the aft prescribed locking device, the securing system for the excavator unit (on top of the ramp), had to be adjusted during transport in ballast condition due to normal ship.

Movement at the location of the disaster (Dacon company).

This sea-area is "famous" among the coaster captains sailing in these waters.
This means that when it is bad in general, this particular area is worse.
The particular day of the disaster was one of these bad days at sea.

4.15 MacGregor, Bergen, statement concerning the reinforcement of the cargo-hold hatches, and the force required to deform (bend) such a cargo-hold hatch at a 90-degree angle:

According to MacGregor, Bergen, the cargo-hold hatches on board ULSUND were strengthened in order to withstand container cargo. According to calculations made by MacGregor, the cargo-hold hatch would have to be subjected to a force of more than 109 tonnes to achieve a deformation where the hatch would be bent at a 90-degree angle.

4.16 Statement from Helly Hansen Spesialprodukter, Moss, concerning the suit which one of the deceased (who was retrieved from the sea by helicopter) used during the ULSUND casualty.

The suit, with production number M.D. 2930, was manufactured by Helly Hansen in the third quarter of 1991, and is of type E-300-O. This suit is a work suit, and carries no formal approval (approval no. A-655466/86 refers to the reflector on the suit). This type of suit is often found on

vessels in addition to approved ship suits, and is often used during work where it is necessary for safety reasons.

4.17 Inspection of the bent hatch cover section

Dacon company continued their operation to discharge the aluminium cargo from Ulsund's wreck in April 2000. In the cargo hold there was one hatch cover section lying on top of the cargo. It was bent into 90 degree angle. As the salvage company raised the hatch cover and brought it ashore, investigators had oppotunity to inspect it. On 14th April 2000, inspection took place in Farsund.
It was noted that the hatch cover's original position had been in the midship area, approximately on frame 70. This was concluded because there is a 40 cm wide stopper welded to the middle of the hatch cover. This stopper is to prevent the excavator grab to slip forward when placed to seaborne position.
The hatch cover has been bent into almost 90 degrees angle. There are no traces of any outside hit on the bended part. The bending force has come from the end/ends of the hatch cover. The inward bended hatch coaming on port side on the same frame supports this point of view.
There is a triangular hole in the hatch cover, the size of it is 35cm in length, 12cm wide in other end and 1-2cm in the other end. This is a trace of something sharp and can be thought to be from a hit by excavator's grab.

Fig. 9: The bent hatch cover section, April 2000, in Farsund. (AIB Finland)

Fig. 10. The bent hatch cover section, April 2000, in Farsund. (AIB Finland)

5 Facts established and comments

5.1 Rebuilding of the ship.

In 1987, the ship was rebuilt when the intermediate deck was removed, the cargo holds were boxed in and one mast and several booms were removed. The ship was given one large loading hatch instead of two. Rails, a traverse beam and an excavator were installed, and the ship was called a self-loader. The excavator, which was of the type Hitachi VH121, weighed 27.1 tonnes.

Up until 1991, the ship was classified in Bureau Veritas, and then in the Norwegian Maritime Directorate (unclassified). Bureau Veritas was thus responsible for all strength and safety aspects of the rebuilding in 1987. The ship is classified as an ordinary dry-cargo ship and not as a bulk ship.

5.2 Stability calculations.

Polarkonsult A/S carried out new stability calculations for the ship on 21 March 1988. The Norwegian Maritime Directorate endorsed these calculations in 6 May 1988. No stability calculations have been made for the ship since.

5.3 Main class 1995.

Main class was carried out in April 1995, before the expiry date, which was August 1996. In connection with the main class in 1995, Det norske Veritas was authorised to inspect the ship on behalf of the Norwegian Maritime Directorate. The 1995 main class was valid until April 2000.

5.4 New excavator installed in 1995.

In May 1995, a new excavator of the type Åkerman H16C was installed on the ship. It had a total weight of approx. 45 tonnes (excavator and traverse beam), i.e. it weighed 18 tonnes more than the Hitachi VH121 excavator installed on the ship during the 1987 rebuilding.

No new stability calculations were made in connection with the installation of a heavier excavator on board ship.

5.5 The ship's strength and safety conditions when it departed from Porsgrunn on 5 September 1997 on bareboat charter to Rofera OY Ltd., Finland.

Investigations have not uncovered weaknesses/deficiencies in the ship's strength and safety conditions when it sailed from Porsgrunn on bareboat charter on 5 September 1997. All the ship's certificates were valid on 5 September 1997. When the ship sailed from Porsgrunn on 5 September 1997, the ship was manned by a Norwegian captain and a Finnish crew.

5.6 The cargo on the casualty voyage, and displacement/draft, on departure from St. Petersburg on 17 February 1998 and Copenhagen on 25 February 1998.

The ship was carrying 24043 MT aluminium on its casualty voyage, loaded in St. Petersburg. The cargo consisted of "T bars" forward in the hold and "Pack" amidships and aft in the hold.

Fig. 11: Aluminium T-bars, discharged from Ulsund's wreck. (AIB Finland)

The impressions gained from observations of the cargo hold of the wreck of ULSUND, made by mini-submarine and video camera (ROV), are that the cargo was well stowed on the casualty voyage. There are thus no grounds for claiming that a shifting of the load could be the reason for the casualty (the ULSUND wreck lies on a fairly even keel, with almost no list, at a depth of approx. 310 metres).

On departure from St. Petersburg 17 February 1998, the vessel's calculated displacement (FW) was 3400.8 with a mean draft of 5.329 metres.

On departure from Copenhagen on 25 February 1998, the vessel's calculated displacement was (salt content 1.010) 3416.2 with a mean draft of 5.281 metres.

Calculations show that the ship cannot have been overloaded on the casualty voyage.

5.7 Conditions during the bareboat charter and on the casualty voyage.

According to the bareboat charterer Rofera OY Ltd., represented by Hannu Norrgård, the ship was during the bareboat charter period in seaworthy and a good technical condition.

During the ship's call at the port of Copenhagen on 25 February 1998, captain X replaced captain X. The latter went ashore on holiday on the afternoon of 25 February 1998, after the routine "handover" had been completed.

On Thursday 26 February 1998, Hannu Norrgård spoke on the telephone with captain X and chief engineer X. By this time, the ship had passed Skagen. There was a violent storm and the ship was sailing at a speed of 3–4 knots. Everything was in order on board, however. The chief engineer had

made temporary repairs to the pipes of one of the auxiliary engines. He ordered a pipe repairman to carry out a proper repair on the engine.

On the day of the casualty, Friday 27 February 1998, the office clerk at Rofera OY Ltd. had been in contact with the vessel on three occasions, and nothing special had been reported.

5.8 Content of the distress signal from ULSUND.

At 21.25 hours on 27 February 1998 in position N 57-57.8 E 006-12.6, captain X notified Farsund Radio in a MAYDAY signal that:

– The ship was making water.
– The port railings and deck were under water.
– Approx. 6 degree list to port.
– Attempting to pump.
– Request immediate assistance.
– Seven persons on board.

In the distress signal from the ship, no mention was made of where the ship was taking in water, nor was there any mention of where attempts were made to pump the water from. The distress signal and the subsequent message lasted a total of 70 seconds, following which no one had any contact with the ship.

5.9 What other ships/helicopters observed when they arrived at the location of the casualty.

The ship "ALREK" arrived at the place where the casualty occurred at approx. 22.25 hours, i.e. approx. one hour after the distress signal MAYDAY had been transmitted. Only wreckage was visible on the surface of the sea. The ship "GARDWAY", which arrived at the place of the casualty at 22.42 hours, reported to Farsund Radio that an echo had been observed on the radar at the position in question at 21.37 hours, but that the echo had disappeared.

The search and rescue helicopter arrived at the place where the casualty had occurred at 23.05 hours. The wind was gale force, 40 knots (20.7 metres per second) and the sea in the area was rough.

The search and rescue helicopter retrieved two persons from the sea, at 23.45 and 00.05 hours, respectively. Both persons were dead. The autopsy shows that the cause of there deaths was drowning. One of the deceased was wearing a type of work suit, Helly Hansen Survival Suit, labelled M.D. 2930. It is assumed that the other person was wearing a similar suit. (Note. The suit used by the latter person was sent to Finland together with the body of the deceased, and this is why nothing of certainty is known.)

5.10 Lifesaving appliances used/unused.

– The ship's two life rafts surfaced in connection with the loss of the vessel, but both rafts were found empty.

- One of the life rafts was presented during the maritime inquiry at Skien and Porsgrunn Municipal Court in March 1998. The life raft was intact and of the type Viking DSL 8-N L08571, labelled SOLAS 1960 and 8 persons. It was noted that the wire/weak link on the hydrostat was worn, that the equipment package was closed and taped, and that when opened it was noted that the contents were in place and dry. The equipment pack contained, among other things, red Pains-Wessex parachute flares, which were unused and labelled valid until 1/2000.
- Observation by video camera and mini-submarine shows that the lifeboat is in place on the davits, covered by a blue tarpaulin. This would thus indicate that no attempt has been made to launch the lifeboat.
- Emergency beacon (EPIRB 121.5–243.0 MHz) has not transmitted any signal.
- According to its equipment safety certificate, the ship had seven survival suits on board.
- The two dead seamen who were retrieved from the sea by helicopter at midnight on 27 February 1998 were probably both wearing work suits, non-approved rescue suits. The suit worn by one of the deceased, and which was presented at the maritime inquiry at Skien and Porsgrunn Municipal Court in March 1998 was of the type Helly Hansen Survival Suit, labelled M.B. 2930. The above suit was found intact, the zipper could be pulled up and down, it was equipped with an approved reflector (A655466/86), and the suit's boot size was 46. Helly Hansen Spesialprodukter have stated that the suit in question, with a production number M.B. 2930 was manufactured by Helly Hansen in the third quarter of 1991, and is of the type E-300-0, a working suit without any formal approval. This type of suit is found on board vessels as a supplement to approved suits, and is used during work when required for safety reasons.
- The ship had seven life jackets, but none of the crew were found wearing such.

The crew's use of lifesaving appliances, or lack thereof, clearly shows that the ship must have sunk very quickly. One must assume that the ship disappeared from the surface of the sea within 10–15 minutes.

5.11 Were the two deceased able-bodied seamen on deck to check/lash something down?

Both of the two deceased persons who were found in the sea after the ship sank were able-bodied seamen. It may be probable that the two able-bodied seamen had been dispatched to the main deck to check and lash "something" down. Due to the bad weather and water on deck, they both used suits, probably of the type Helly Hansen Survival Suit. The video recording of the wreck shows that mooring lines were stretched between scuppers no. 9 and 10 on the port side of the main deck. Similarly, a wire has been lashed around the port-side rail on which the excavator ran, at approximately the same area of the main deck as the mooring lines mentioned above. It is possible that attempts were made to lash/secure, for example, the excavator, hatch-covers, or other equipment on board.

5.12 Short summary of facts relating to the sinking of mv Ulsund

The ship's bow section has ripped off and is lying on the port side of the hull.
The excavator has got loose and is missing.
There is no deformation in the brackets for the fastening of the excavator traverse.
A hatch cover section from midship's area has been bent inwards almost 90 degrees.
There are no signs of any other hit on the hatchcover section excluding one minor hole.
The hatch coaming on port side between frames 65 – 75 has been bent inwards.
The other hatch covers have been spread around the hull like after explosion.

The superstructure has got indents by external force and is lying on the seabed port side of the hull.

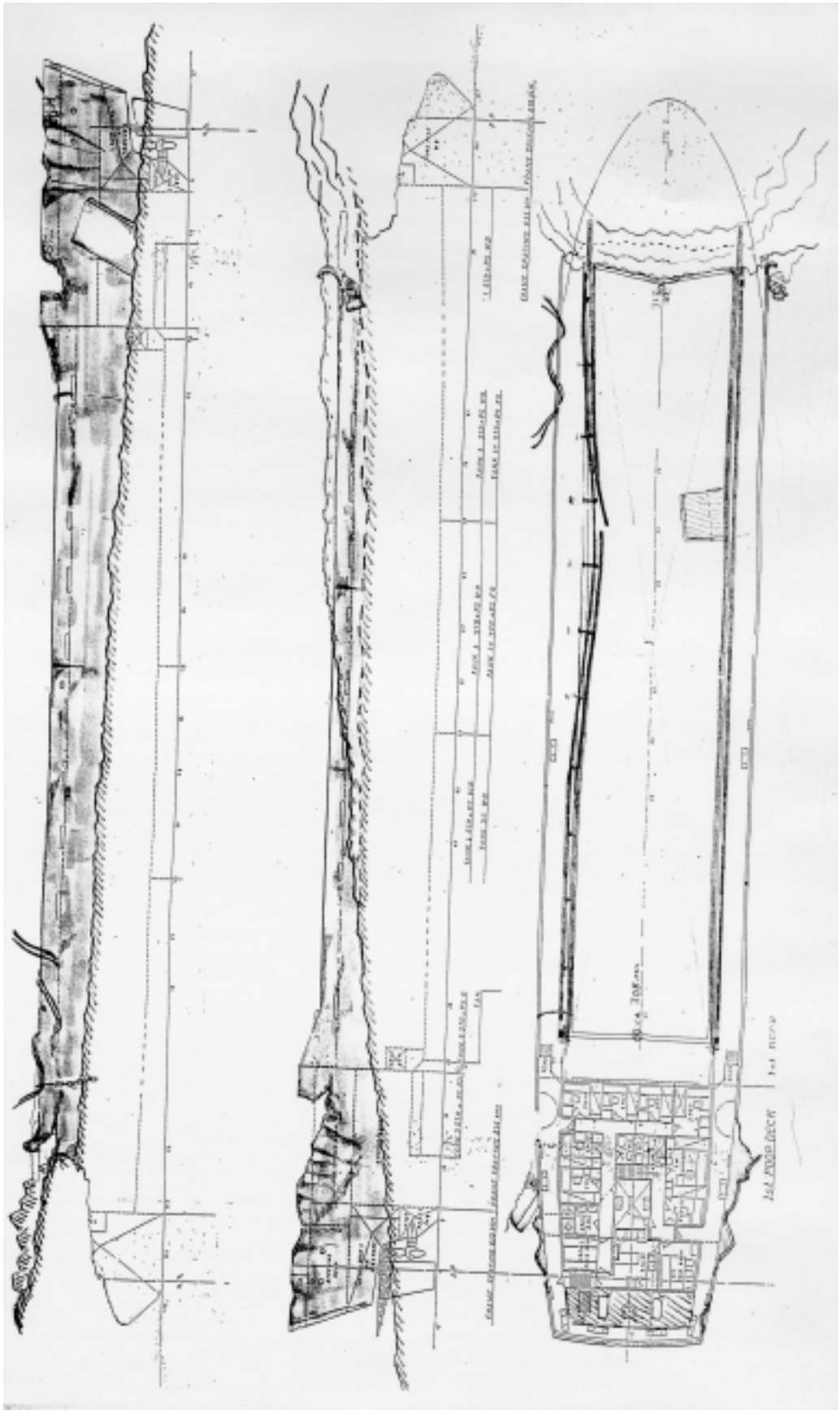


Fig. 12: Sketches of the hull (Dacon company)

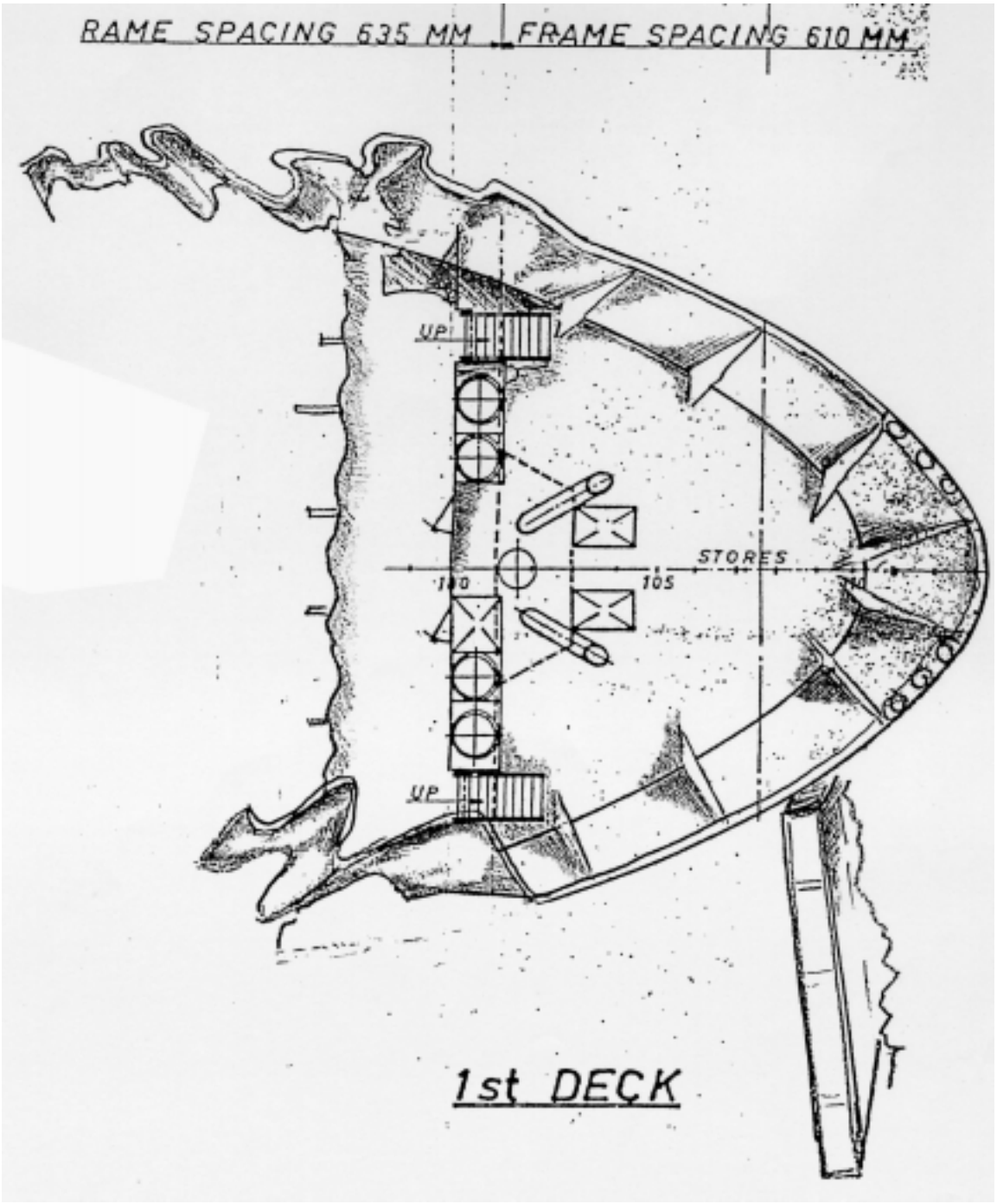


Fig. 13: Sketch of the forecastle head (Dacon company)

Fig. 14: Brackets for the fastening of the excavator traverse (Dacon company)

Fig. 15: Brackets for the fastening of the excavator traverse (Dacon company)

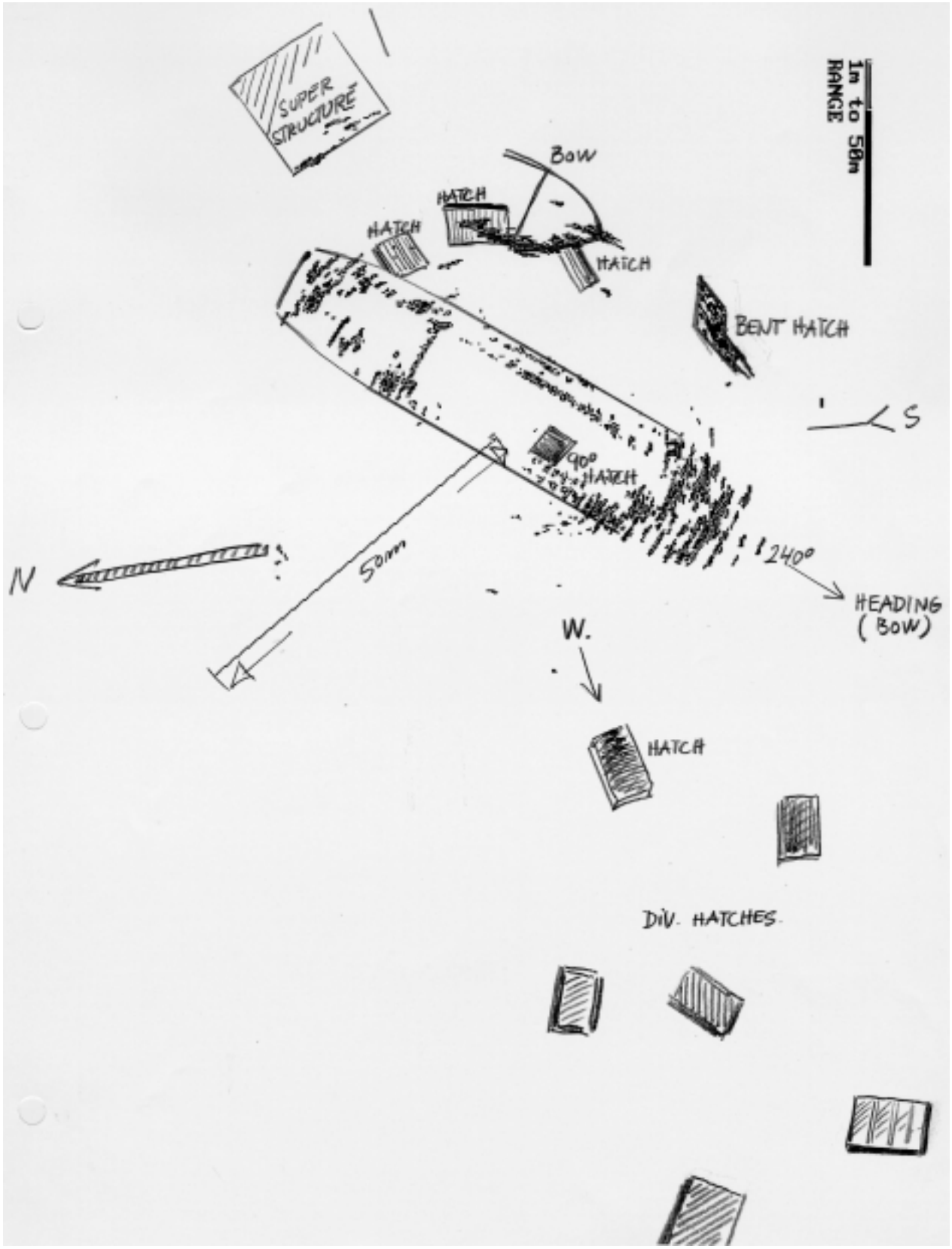


Fig. 16: Sketch of the area, based on sonar picture (Dacon company)

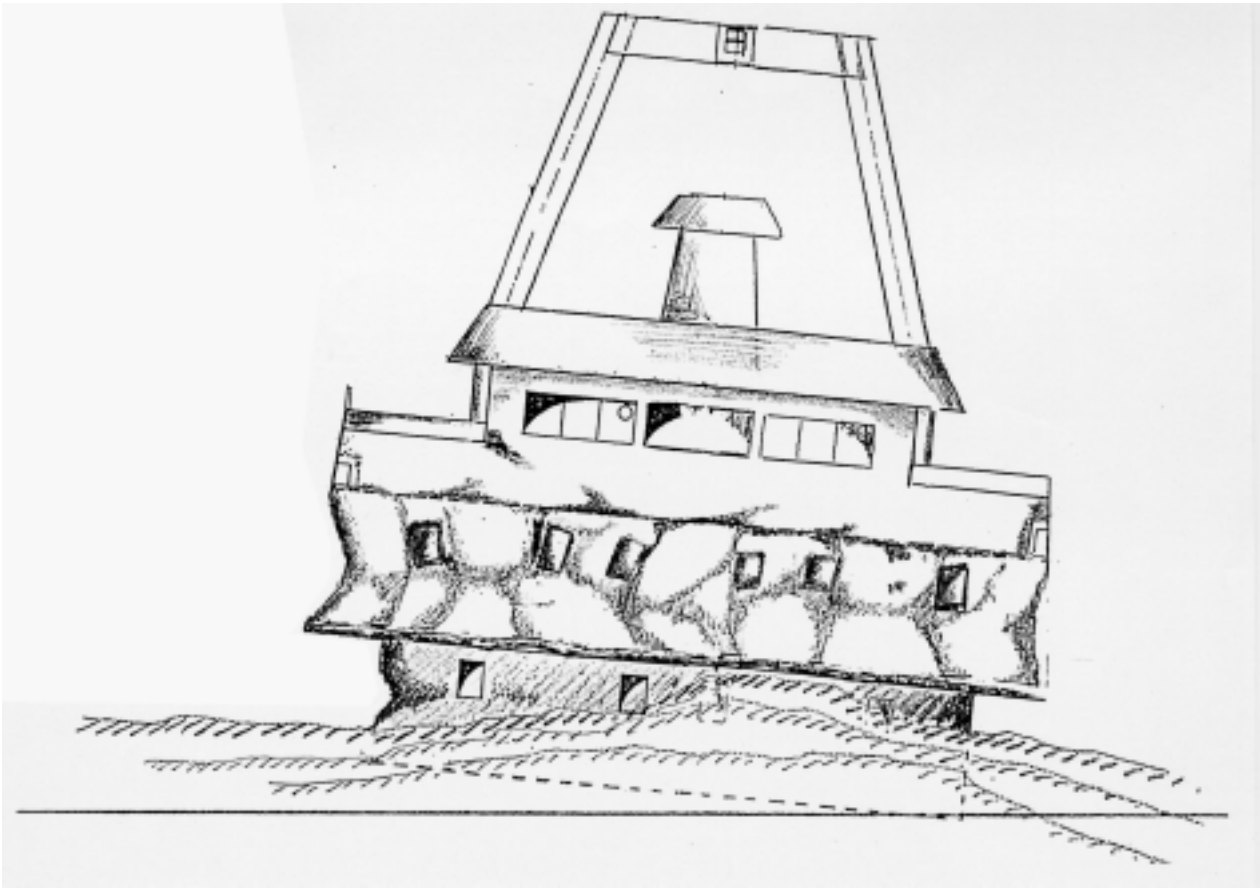


Fig. 17: Sketch of Ulsund’s superstructure (Dacon company)

6 Conclusion, probable cause of the casualty

6.1 The ship's stability, hogging, cargo etc.

– Estimates made by or for investigation show that on departure from both St. Petersburg on 17 February 1998 and Copenhagen on 25 February 1998 the ship's stability was good.
– These estimates also show that the ship was not overloaded on the casualty voyage when it departed from St. Petersburg and Copenhagen.
– Video recordings from the cargo-hold show that the cargo was well stowed and secured.
– Owing to the placement of the cargo in the hold (in accordance with the loading plan), one may ascertain, with great probability based on earlier load conditions, that the ship had a hogging on the voyage.

6.2 Requirements regarding placement, and the securing of the excavator/traverse beam when the ship was underway, and what was observed on the wreck in the summer of 1999 in this respect.

In accordance with the test certificate for excavator/traverse beam, the placement of equipment was as follows when the ship was underway: *"During voyage the transverse beam shall be parked on aft end of cargo hatch and locked" (see document, attachment 1A).*

According to information from ship owner Trond Kittilsen, the excavator/traverse beam could either be secured at the front end of the wheelhouse or at the aft end of the forecastle. There were two steel brackets for securing the traverse beam at the front end of the wheelhouse, where these steel brackets were welded to the starboard and port rails of the hatch covers. Similarly, two steel brackets for securing the traverse beam at the aft end of the forecastle were welded to the starboard and port rails of the hatch covers. In each of these four steel brackets, there was a hole, enabling one to lock the traverse beam by inserting a steel bolt with a diameter of 100 millimetres (see documentation, attachment 1B).

Video recordings of the ULSUND wreck in the summer of 1999 show that none of the steel brackets on the rails where the traverse beam could be locked with steel bolts were deformed/damaged, neither those at the aft end of the loading hatch nor those in front.

Since none of the four steel brackets, which are arranged and devised for fastening the traverse beam, have been deformed/damaged, this proves that the excavator/traverse beam cannot have been parked and locked as was required of the equipment, i.e. *"parked on aft end of cargo hatch and locked"*.

6.3 Leaking of water into the ship etc.

When questioned, some of the crews that sailed on the ship in the autumn of 1997 and the winter of 1998 explained that on some occasions water had leaked into the hold and the double bottom tanks nos. 1, 2, and 4.

In his distress signal made at 21.25 hours on 27 February 1998, the ship's captain stated that:

– The ship was making water, without stating where.

– Attempts were made at pumping, without stating from where.
– The ship's port-side railings and deck were under water, and the vessel had a six degree list.
– The ship disappeared from the surface of the sea in a short space of time, an estimated 10–15 minutes.

On the basis of the above distress signal, and the brief period of time before the ship disappeared from the surface of the sea, the ship must have taken in large amounts of water within a relatively short period of time. It is highly probable that water has leaked into the hold. No other tanks or containers have a volume large enough to cause the ship to sink by the leaking of water in such as short space of time. Since the ship had a list and the deck was under water, the ship's stability was reduced dramatically.

The cause of the water penetration is unknown, there are two matters that may have led to this, i.e.:

1. Due to the bad weather, the excavator/traverse beam, weighing a total of approx. 45 tonnes, may have come loose and damaged, or even removed, the hatch covers with, for example, the excavator arm or the grab. In the bad weather, with W-NW winds of 30 knots and a significant wave height of 5–6 metres, vast amounts of seawater may have entered the hold.

From video recordings of the wreck in the summer of 1999, it may be concluded that the excavator/traverse beam was not locked as described in the certificate for the above-mentioned equipment, i.e. that the traverse beam was not locked by inserting steel bolts into the brackets at the aft end of the loading hatch, since none of the steel brackets were deformed or damaged.

The steel brackets at the front end of the loading hatch are not deformed or damaged, which would indicate that the excavator/traverse beam was not locked to the aft end of the forecastle either.

However, there are remains of the mooring lines and wire approximately amidships on the main deck, perhaps indicating that the crew could have used this to fasten "something". It is natural to believe that mooring line and wire have been used to lash/lock the excavator/traverse beam, which has stood in a position approximately midway over the loading hatch, most likely with the grab resting on the hatch cover (List of Sources No 3).

2. The crew members who sailed on the ship in the autumn of 1997 and the winter of 1998 have stated of the occasional leaking of water into the double bottom tanks nos. 1, 2 and 4, and occasionally into the hold. Such leaks could also have occurred on the casualty voyage, which has meant that the ship had little freeboard, and would thus be subjected to enormous stress on its hull, particularly on the bow. In the bad weather, with a significant wave height of 5–6 metres, cracks may have formed in the bow section, resulting in large amounts of water leaking into, among other things, the hold, thus causing the casualty.

6.4 A probable scenario

During the voyage from St.Petersburg to Copenhagen Ulsund's bow area was under heavy ice pressure and in Baltic Sea Ulsund met heavy seas.
During the voyage from Copenhagen, after passing Skagen on 26th February Ulsund met vigorous seas over 30 hours. The draft had grown because of fresh water and bunker oil taken in Copenhagen, and continuous leakages.

Sometime or several times during the voyage it is likely to believe that the sea-conditions would involve adjustments on the sea fastening of the excavator and/or the traverse.
The excavator boom, pointed towards the bow with the grab resting and secured on one of the hatch-sections. Any movement in the excavator (on top of the ramp) would create huge stress on the system/method for locking the grab in a secured position. Based on findings in the rail for both hatch-covers and excavator/traverse, an immediate acceleration of significant force to the rail-system in a sideways direction to starboard, caused the observed damages.
Such a force can be the results of the excavator boom swinging out towards starboard with the grab and parts of the boom into the sea with a huge pulling force and roll towards starboard.
With the release and loosing the excavator and it's traverse one or more hatch covers gets loose, one bending because of the pulling forces from hatch coaming bending inwards with the traverse getting loose.
The intake of water grows and the ship gets a continuous list to port. Due to a significant load of water, maximum load-capacity, list, low position of the bow and partly destroyed hatch-covers, the process of sinking is very rapid. The master has no time to give any more information by VHF and the crew members had to do outmost to try to save themselves. Due to the weather conditions in Skagerrak with W-NW wind of approx. 30 knots (near gale) and significant wave height of 5-6 metres, and the fact that it was darkness, the 7 crew members did not succeed in saving there lives with the lifesaving equipment they got onboard.

During this time-gap between the filling of water into the hold and the moment of sinking, the sea rolls into the superstructure and in a few hits by waves create structural damages in front of the structure, starting to deteriorate the area between the deck and the superstructure. When sinking rapidly the rest of air inside the hold bursts out and some of the remaining hatch-covers will fall off.
Experiences from shipwrecks in deep water with low cubic, heavy loads, like iron ore, aluminium, copper, zinc etc.do show that the ships are standing in an upright position in the seabed. Usually there are severe damages in the nose section. Ulsund is typical for this kind of vessels and cargo. During sinking the weight of the cargo, added by trapped air in the engine room and the crew quarters, the ship sinks with a heavy nose and hits the seabed with destructive force.
In the impact with the seabed, the bow broke off, bending up and backwards, falling to rest close to the main section of the hull. The superstructure tears off close to the seabed, separated first at deck level in the front bulkhead due to a combination of deterioration in this area and a sudden relief of trapped air inside the engine room and crew quarters on the main deck. Overpressure and implosion effects are observed in the aft ship, which is typical for this kind of situations.

7 Lessons to be learned

- Excavator lashing and securing. Investigators will adress to all parties concerned; Dockyards, Planners, Shipowners, Operators, Masters and Classification Societies that,

  Excavator and its traverse and other heavy cargo-handling equipment must be arranged and secured as indicated in documents for such equipment when the vessel is under way.

- Water ingress and leakages. Investigators will highlight the importance of this.

  If there is water ingress in a vessel, for instance to tanks or holds, such problems must be resolved before the ship puts out to sea. All leakages should be handled as incidents and reported to operators as part of ISM.

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Martti Heikkilä
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Risto Repo
Accident Investigation Board Finland, Helsinki

Jerker Klawer
Finnish Maritime Administration, Helsinki
(untill 30.11.2000)

8. List of Sources

1. Blueprint of the ship, stamped by BV on 13 April 1987, with stability estimates approved by the Norwegian Maritime Directorate 1988.
1A. Control book for lifting appliances with a test certificate dated 11 May 1995 for the Åkermann H16C excavator.
1B. Sketches showing the fastening of the excavator.
2. Protests (2) submitted by Captain Olli Norrgård in St. Petersburg.
3. Sketch/overview of the placement/amount of the cargo.
4. Sketch showing binding/support of the cargo astern in the hold (front of the cargo).
5. Sketch showing binding/support of the cargo foremost in the hold (front of the cargo).
6. Sketch of the aluminium cargo, “T-bars” and “Pack”.
7. Sketch of the excavator’s fastening devices (from Captain Olli Norrgård).
8. Chart copies/distances showing the voyage from St. Petersburg to Copenhagen.
9. Estimate of “Load condition” on departure from St. Petersburg on 17 February 1998 and Copenhagen 25 February 1998.
10. Overview map showing the approximate route/location of the casualty voyage, from St. Petersburg to the position of the casualty.
11. Accident Investigation of M/S ULSUND, Research Report VAL33-980807, of 6 October 1998, from the Accident Investigation Board, Finland.
12. Sketch outlining the damage to the ULSUND wreck, prepared by the Finnish Maritime Authorities.
13. Report ” The sinking of M/S Ulsund” No.3012-01, 14.10.1999 by DACON Marine Operations A/S, Norway
14. Protocols of the statements given to the Finnish police by seamen who had been sailing onboard ULSUND in 1997 and 1998.