Investigation report

B 7/2004 M

Ms SUPERFAST VII, grounding off Hanko on 12.11.2004

Translation of the original Finnish report

This investigation report was written to improve safety and prevent new accidents. The report does not address the possible responsibility or liability caused by the accident. The investigation report should not be used for purposes other than the improvement of safety.

SUMMARY

The Ro-Ro passenger vessel SUPERFAST VII was on way from Rostock to Hanko on 12 November 2004. She had 140 passengers. Her cargo was trailers, trucks and cars. The vessel took a pilot between Russarö and Gustafsvärn at 19:05. The vessel reached the turning area outside the port at 19:14, when the tugboats the Ajax and the Iso-Pukki were made fast on her starboard side.

The master, the Staff Captain, the chief mate, the helmsman and the pilot were on the bridge. The master manoeuvred the vessel on the port wing, the chief mate observed from the starboard wing the distance of the vessel to the buoys on the north side of the fairway. The pilot kept contact with the tugboats. The Staff Captain was on the bridge without any actual task.

The master of the vessel and the pilot were planning to enter the port so that the vessel would be reversed to the port as the wind was from the bow and the tugboats were on the starboard side ready to push the vessel to the quay. At the turning area, the vessel drifted north of the fairway and so the tugboats were asked to push the vessel south while she was reversing. As a result of this measure and, according to the master, because of the wind, the vessel drifted south of the fairway.

The reversing was continued, and the efforts of the master to bring the vessel into the fairway were not successful. As the stern of the vessel was very close to the breakwater, the bow tugboat was asked to move portside. This did not succeed, because the vessel had drifted so close to the breakwater that, due to the shallowness of the water, there was no room for the tugboat.

The vessel grounded at the peak of the Hanko breakwater at 19:24, but she was able to continue her voyage to the quay, to which she was moored a little later.

The damage to the vessel did not result in danger of sinking nor stability problems.

The investigation revealed that the strongest background factor of the accident were the defective instructions of the Safety Management System (SMS) of the company. This resulted in insufficient utilisation of the existing navigation equipment and a lack of bridge co-operation. The instructions did not contain harbour manoeuvring in a storm, which resulted in a defective estimation of the wind effect.

THE ABBREVIATIONS USED

AB	Able bodied seaman
AIS	Automatic Information System.
ARPA	Automatic Radar Plotting Aid.
COG	Course Over Ground.
DGPS	Differential Global Positioning System.
GPS	Global Positioning System.
ECDIS	Electronic Chart Display and Information System.
IEC	International Electro technical Commission.
IMO	International Maritime Organization.
IMDG	International Maritime Dangerous Goods (Code).
ISM	International Safety Management (Code).
MF/ HF	Medium Frequency / High Frequency
OOW	Officer on Watch
ROT	Rate of Turn
SENC	System Electronic Navigation Chart.
SMS	Safety management system
SOLAS	Safety of Life at Sea.
VDR	Voyage Data Recorder.
VDC	Voyage Data Capsule.
VHF	Very High Frequency
VTS	Vessel Traffic Service.
UTC	Universal Coordinated Time

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FOREWORD

The Accident Investigation Board was notified of the grounding of the SUPERFAST VII on 12 November 2004 at 20:00.

On 15 November 2004 the Accident Investigation Board appointed an investigation commission to investigate the accident. Captain Juha **Sjölund** was appointed Investigator in Charge per consent and Captain Karl **Loveson** was appointed member and Captain Kari **Larjo** was appointed expert.

The Finnish investigation authorities have acted as the party in charge of the investigation in accordance with Resolution A.849(20) of the International Maritime Organisation (IMO).

Hanko Port is part of sector 2 of the Helsinki VTS Centre and, on the day of the accident, the SUPERFAST VII was being monitored by it. The VTS gave the investigators a recording showing the movements of the vessel before and after the grounding.

The vessel was equipped with a VDR (Voyage Data Recorder) required by Chapter V, Rule 20 of the new SOLAS Convention to record data for accident investigation. Due to delayed securing of the recording, the investigators did not have the data recorded available to them. The master of the vessel did not give a maritime declaration, and therefore the investigators had to rely on the ECDIC recordings as well as on the hearing of the crew and the pilot to establish the path of the vessel.

The investigators heard the master, the chief mate and the Staff Captain of the vessel and familiarised themselves with the vessel in Naantali shipyard on 16 November 2004. The engine crew was heard in Naantali on 18 November 2004 and the pilot on 25 November 2004. The masters of both tugboats were heard with regard to the incident.

Expert Kari **Larjo** accompanied the vessel on a voyage Hanko–Rostock–Hanko in summer 2005 and studied the documentation and navigation functions of the vessel.

Statements on the Investigation Report. The final draft of the Investigation Report was sent to Superfast Ferries S.A Headquarters and to Finnish Maritime Administration for a statement under section 24 of the Decree on Accident Investigation (79/1996). The statement obtained from Superfast Ferries is appended to this Investigation Report. The company has partly improved their SMS bridge procedures after the accident and prior to the their statement and considers additional improvements and training according to the issued recommendations. Additionally Superfast Ferries has issued instruction to the masters how to save the data from the VDR. The investigation is however based on the company instruction which were in force at the time of the accident, thus the investigators stick in their points of view in spite of the company partly discrepant opinion.

1. EVENTS AND INVESTIGATIONS

1.1 The vessel

Figure 1. The Ms SUPERFAST VII *(© Superfast Ferries)*

1.1.1 General information

Name of the vessel	The Ms SUPERFAST VII
Type	Passenger/trailer ferry
Nationality	Greece
Company	Superfast Ferries
Owner	Superfast Okto
Home port	Pireus
Call sign	SWFL
IMO No.	9198941
Year and place of construction	2001 Kiel
Classification society	American Bureau of Shipping
Class	ABS + A1E, RoRo Trailer and Passenger Ferry
GRT	30285
Net weight	10769

DWT	5525
Length, max	203.30 m
Length, B.P.P.	185.60 m
Breadth, moulded	25 m
Draught	6.50 m max
Engine power	4 x 11500 kW
Bow thrusters	2 x 925 kW
Stern thruster	1350 kW
Wind area	4425 m² (at a draught of 6.35 m)
Speed	27.1/30.4 knots
Number of passengers	626

The vessel has two controllable pitch propellers, two rudders and two bow thrusters and a stern thruster. The information is based on the master's notification of the maritime accident.

1.1.2 Manning

The vessel had a crew of 63. The deck crew was 14 people, including the master and four mates. The engine crew was 10, including the chief engineer, four engineers and one electricity engineer. The other 27 were mostly housekeeping crew. The crew represented several nationalities, as Greece, Germany, Finland, the Philippines, Austria, South Africa, Azerbaijan, the Ukraine and Bulgaria.

At the time of the grounding, the master, the chief mate, the helmsman, the Staff Captain and the pilot were on the bridge. The master is Greek and he was born in 1962. He has 16 years of experience at sea and he obtained the qualifications of master in 1997. He worked in supervisory duties in the construction of this series of vessels since the beginning and thereafter as master of the SUPERFAST VII.

The Staff Captain is Greek and he was born in 1960. He has no watch duty but he participates in the mooring and unmooring of the vessel. At other times he takes care of administrative tasks. He obtained the qualifications of sea captain in 1995. He has served onboard cargo and passenger vessels for 14 years. He came to serve in the Superfast company in 2001 and onboard the SUPERFAST VII in 2003.

The chief mate is Finnish and he was born in 1973. He obtained the qualifications of chief mate on 28 June 2001.

The Greek AB at the helm was born in 1958. He has served onboard the SUPERFAST VIII and SUPERFAST VII vessels since 2001.

The pilot of the vessel was one the two chief pilots of the Hanko Pilot Station. He was born in 1954. He is qualified as a captain and he has been a pilot in Hanko since 1

January 1990. He has been piloting SUPERFAST vessels daily within the scope of his watch hours ever since they started their traffic.

1.1.3 The bridge and control equipment. The steering consoles

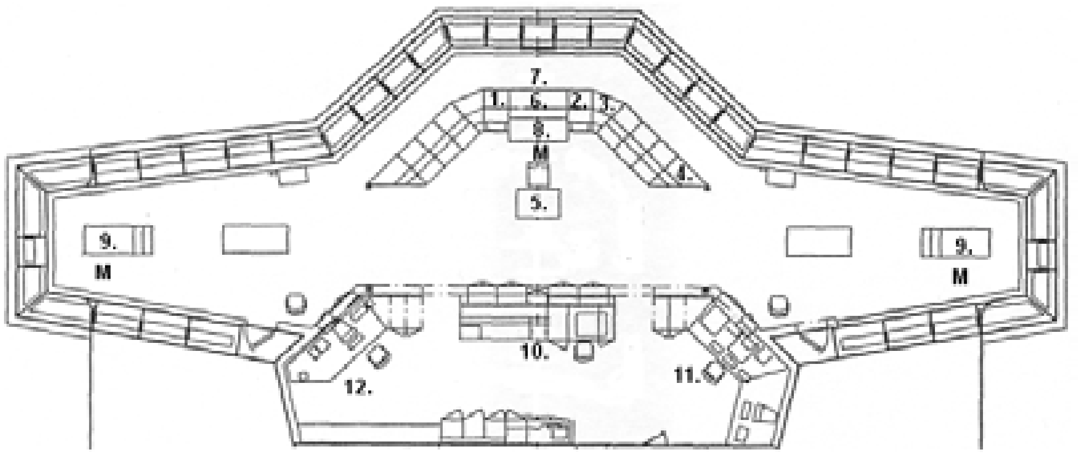

Figure 2. Layout of the equipment on the bridge

1. 3-cm radar display, Raytheon 26", X band
2. 10-cm radar display, Raytheon 26", S band
3. Digital chart display, Raytheon Pathfinder 20"
4. GPS Leica AP MK 10, DGPS Professional Leica MK 10, AIS MX Leica 420 Navigation system.
5. Steering column
   - Gyro indicator, Raytheon Anshcütz Standard 20 133–556 NG002
   - Magnetic compass indicator, Anschütz
   - Rudder angle indicator for both rudders, Anschütz
6. INS indicator, Nauto conning display, Raytheon Pathfinder 20”
7. Ceiling panel
   - Log display, Consillium SAL SD 1–6
     Digital slave display of gyro compass, Anschütz 133–811, BSH/046/34/G/2/97
   - Echo sounder display. ELAC DAZ 25
   - Wind gauge. Relative wind direction and speed. YOUNG 6206
   - ROT indicator, Anschütz BSH/46/024275/1/97
   - Rudder angle indicators for both rudders, Anschütz
8. Autopilot, Anshcütz Nautopilot NP 2030 / Raytheon
9. The steering consoles in the wings
   - 3-cm slave display of the radar, Conrac NEPTUN 750 P 9617
   - Digital chart display, Conrac NEPTUN 750 P 9617
   - ROT indicator, Anschütz
   - Relative wind direction and speed, YOUNG 6206
   - Rudder angle indicators for both rudders, Anschütz
10. Chart room
    - GPS
    - Echo sounder
    - The log
    - Angle speed
    - Loran C, FURUNO LC-MARK II

- Radio bearing equipment, TAIYO TD-C338 Mk

11. “NaPa” computer for stability calculations, HP Vectra VE

The computers of the VDR equipment and the electronic chart equipment are missing from the otherwise detailed equipment list, but they are on the bridge.

Radio equipment

The list has been prepared on the basis of the equipment list given by the company and photographs.

Equipment	Type and manufaturer
NAVTEX receiver	SAM electronics, DEBEG 9000
Inmarsat C SES	Raytheon STR 1500 CN
Inmarsat B	Nera SATURN BM,
Fax	Toshiba TF 471
Radio MF/HF	Raytheon STR 2000
DSC Controller	STANDARD STR 8400
Handset VHF	STANDARD STR 8410
VHF DSC Controller.	STANDARD RADIO STR 3400 DSC
Portable GMDSS VHF	JOTRON TRON 93080
2182 kHz Watch Receiver	STN ATLAS, DEBEG 2150

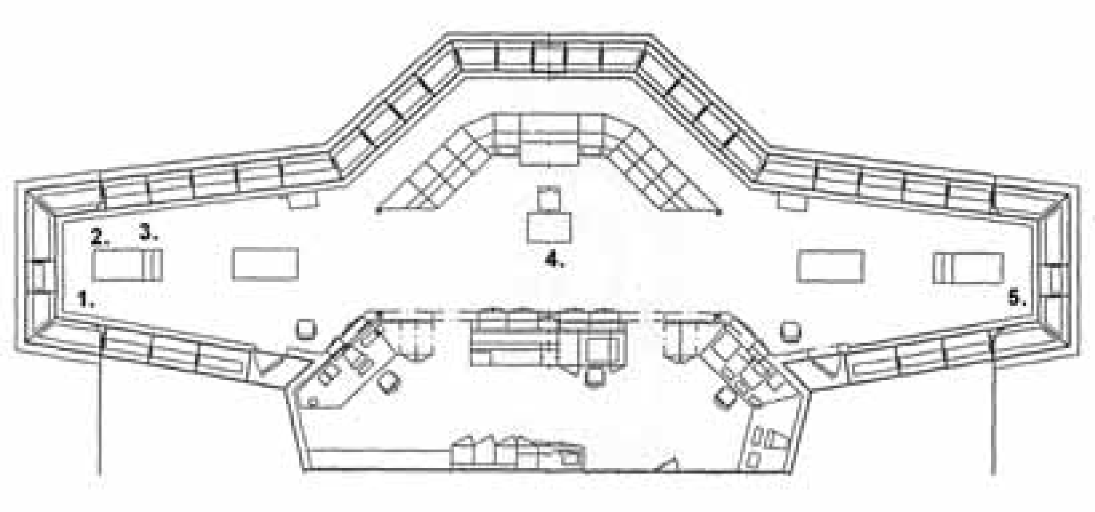

Figure 3. Places of the persons on the bridge

1. *The master was steering the vessel, and he had overall responsibility.*
2. *The pilot acted as adviser.*
3. *The Staff Captain was in practice an observer.*
4. *The helmsman acted as ordered by the master.*
5. *The chief mate was checking the buoys on the north side of the fairway and kept contact with the safety officer in charge of the stern mooring.*

1.1.4 Controls of propellers and rudders on the bridge

Figure 4. The console on the starboard wing.

Figure 5. The control levers for the main propellers. The master used these.

The variable pitch propellers are manufactured by KaMeWa. Their control unit is presented in Figure 5. The levers work on the Follow Up principle. The sides of the console have emergency control levers functioning with the Non Follow Up principle.

To the left of the control console of the main propellers are the control levers of the three steering propellers. Two steering propellers are in the bow and one in the stern. The pitch angles of the thrusters and the ampere indicators of the electrical motors are to the left of the levers (Figure 4). Only two thrusters could be used simultaneously.

The control of the main propellers and steering propellers is transferred from the bridge to the wing by means of push buttons. The control of both bow thrusters is transferred by means of one push button. The control of both main propellers is transferred to the wing by means of one push button.

An indicator panel is located at the end of the console (Figure 6). The indicators most important for steering are all there. In the top row, on the right, are the indicators for the rudder angle, scale 0–45°. Below them are the tachometres of the main propellers. In the bottom row, on the left, is the ROT indicator, scale 0–30°/min. Between the ROT indicator and the tachometres of the main propellers is the wind gauge. It indicated the relative direction of the wind with an accuracy of 10 degrees and the wind speed could be read as knots, km/h or m/s. The indicator also shows the speeds of wind gusts and changes in their direction. This indicator is usefull for harbour manoeuvring.

Figure 6. The indicator panel on the wing. The indicators from the top left: console light dimmers, mooring alarm, dimmer of rudder angle indicators and rudder angle indicator. Bottom row left to right: angular velocity indicator, wind gauge and tachometres of main propellers.

Figure 7. Selection of rudder control point in the console of the helmsman.

The place for rudder control is selected from the steering column with a mechanical switch (Figure 7). The figure of the helm means the control station of the helmsman. TRACK PILOT evidently means the Anschütz Nautopilot D autopilot in the centre console. DESK and REMOTE CONTROL mean the work station of the OOW in the centre console and the wings of the bridge.

The bridge wings has manual controls for the rudders (Figure 8). Highest on the right (Synchron), the figure shows the selection of the Follow Up steering for synchronised steering, so that both rudders turn starboard by means of the Tiller FU turn knob. On the left (Independent) is the control of the rudders separately by means of two Tiller FU turn knobs.

Figure 8. The Follow Up control of the rudders on the bridge wings.

When the front of the knob is turned to the left, the rudder turns left. The movement of the knob does not describe the actual direction of the rudder. If the rudder is thought of as a "lever", this gives the wrong picture of the movement of the rudder. Therefore it is important to check the direction of the rudder angle (i.e., the colour) at the front of the knobs.

In harbour manoeuvring, six different steering levers have to be handled. There are two control levers for each of the main propellers, the rudders and the thrusters. The KaMeWa JOYSTICK combines the control of all propellers and rudders to one lever and one turn knob. (Figure 9). The lever is turned in the direction in which the joint force of the steering equipment is directed. The round Heading Control knob turns the vessel in the direction desired. The Pivot Point can be placed in the bow or stern of the vessel or midships. In harbour manoeuvring, with a low speed, the pivot point is set midships. The KaMeWa Joystick is a very good steering mode in high winds, because it makes it possible to concentrate on the electronic chart in addition to steering. The Joystick operates the propellers separately so that when turning, the rudder stern of the reversing propeller goes automatically midships and the rudder behind the propeller rotating ahead turns inwards. The JOYSTICK was not used before the accident, nor was there any company instruction on its use.

Figure 9. The KaMeWa Joystick, efficient for harbour manoeuvring.

There are two displays in the ceiling above the console. One can be used to show a digital C-Map. The chart software indicates the wind direction, the symbol of the vessel and its movement over the ground. If the chart had also showed prediction of the vessel's movements, the danger could have been seen earlier.

The arrangement in the wings is technically good. The digital charts, the wind gauge and the KaMeWa Joystick form a good technical entity for harbour manoeuvring. The Safety Management System (SMS) did not support the use of modern technology.

1.1.5 The VDR

The International Maritime Organisation (IMO) amended the SOLAS Convention Safety of Life at Sea[1] 2001.
Rule 20, point 1 of the new Chapter V, Voyage Data Recorders, requires as follows:

> ”*To assist in casualty investigation, ships, when engaged on international voyages, … shall be fitted with a voyage data recorder* .... ”.

[1] SOLAS, International Convention for the Safety of Life at Sea, 1974 and 1988 Protocol relating thereto, 2000 Amendments, effective January and July 2002. International Maritime Organisation, London 2001-{}-
Rule 19 of the amended Chapter 5 Carriage requirements defines the requirements of the navigation equipment of a vessel. Rule 19 in its entirety is applied to new vessels in international traffic and other vessels are governed by Rule 12 of the old Chapter V of the Convention and points 2.1.6 and 2.4.2. of the new Rule 19 and Rule 20.

The Rule required the SUPERFAST VII to have a VDR, but this Rule does not actually order to store the data after an accident. Under the wording, the purpose of the Rule is to promote the investigation of accidents, and this is not possible unless the data is stored[2].

In 2002, the Marine Safety Committee (MSC) of the IMO gave an instruction (MSC/Circ 1024), according to which the data registered by the VDR should, as soon as possible after an accident, be taken into the possession of the accident investigators and the owner of the vessel3. According to the instruction, the company is, by means of its standing orders, responsible to ensure that the data are stored sufficiently early. The Instruction refers to the IMO Resolution regarding accident investigation A.849(20). By the year 2005, Finland has not published the MSC Instruction (MSC/Circ, 1024) in its Information Bulletin. We do not know if the Maritime Administration of Greece has published it.

The files of a VDR contain information on the position, movements and physical condition of the vessel and on the steering of the vessel before, at and after the time of the accident.

The VDR has to record the data for the last 12 hours. The recording may be continued over older data than that. Numerous vessels have a longer VDR recording period than 12 hours.

The leading maritime investigator of the Accident Investigation Board was in telephone contact with the maritime inspector who was onboard the vessel on the day following the accident on 13 November 2004. The inspector checked the type of the VDR of the vessel and asked the crew of the vessel to secure the VDR recording. Later on it was established that the VDR central unit of the SUPERFAST VII stored information for 7 days.

Also the Chairman of the Investigation Commission requested the master for the recording on 16 November 2004, four days after the accident, but the data of the VDR were not made available to the investigators. The crew did not activate the recording of the last 12 hours and also the back-up recording of the 7 days became too old.

The ”Superfast Ferries, Fleet Operation Manual” does not contain instructions for the storing of VDR data.

1.1.6. The digital chart

The electronic chart system = The general term for all equipment that is able to find the position of a vessel on a nautical chart displayed on a computer display.

2 Information Bulletin 9 of the Finnish Maritime Administration of 12 January 2003 clarified the installation orders of VDRs with regard to Finnish ships to comply with the MSC Resolution (MSC 88(73)). The Bulletin did not specifically mention that the VDR data have to be stored after an accident to promote accident investigation.

3 MSC/Circ. 1024 “Guidelines on Voyage Data Recorder (VDR) Ownership and Recovery”, 29 May 2002. ANNEX Point 2.1.

The above systems are of two types:

Electronic Chart Display and Information System (ECDIS), a system that meets the requirements of IMO/SOLAS on the use of an up-to-date chart onboard.

> *"Electronic Chart Display and Information System (ECDIS) means a navigation information system which, with adequate back up arrangements, can be accepted as complying with the up-to-date chart required by regulation V/19 & V/27 of the SOLAS Convention."*[4]

Electronic Chart System (ECS), a system that can be used to assist in navigation, but which does not meet the requirements of the IMO/SOLAS V19 and V20 Rules on the use of an up-to-date chart onboard.

> *"ECS is a navigation information system that electronically displays vessel position and relevant nautical chart data and information from an ECS Database on a display display, but does not meet all the IMO requirements for ECDIS and is not intended to satisfy the SOLAS Chapter V requirements to carry navigational chart."*[5]

The SUPERFAST VII was using one **Electronic Chart Display and Information System (ECDIS)** as well as up-to-date paper charts meeting the requirements. The ECSID system can be used in navigation instead of paper charts, but it has to be used with ENC charts produced by the National Chart Authority, and it further has to be backed-up in an acceptable manner in order for it to wholly replace paper charts. (IMO Resolution A.817(19))

ENC charts have so far not been published of the actual Hanko port area, north of latitude 60N, by 4 January 2005. This means that the electronic chart system of the vessel did not at the time of the accident and at the accident position meet the ECDIS requirements. The equipment functioned at the level of the ENC definition. In practice this is not of significance, because the equipment in any case meets the requirements set by the user for the information source of navigation.

The Raytheon ECDIS equipment of the vessel uses C-map vector charts. The displays of the equipment are located in the centre-most control position in the right-hand console and in the control consoles of both wings.

1.1.7 Passengers, cargo and bunkers

The vessel had 140 passengers. Its total cargo was 1,238.7 tons consisting of trailers, trucks and cars. The outer deck had two cargo units containing dangerous substances. She carried 745.5 tons of fuel oil and 98.7 tons of diesel oil. The draught of the vessel was 6.35 m with even keel.

4 Primar Stavanger, IC-ENC, Facts about chart and carriage requirements. 25.11.2004

5 Primar Stavanger, IC-ENC, Facts about chart and carriage requirements. 25.11.2004

1.1.8 The tugboats

Figure 10. The tugboat Ajax *(©Alfons Håkans)*

The forward tugboat

Name of the vessel	M/S AJAX
Type	Tugboat
Nationality	Finnish
Company	Håkans Tug Ltd
Owner	Alfons Håkans
Home port	Helsinki
Call sign	OIVQ
IMO No.	5330668
Year and place of construction	1950 Lödöse, re-engined 1977
Classification society	The Finnish Maritime Administration
GRT	200
Net	60
Length, max	28 m
Breadth, moulded	8.32 m
Draught	4.59 m
Engine power	2700 bhp
Propeller	Variable pitch propeller, dia 2150 mm
Speed	12 knots
Bollard pull	27.0 tons 265 kN

Figure 11. The tugboat Iso-Pukki (©Alfons Håkans)

The stern tugboat

Name of the vessel	M/S ISO PUKKI
Type	Tugboat
Nationality	Finnish
Company	Alfons Håkans
Owner	Alfons Håkans
Call sign	OGVG
Year and place of construction	1968 Åmål Sweden
Classification society	The Finnish Maritime Administration
Ice class	1 A Super
GRT	264
Net	88
Length, max	30.5 m
Breadth, moulded	9.03 m
Draught	4.6 m
Engine power	2000 bhp
Propeller	Fixed, dia 2,300 mm
Speed	12.5 knots
Bollard pull	20.0 tons

Both of the tugboats are so-called traditional tugboats, whose functionality is at its best either when pushing or towing. The tugboats were made fast from their bows to the starboard of the SUPERFAST VII, so that the purpose was only to push in connection with the mooring. The traditional type of tugboat is clumsier than modern tugboats. If also reversing power is needed in addition to pushing, it is considerable lower than the pushing power.

1.2 The accident voyage

In the investigation, the events are usually described in accordance with the maritime declaration. The master of the SUPERFAST VII did not give a maritime declaration nor did he record the accident events in his maritime accident notification. The master has recorded the accident event in the ship's log in Greek and an English translation thereof was made available to the investigators. The investigation had to record the events on the basis of this copy and the hearing of the crew and the pilot.

1.2.1 Weather conditions

On 12 November 2004 at 17:00, NAVTEX gave a storm warning for the south-western Gulf of Finland:

Southwest severe gale 23 m/s.

Forecast for next 24 hour; Gulf of Finland; Southwest 16–23 m/s.

According to the forecast, low pressure was moving to the north-east and the wind would weaken during the night and turn west.

Table 1. The wind gauge of Tulliniemi registered the following information on 21 November 2004. According to the VTS station of Helsinki, the wind speed has been corrected to correspond to the speed at 10 indicators above sea level.

12.11.2004	Wind direction	Wind speed
1200	236°	20–23 m/s
1600	223°	18–23 m/s
2000	238°	20 m/s
13 p. 0400	358°	8–11 m/s

The information measured proves that the forecast was right. The strength of the wind was diminishing when the accident took place at 20:25.

Table 2. Wind direction and speed from different sources at the time of the accident.

Observer	AT	Wind direction	Wind speed	Explanations
Gulf of Finland Coast Guard Division record	1953	230°	21–23 m/s	Place of measurement not known
Master of the SUPERFAST	Observation at the time of the event	230°	21 m/s	
Staff Captain of the SUPERFAST		230°	23–35 m/s	
The pilot		231°	20–22 m/s	

1.2.2 Embarking the pilot and preparations to enter port

According to the pilot, he went onboard at 19:05. The master had ordered two tugboats (the AJAX and the ISO-PUKKI) as well as planned and agreed on the operations with the tugboats. According to the plan, both tugboats would be fastened to the starboard of the vessel with their own ropes. It would be the task of the tugboats to push the vessel to port in accordance with orders to be issued from the bridge. It was agreed that the highest reversing speed would be 4.0–4.5 knots. Nothing was agreed on the division of the tasks on the bridge when the piloting started.

According to the master, it was normal to use two tugboats when the wind speed was over 15 m/s. In the opinion of the master, the most dangerous wind direction was between south and south-east, when the wind limit was 13 m/s for using tugs.

The chief mate had a radiotelephone. His task was to look out for distances on the starboard wing to the buoys north of the fairway and to be in contact with the safety officer, who was in the stern on portside. His task was to inform the bridge of the distances from the stern to the quay.

The Staff Captain did not take part in the preparatory measures for piloting and reversing.

The helmsman was in the centre of the bridge next to the steering column and he was steering the vessel in accordance with the rudder commands by the master. The rudders were controlled in a synchronised manner, i.e., both rudders at the same time with follow-up steering.

The Staff Engineer, the first electrician and the electrician were called to the engine room (control room) in addition to the engineer on watch. The manning of the engine room complied with the normal practice of the company. The master asked to adjust the main engines for harbour manoeuvring. The master requested 510 rpm as the fixed rpm and 90 % of the maximum output of the main engines. All the four main engines were operating. The two shaft generators were engaged. They powered only two of the three thrusters.

According to the instructions by the company, the bridge had to fill in the check list Arrival-Bridge Check List. It was not filled in. The list had the following question: *Is there a recent weather report and has it been taken into account?*

According to the instructions, the pilot and the mate/master have to fill in the check list Pilot's Check List. It was not filled in. The list asked the following question: *Have the effects of currents and wind during mooring/casting off been discussed?* This refers to the mooring of the vessel and not to piloting in a storm.

The third engineer had appropriately filled in the Arrival-Engine Room Check List.

The vessel was using the operations manual of the company Fleet Operations Manual from 1996. It took no stand to the wind limits or the handling of the vessel in port in a storm.

1.2.3 The accident events

The information available to the Investigation Board, when the VDR data were missing:

The print-out of the digital chart system of the SUPERFAST VII. The print shows the position of the vessel graphically at full minutes and roughly the track. The chart did not have the symbol of the vessel. The heading of the vessel was drawn in the investigation by means of the print of the course recorder.

The numerical direction and position information as well as the speed over ground copied from the replay function of the Transas Tsunamis digital chart display of the tugboat ISO-PUKKI. This information was compared to the recording of the SUPERFAST VII.

A video recording of the vessel's track at 2–3 second intervals sent to the Helsinki VTS by the AIS equipment of the SUPERFAST VII. The recording also has a very rough radar image. The time used in the VTS recording is the system time of the recording computer, which, according to the equipment supplier, is accurate.

The investigation revealed that the times of the different recorders are not fully uniform. The time used in the VTS recording is about 2 minutes later than in the chart print-out of the SUPERFAST VII. It is possible that the system time of the digital display of the SUPERFAST VII was not updated from the GPS system.

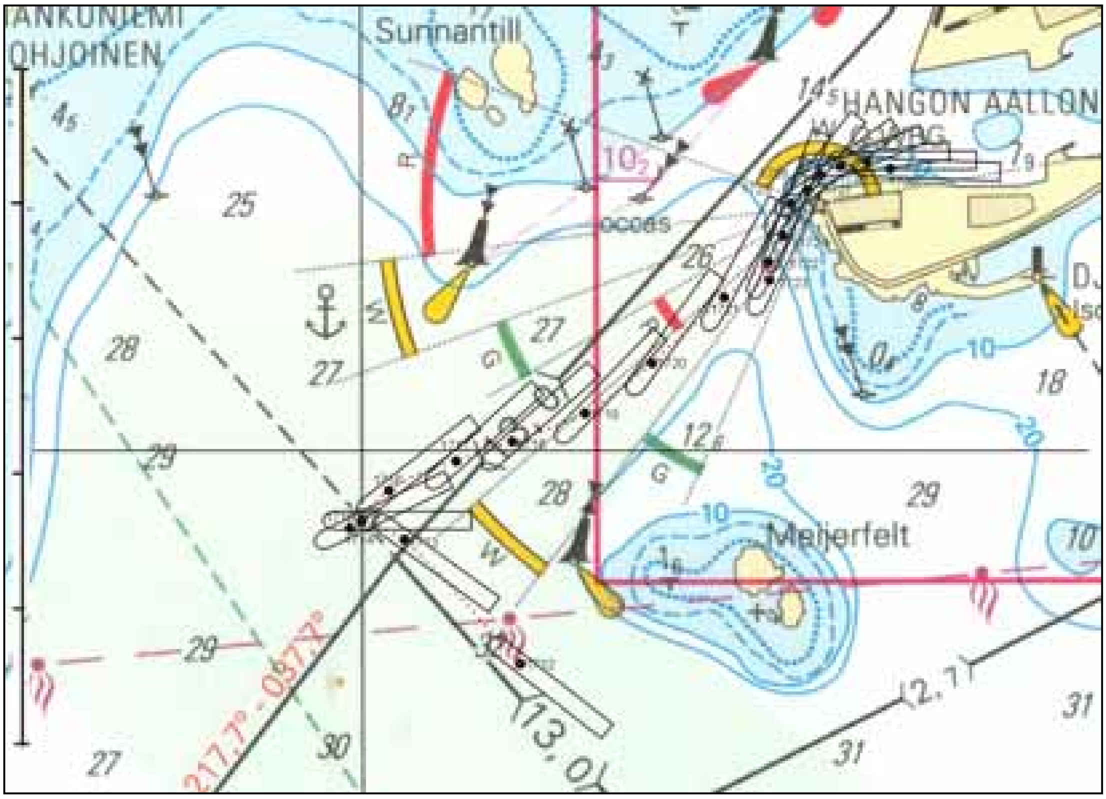

Figure 12. The track of reversing the SUPERFAST VII

The view of the investigators on the track is in Figure 12, which has been traced on the basis of the above information.

The master of the tugboat ISO-PUKKI said that he had fastened the tugboat at 1915, when the vessel being assisted had no speed ahead. This complies with the chart print-out of the SUPERFAST VII. In the VTS recording, the speed of the SUPERFAST VII at 19:15 is still an estimated 5 knots, and according to the information of the ISO-PUKKI its speed over ground at 19:15 was 8 knots. The VTS recording shows that the SUPER-FAST VII stopped at about 19:17, when also the speed of the ISO-PUKKI over ground was 1.6 knots.

Table 3. The events in table form.

Time (VTS)	Bow direction	Speed	Event
19:05			Pilot onboard near Gustavsvärn. Pilot negotiated with tugboat masters and agreed on means of assistance.
19:14	308	+5	The SF VII approaches the intended turning area at the crossing of the entry fairway and fw. passing the break-water.
19:15	306	+3	Vessel crosses fairway to port
19:16	270	+2	Turning started, bow speed decreasing
19:17	244	n. 0	Vessel stopped. Tugboats fastened. Master moves from SB steering station to BB. Staff Captain pilot follow him.

19:18	232	-1	Vessel gains speed astern. Tugboats push at first.
19:19	228	-2	Vessel runs normally towards breakwater north-east of fairway.
19:20	228	-1	Vessel crosses fairway and speed aster decreases
19:21	224	-2	
19:22	216	-3	Speed astern increases and drifting south-eastwards of the fairway decreases.
19:23	209	-3	Vessel c. 160 m south-east of fairway.
19:24	204	-2	BB stern passes breakwater tip
19:24:3	202	0	Vessel stops and moves slightly forward. Grounding The tug Ajax is ordered off the bow and to push from BB. Master considers sailing out, but decides to continue to moor. The tug Iso-Pukki has no time to obey order to let go.
19:25:20	201	0	Vessel has moved forward at c. 1 knot for c, 1 min. Master of the Ajax notes the space between the vessel and the breakwater too small to push from the left.
19:26			The SF VII continues normally to moor assisted by the tugs
19:40			Vessel is moored to the quay. Master in contact with maritime authorities and insurance co. inspector and he orders a diver to check the damage to the vessel.

1.2.4 Measures and notifications after the event

According to the master, at 19:28 the engine room notified the bridge that water was leaking into the engine room. The harbour manoeuvring of the vessel was continued until the vessel was moored at 19:40. The tugboats completed assisting and left at 19:42. Local authorities and the company were notified of the grounding at 19:44. According to the report of the Helsinki VTS, the pilot notified them of the event at 19:48 and the VTS forwarded the notification to the maritime inspector at 19:55. At 19:50 the master asked the agent of the vessel to order a diver to check the bottom of the vessel. The crew of the vessel examined the damage to the vessel by checking the engine room, the propulsion equipment, tanks and the void spaces. At 19:57 the pilot notified the VTS that the vessel was leaking oil and that the MRSC had ordered the fire brigade to the position.

According to the accident report of the Tammisaari Emergency Response Centre, there was a minor amount of bilge oil between the vessel and the quay. The crew of the vessel put an emulsion decomposing oil into the water. The Fire Brigade contained the oil with an oil barrier to the area between the stern of the vessel and the quay in order to prevent it from spreading to the harbour basin.

The crew of the vessel controlled the leak by means of the bilge pumps of the vessel. At 23:10 the maritime inspector arrived onboard to inspect factors relating to the accident and the seaworthiness of the vessel. The representative of the classification society arrived onboard at 01:00 on 13 November 20:04 and the diver ordered by the master at

02:00. The representative of the classification society demanded temporary repairs to the vessel to have it moved to the docks.

1.2.5 The damage to the vessel

Figure 13. Part of the damaged section cut off portside of the stern of the vessel.

Void space 609 below the engine room had a rupture on portside between frames No. 73 and 85. The engine room had a rupture of about 15 cm above the tank top. There were dents for a length of several indicators and the bb bilge keel was damaged in the stern for 3.4 indicators. About 14 tons of steel were used for the repairs and the costs were approximately 200,000 €. The vessel was out of traffic for about two weeks.

1.2.6 The port and its navigational safety equipment

The Finnish Maritime Authority swept the port area in summer 2004. In connection with the sweeping, the pilots expressed the wish that the shoals at the peak of the breakwater be marked with maritime safety equipment. This did not take place. The mark indicating the shoals was installed after the grounding of the SUPERFAST VII on 20 January 2005 at 59°49.20N 022°26.63E.

1.2.7 The operation of the VTS system

The supervision area of the Helsinki VTS is divided into three sectors and Hanko port belongs to sector 3 of the Helsinki VTS. The VTS did not have a reason to react to the movements of the SUPERFAST VII before its grounding, because the vessel was in scheduled traffic and it was steered by its permanent master and an experienced pilot.

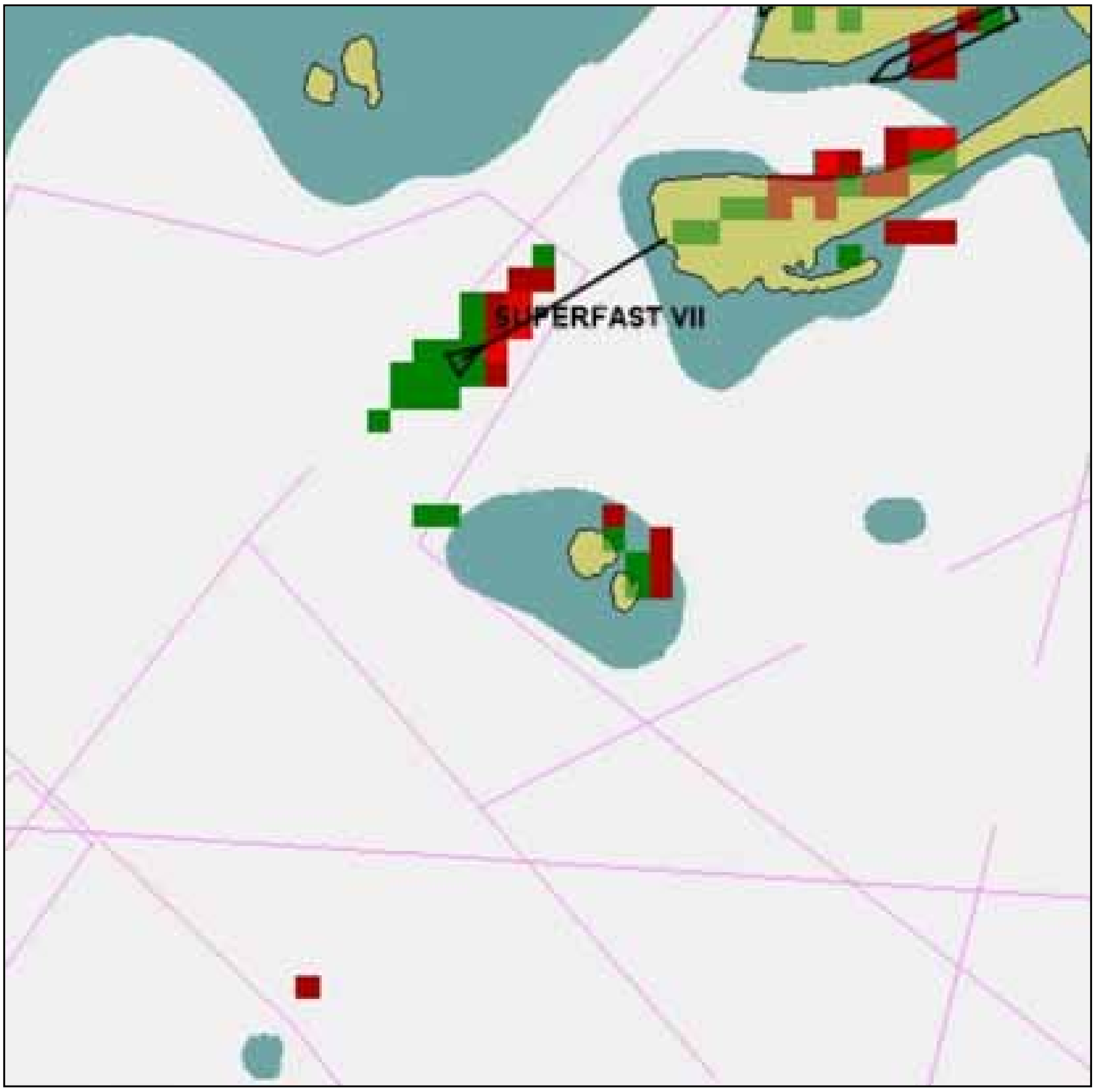

Figure 14. A cut from the VTS recording shows how difficult it is by means of it to monitor close situations in the port area.

1.3 Rescue operations

According to the situation report of the Hanko Coast Guard Station, the patrol boat Pv-120 went to check the grounding of the SUPERFAST VII. A minor amount of oil had leaked into the sea. The crew of the patrol boat performed an alcohol test on the persons on the bridge, and the result for all was 0 ‰. Police patrol 710 checked the blood alcohol contents of the masters of the tugboats, and the result was also 0‰ for all. The diver of the Emergency Services inspected the damage to the vessel, which is described in Point 1.2.6.

When the temporary repairs were completed, the maritime inspector gave the vessel permission at 16:00 on13 November 2004 to move to the dock for repairs.

1.4 Orders of the operator "Extracts from the SMS System"

In 1993, the IMO gave its first resolution[6]on safe practices of ship operation. It required the company to define safe practices in ship operation for its vessels. The IMO called this requirement the Safety Management System (SMS). Each company had to prepare its own SMS. An SMS had also been made in the Superfast Ferries company.

The chapter on navigation in the SMS Instruction of the company was available to the investigators: Superfast Ferries, Fleet Operation Manual 31.03.1996, Chapter 4, NAVIGATION.

Chapter 4 handles the tasks of the master and the crew in fulfilling the code.

Point 4.1.1 of the instruction requires that the ship's officers act as follows:

- they have to comply with the rule of the road, (COLREGS)
- they have to comply with national rules,
- they have to act efficiently and economically, i.e., optimally in the circumstances.

Company instructions do not define what Safe Practice[7] is as required by the IMO. The company instruction has not been updated in accordance with the requirements of the IMO 2001 Resolution. The IMO requires that the company defines safe practice of operation. The company has not defined safe practice of operation in a strong wind. The company has delegated the defining of the practice of operation to the master, who has to ascertain the optimum operating practice in accordance with the situation. The instruction does not have instructions for harbour manoeuvring in a strong wind.

The master did not have the chapter of the SMS Instruction describing the part of the company in fulfilling the code.

6 IMO Res. A.741(18), 4 Nov 1993. International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code).
7 IMO Res. 1 January – onwards (22)Annex, par. 2.2.1.1.

2 ANALYSIS

2.1 Decision-making when approaching the quay

Upon boarding the vessel, the pilot already knew from experience that the power of the bow thrusters of the SUPERFAST VII was small. He also knew of his right to interrupt the piloting if he considered the circumstances dangerous. The Pilotage Enterprise had left the wind limit for the pilot to decide. The primary task of the pilot was to assist the vessel to harbour, and no party supported him in decision-making. Because the master had already ordered two tugboats, the pilot, for his part, did not see any reason to interrupt the piloting.

The instruction of the company did not give the master any support to wait for the wind to decrease. The instruction had no wind limit, and the instruction described the pilot as an adviser. The master did not ask the pilot for any advice regarding the wind limit. The pilot might have made the master reconsider mooring, but the master did not discuss the topic. On this basis the master had made his decision already before the pilot came onboard.

As a conclusion we can note that the pilot and the ship's officers did not have a basis to interrupt the piloting. The matter had been left for them to decide in the hope that they would draw the right conclusions. Everything took place under the responsibility of the master, but the instruction of the company failed to give the master any support for decision-making.

2.2. The lack of important VDR data

No one could or remembered to back up the VDR recording right after the grounding. The Investigator in Charge asked the master to back up the VDR recording on 16 November 2004, because it was still possible. The master promised he would do it. However, afterwards it turned out that the master had not done it and so it could not be utilised in the investigation of the accident. The investigators do not know whether the master forgot it or whether it involved a wilful delay. Point 9 of the ISM Code requires that the company have procedures for the analysis of an accident. The actions of the company and the vessel give the understanding that the point of the ISM Code in the SMS instructions of the company is not functional in this respect.

The master did not make a maritime declaration and the Maritime Administration did not require it. The written extract from the ship's log given by the master describes the events after the grounding. The investigators have succeeded in outlining the events before the grounding on the basis of the hearing of the master, pilot and mates of the vessel and by means of other recorded information.

2.3. The company's view on navigation equipment

According to the SMS instructions of the company, it was the duty of the ship's officers to monitor the position and direction of the vessel during piloting[8]. According to the instruction, it was the master's duty to ensure the position of the vessel by utilising all the electronic navigation aids, such as GPS positioning[9].The instruction asks to check the accuracy of the GPS[10]. It is possible only to check the statistical accuracy calculated by the GPS system itself and the number of satellites.

Regarding the installation of the GPS, the instruction gives dangerous advice by saying that it has to be ensured that the log and the compass are connected to the GPS equipment[11]. This kind of installation was a background factor in the accident of the m/s Royal Majesty in the US on 10 June 1995. No heading and speed sensors may be connected to the GPS receiver.

The attitude of the company to satellite navigation is more critical in connection with the instruction on the electronic chart. The instruction considered the digital charts erroneous and, according to the instruction, also the GPS is displayed erroneously on the chart. The instruction categorically forbade the use of electronic charts in position determination. According to the company, they have to be considered in the same way as navigational aids, which cannot be trusted. Decisions have to be based on paper charts.[12] The master was to ensure that this order was complied with. The digital chart and GPS positioning were not used when the vessel reversed towards the port. The position fixing was visual.

The master supplemented the instruction of the company with his own standing order, but he had to comply with the line of the company. He emphasised that the GPS system is not officially approved, and so it has to be considered like experimental equipment or a navigational aid.[13] Regarding piloting, the standing order of the master said that the position of the vessel had to be monitored by all means possible.[14] In his order, the master mentioned cross bearing, radar distances and the Parallel Index radar navigation method[15]. The most exact positioning device of the vessel, the GPS, was only used in open seas. In connection with open-sea navigation, the master required the mates still to be able to use the sextant[16]. Traditions prevailed over modern technology.

During reversing, the bow of the vessel had to be kept carefully against the wind. The easiest way would have been to indicate the direction of the wind with an electronic bearing line on the digital chart and by monitoring the symbol of the vessel. The digital chart would have clearly indicated the danger when the wind started to push the vessel

8 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, Point 4.8.3.
9 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, Point 4.3.1.4.
10 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, Point 4.12.7.
11 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, Point 4.12.7.
12 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, Point 4.14.5.
13 Master's standing order no.2, point 3.
14 Master's standing order no.2, point 4.
15 Master's standing order no.2, point 5.1.
16 Master's standing order no.2, point 5.3.

towards the beacon. No one looked at the digital chart and no one noticed that the wind started to push the vessel from starboard. However, everything took place in accordance with the instruction of the company.

Regarding the handling of the vessel, the instruction emphasises that steering is both an Art and Science. The instruction only refers to the control of the dynamic state of the vessel by stating that everyone has to develop a "feel" on how the vessel behaves[17]. Elsewhere, the instruction warned not to trust one's feelings[18]. The instruction did not recommend technical means, by which the dynamic state of a vessel can be determined. Technically, the movement of the vessel, i.e., the "feel", could have been presented by means of a prediction on the digital chart. However, the anti-technical attitude of the instruction would have prevented it.

2.4. The company’s view on sharing tasks

According to the instruction of the company, the reversing of the vessel to port involved situation Watch Condition 3. There had to be three persons belonging to the officers on the bridge[19]. In a piloting situation, the master had the right to give orders and he had the responsibility[20]. According to the instruction, the pilot has the status of an advisor and the master had to give the pilot the information he needed. The vessel had a Pilot's Check List, according to which the master had to discuss the effect of the wind on steering with the pilot. On the basis of the hearing, this did not take place. The discussion was merely informing the pilot of the things the master had agreed upon when ordering the tugboats.

The minimum manning of "Watch Condition 3” was three officers. The master, the pilot and the Staff Captain were on the port wing. The chief mate was on the starboard wing. The master used the adjustment of the main propellers and the bow thrusters and gave the orders to the helmsman. The chief mate had radio contact with the mate keeping look-out at the stern of the vessel. The pilot kept contact with the tugboats. In addition to the minimum manning, the Staff Captain was on the bridge. This was evidently due to the exceptional weather conditions. The Staff Captain did not have a task, because he was outside the task definition of "Watch Condition 3".

What draws one's attention in the instruction of the company is that the tasks of the officers are determined on the basis of rank. The result is that the tasks become turfs, and no overlapping assignments or monitoring is created. One result of the instruction is also that not everybody achieves the same work performance. The tasks are distributed in the instruction and thereafter the persons only concentrate on their own tasks irrespective of the circumstances. Any extra persons are left without a task.

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17 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, point 4.7.1. “As a member of the bridge staff, observe the ship’s progress, ask when necessary and try to acquire the ‘feel’ of the vessel”.

18 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, point 4.11.2. “Judgement which is based exclusively on the ‘feel’ of the ship must be avoided.”

19 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, point 4.2.5.

20 Superfast Ferries, Fleet Operation Manual, Chapter 4, Navigation, point 4.8.1.

It would be most important to determine the tasks of the officers in different circumstances irrespective of their rank. When entering a port in a storm, the tasks are:

1. Control of manoeuvring and dynamic state.
2. Knowing position fixing and wind direction.
3. Monitoring position fix and wind direction.
4. Contacts with the tugboats.
5. Contacts with the bow and stern.
6. Look-out.

There are more tasks than there were persons on the bridge. The tasks are divided and combined between the persons. The distribution should be done in connection with each preparation. The master has to be familiar with the position fixing and the dynamic state of the vessel. A person able to the same has to monitor these three tasks.

2.5. Summary of the Safety Management System

The company has partly repeated the IMO Resolutions, which is not likely to be the purpose of the SMS. The instruction can give the idea that the company has knowingly avoided taking any kind of responsibility for the safe operation of the ship. In the view of the investigators, the company managing the vessel, has not seen the principles of the ISM Code as a possibility to instruct the crew of the vessel as clearly as possible.

2.6 Effect of the wind on port manoeuvring

2.6.1 Master's plan to reverse the vessel

The pilot told that the master had planned the operations with the tugboats so that they would be ready to push. The master and the pilot agreed that the maximum reversing speed would be 4 knots. During reversing, the bow of the vessel had to be kept against the wind.

The facade light of the beacon was the only visual steering reference (Figure 16). The digital chart was not used due to the SMS instruction. Also the pilot said that he trusted his own eyes more than a digital chart. Portside, there was no other clear visual reference in addition to the beacon which the master could have used for steering. Before starting to reverse, the master turned the vessel to 230° in order to see the lit end of the quay.

Master's aim was to keep wind directly from the bow. The tugboats were already fastened to the starboard side of the vessel so that they would be ready when mooring. The tugboats could push efficiently when their bows were facing the side of the SUPERFAST, but their reversing power was low. This required that the tugboats would not push too much to portside, i.e., east, during the reversing. With regard to reversing, the positioning of the tugboats was not optimum, but, because of the circumstances, the places of the tugboats could not be changed from side to side, when the reversing would become mooring.

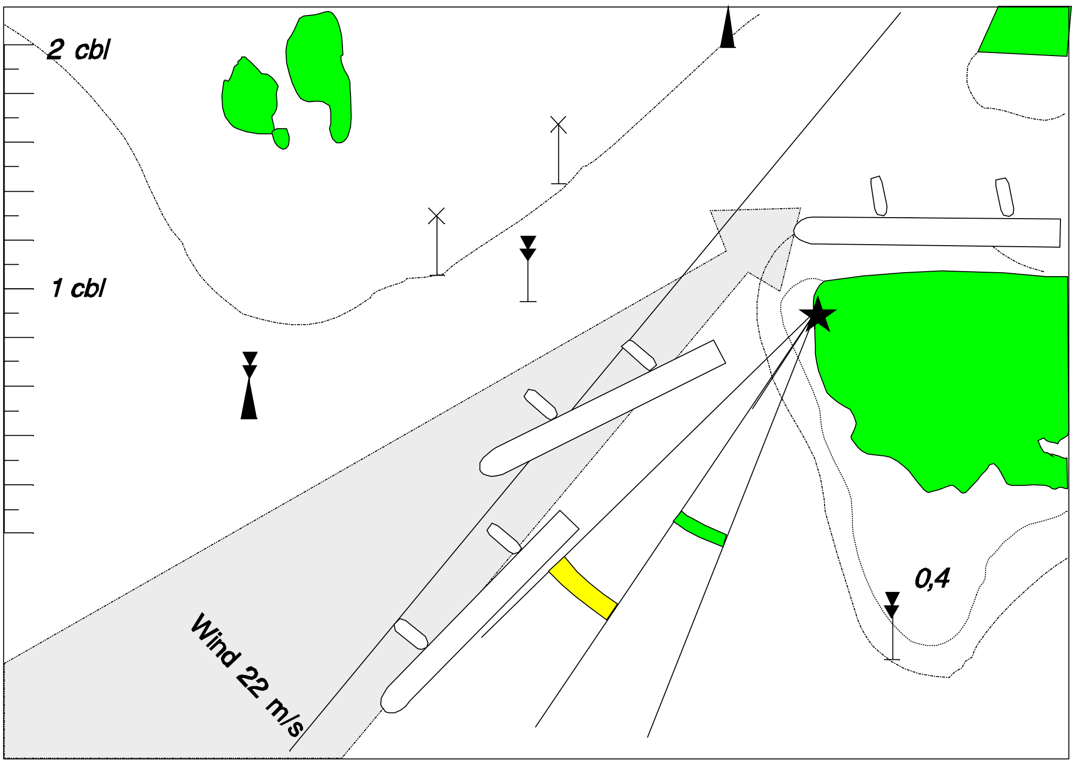

Figure 15. The approach plan of the master. It was the purpose of the master to keep the wind directly from the bow during the reversing. The beacon and its facade light were the visual guidance marks when reversing. The figure is an estimate of the Investigation Board.

The wind direction was approximately 230°, but wind direction always varies in gusts. In Figure 15, the variation of wind direction has been estimated at ±10 degrees, but it may have been bigger. On the basis of the Tulliniemi wind gauge, the strength of the wind gusts was 5 m/s at 16:00. The Staff Captain estimated the gusts at about 7 m/s and the pilot 2 m/s. In a high wind, the strength varies about 5 m/s, but it is difficult to see this visually from the wind gauge. It is very difficult to keep the bow of the vessel in an exact direction in a wind with heavy gusts. The gusts vary more quickly than the power of the bow thrusters can be changed.

When the pilot embarked, the vessel drifted slightly to the west from the intended reversing line. The master asked the tugboats to push the vessel closer to the course line. The master noted in the interview that the wind suddenly shifted to 250° and the wind speed was 23 m/s. If the tugboats pushed at that moment, the vessel quickly drifted to port, i.e., east (Figure 14). The wind started pushing at about 25 degrees from starboard.

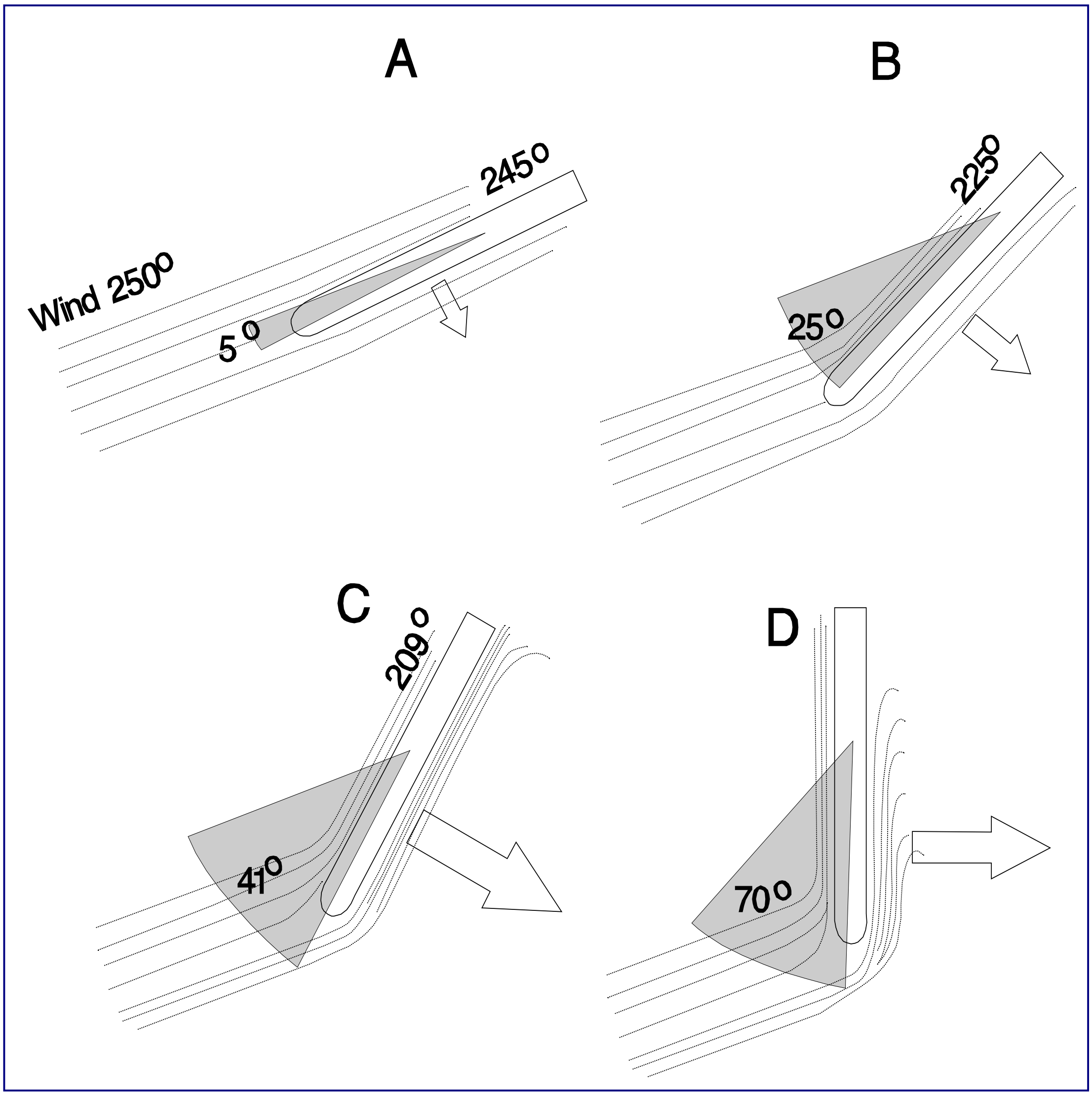

Figure 16. The wind forms a lift on the side protected by the hull. The lift of a relative wind is at its greatest at about 50 degrees from the bow. The situations A-C describe the SUPERFAST VII. Situation D was not realised. The buoyancy decreases with wind angles exceeding 60°.

When the tugboats fastened, the heading of the vessel was about 245° (Figure 16, A). The wind was 5° from the bow. The vessel turned so that the master could see the beacon. The heading was 225° when the vessel had crossed the fairway line (Figure 16, B). The wind was 25° from the bow and it turned portside of the hull of the vessel creating a lift. The lift and the turning torque caused by the wind increased. Near the end of the quay, the heading of the vessel was about 209° and the wind was 41° from starboard (Figure 16, C). The lift created by the wind was strong. The turn ended in direction 201°.

When the relative direction of the wind is over 60°, turbulence begins to form in the lee side of the hull and the buoyancy caused by the wind decreases (Figures 16 D and 17). This phenomenon has the greatest effect on passenger ships and trailer ferries.

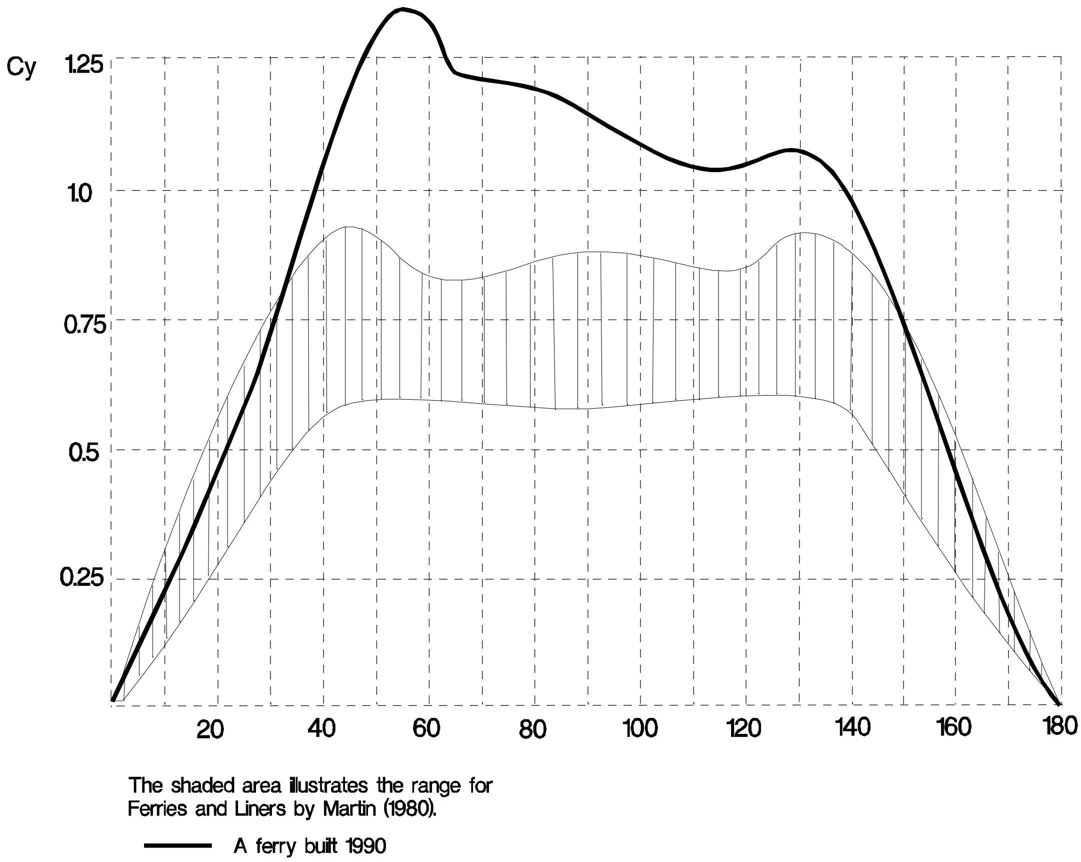

Figure 17. The coefficient of the force affecting the side of a passenger vessel Cy as a function of the relative wind direction[21]

The force of the wind is at its highest with a wind direction between 40° and 55° When the SUPERFAST was near the beacon, the effect of the wind was at its highest during the whole of the reversing.

When the wind is starboard of the bow, the wind turns portside along the hull and creates a lift in the same way as the rudder in the propeller stream. The lift of the wind on portside creates a force that grows the more the vessel turns to port. In Figure 12, mean wind is almost from the bow at slightly over 10° from starboard. The situation can be managed easily if the direction and speed of the wind are steady. When the direction and speed of the wind change momentarily, the vessel starts to drift quickly. When positioning is dependent only on a light at the end of the quay, the drifting can only be noticed as a change in compass direction.

The vessel normally used helmsman in harbour manoeuvring and the master had to give the helm orders orally. The use of the traditional way of steering is likely to be due to custom and the distribution of the tasks. The rudders were steered in a synchronised

21 L.L. Martin, Ship Manoeuvring and Control in Wind. The Society of Naval Architects and Marine Engineers, SNAME. One World Trade Center, Suite 1369, New York, N.Y. 10048. Transactions, Vol, 88, November, 1980.

manner by means of the orders given by the master, i.e., both rudders always turned to the same rudder angle.

The master could have had the opportunity himself to steer both rudders from the wings with follow-up steering. (Figure 8.) This manner of steering would have enhanced the operation of the rudders and the control of the stern, but the increase in control devices would have made it more difficult to concentrate on steering.

The vessel also had KaMeWa Joystick steering, where two adjusters are used to give orders to all propellers and rudders. In Joystick steering, the rudders turn separately to create the force desired. This possibility was not used. In the opinion of the investigators, the Joystick steering had not been adjusted properly and the users could not have obtained the necessary familiarisation and confidence in the use of the equipment.

The electronic chart display and the Joystick steering would not have helped to get the vessel to the quay, but the danger would have appeared earlier and the grounding could have been avoided by sailing out of port.

2.6.2 The wind limit

According to the master, the company does not have wind limits, because the company has not found suitable means to determine a wind limit. Hanko port has not set a wind limit to ship operations, and no wind model has been made of the port area. According to the investigation, the wind limit cannot be determined on the basis of experience, because the limit could be found only by failures. The master had been left on the basis of experience to determine the wind limit.

According to the pilot, the SUPERFAST always orders tugs when the wind speed is over 15 m/s. In the opinion of the master, the wind limit upon entry into port is 23–26 m/s. In that case, the manoeuvre should have succeeded. The statement of the master has been given after the accident, when the wind speed has been just below the limit stated by him.

The dynamic state of the vessel cannot be decided on the basis of the Wheelhouse Poster. However, the IMO requires that the officers have to be familiar with the steering characteristics of the vessel in all circumstances[22]. The requirement includes knowledge of the operating limits of the vessel, without the knowledge, the IMO requirements cannot be fulfilled. The operating limit set by the wind has to be determined on the basis of the dynamic state of the vessel. On the basis of the ISM Code [23], the IMO has left the matter to the responsibility of the shipping companies. The company in turn has left the matter in the discretion of the master, but the master cannot determine the wind limit without a clear theory and the support of the company.

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22 IMO, STCW CODE-95, Table A-II/2, Manoeuvre and handle a ship in all conditions.

23 Resolution A,913(22) 29 Nov. 2001. Annex paragraph .2.2.1.1. The objective of the safety management system is to “provide safe practices in ship operation”…...

The wind area of the vessel is 4,425m^2 with a draught of 6.35 m. The total power of the bow thrusters is 1800 kW, which, with regard to the power, corresponds to the situation in trailer-ferry traffic between Finland and Sweden in the 1970s. After that, the powers have increased, which means that the bow thrusters of the SUPERFAST were weak in comparison with the development in the field. In his hearing, the pilot clearly noted that the power of the bow thrusters of the SUPERFAST were its weakness in harbour manoeuvring. The high speed of the vessel evidently set a limit for the diameter of the bow-propeller tunnels. Compared to the other technical solutions of the vessel, it can be concluded that the company had installed the most suitable bow thrusters with regard to the service speed of the vessel.

The effect of the wind on the hull of the vessel changes with a change in the relative angle of the wind. When the wind hits the bow structures in an oblique angle, a powerful lift is created on the lee side of the vessel. This causes a torque (Figures 16 and 17), which affects the steering. The wind effect is highest 40°–60° from the bow. The wind limit can be observed in this situation, when the bow thrusters try to turn the bow into the wind, but the turning stops when the wind is about 50° from the bow[24].

Harbour wind model

A terrain model is prepared of the port and placed in a wind tunnel. Changes in wind direction and force are measured at the desired points in the area of the model. The model is turned e.g. at 10^o intervals and the measurements are repeated. The result is a coefficient for the wind directions and speeds, which indicate changes compared to an open wind. These coefficients are utilised to convert open-sea wind to correspond to a certain point in the port. Wind models have been made for example for Mariehamn, Helsinki and Tallinn areas. If there is no wind model of a port, the wind limit of the vessel has to be determined as if the vessel were in open sea[25].

Determining vessel’s wind limit using a desk-top computer simulator

The wind limit can be measured with a simulator. The steering simulator is too slow for this purpose. The fastest way is to use a desk-top computer simulator. First, you have to order the hydrodynamic mathematical model of the vessel. The wind effect is measured using a wind tunnel experiment with the ship’s above waterline miniature model. The effect of the wind flow on the vessel is measured with different wind directions. Manoeuvring test and the wind-tunnel test are used to make the final mathematical model of the vessel.

There are numerous simulator programmes available. When ordering the programme, it has to be ensured that the wind refers to wind information at an altitude of 10 meters, because weather reports have been standardised to this altitude. It has to be possible to

24 MS CITY OF SUNDERLAND, grounding in Hanko on 1 January 2002, Analysis, Investigation Report 2/2002 ISBN 951-836-099-5.

25 MS CITY OF SUNDERLAND, grounding in Hanko on 1 January 2002, Statements of Hanko Port and the Finnish Port Association to the Recommendations of the Investigation Report, Investigation Report 2/2002 ISBN 951-836-099-5.

enter variations in the force and direction of wind gusts in the programme. Also the water depth has to be given to the programme so that it will take into account the effect of shallow water. Several programmes make it possible to use tugboats.

The interface needed for the programme is a standard keyboard. If all the steering equipment of the SUPERFAST is used separately, like in the accident event, an ordinary keyboard is not sufficient. The Joystick steering makes it possible to use an ordinary keyboard, so that the arrow buttons steer the handle of the Joystick and for example the z and x keys turn the torque of the Joystick. What is essential to facilitate observations is that the relative direction of the vessel is shown above the symbol of the vessel. The same applies to an ordinary chart display.

The vessel had a digital chart. The same chart can be used in the simulator of a desktop computer. Figure 18 has an example of the display of a simulator.

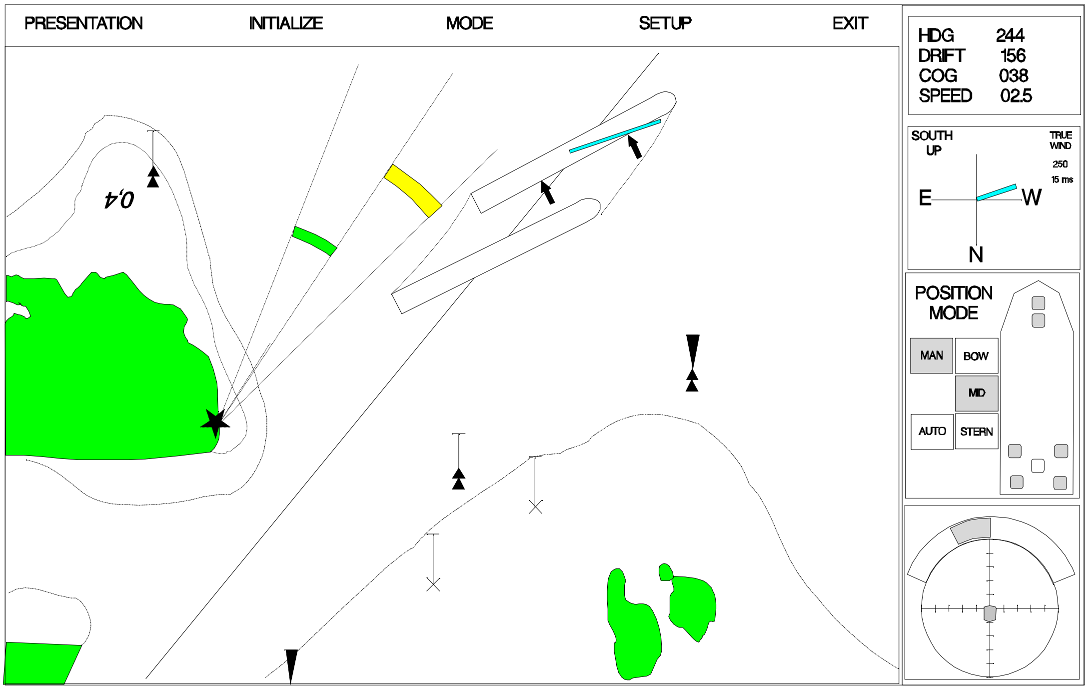

*Figure 18. An example of a simulator display. The chart is **south up** in order to correspond to the Joystick user interface on the right-hand side of the display. The prediction of the vessel for 1.5 minutes is shown by the dotted line. At the highest speeds, a forecast of 45–60 seconds is sufficient.*

The vessel is reversing north-east and the future position of the vessel is indicated by the dotted line. The duration of the forecast can be selected. At slow speeds, a forecast of 45–60 seconds is normally used. The right-hand side of the display has the most important movement data on the vessel. Below it is the wind data for the moment and the orientation of the figure. The interval between the gusts is about 5 seconds, the force of the gusts is ±5 m/s and the variation in direction is ±20°. The gusts are varied in accordance with a random variable, within the limits given. The two lowest boxes show Joystick steering. The symbol of the vessel has indicator lights of the propellers and the rudders which are in use. The figure shows that the bow thrusters, main propellers and rudders are operating. The steering propeller of the stern of the SUPERFAST was not operating. The steering mode is the Joystick Operation Mode. The pivot point is in ship's centre (MID). The lowest box shows the positions of the Joystick handle. The handle is slightly towards reverse. The turning torque is to the left. The wind is trying to turn the vessel to the right. The tugboats can be seen as arrows on the sides of the vessel. The simulation can be stopped by pressing the space key and the tugboats can be given orders my means of a special menu.

Both a graphical and numerical print-out is taken of the simulations. The graphical print contains a simple chart, where the symbol of the vessel is printed at regular intervals. The time of the simulation clock has to be indicated next to the symbol. The graphical print-out is used to mark the critical points after the run, where large rudder angles or the full power of the bow thrusters have been used. They predict the wind limit. The numerical listing has to have complete wind data, data on the movements of the vessel, steering commands and the engine powers used.

In Hanko the winds are from the south-west, and so the interesting sector in 180°–270°. The simulations are started for example with wind direction 180°. In the first run, 10 m/s is selected as the wind speed. The variations in wind direction and speed ±15° and ±5 m/s are set in the simulator. After a successful run, the wind speed is increased by 1 m/s. The runs are continued until steering difficulties emerge and the power of the vessel is no longer sufficient. This means that the wind limit has been exceeded. The wind limit is the last successful run. It is marked in the round diagram depicting the compass direction, where the circles indicate wind speed. A new wind direction, 190°, is selected and the same is repeated. This is continued until we come to direction 270°.

After that, the wind limit has to be studied critically. During every simulation, one learns to predict the behaviour of the vessel, which makes the following runs easier. A desk-top computer simulator is a good teacher. One cannot get this experience in practice, because high winds are rare. A storm is always a surprise and the master has to handle the control equipment of the vessel without the practice given by the simulation equipment. The wind limit found by simulation describes the technical performance ability of the vessel. The human wind limit is slightly lower. If the technical wind limit on the basis of the simulations seems to be 15 m/s, the human wind limit is lower, 14 m/s.

3 CONCLUSIONS

The lack of the data registered by the VDR equipment of the vessel hindered the investigation. The attitude of the master towards the investigators was friendly, but in spite of this, a recording of the VDR equipment was not obtained from the vessel. The IMO Resolution is clear (Point 1.1.5 of the Investigation Report). The VDR equipment and its recording are needed for the investigation of an accident. Technically, the recording is a very easy measure. Despite requests, the recording was not given, from which the Investigation Commission draws the conclusion that it was concealed. The VDR recording would have given more accurate information for the basis of the investigation, which might have had an effect on the end result.

The bridge had modern equipment. The technical solutions prove that, for this part, the company knew its responsibility for the safety of the vessel. The solutions made exceeded international requirements. However, the instruction of the company was in conflict with the technical solutions. The SMS instruction shows a critical attitude towards modern navigation technology. The company transferred responsibility for the use of modern navigation and steering equipment to the master. The instruction did not give the master any support in his decision-making. The instruction supported old-dated operating methods discriminating against technology. The result was that new technology was not used. On the bridge, the operations complied with the instruction of the company.

When preparing for pilotage or entering a port, the tasks should be varied. The aim has to be that everyone reaches the same performance. By varying the distribution of tasks the work becomes interesting. The monitoring of work is carried out at all levels so that familiarity with the work tasks is overlapping. The instruction restricted the development of work and did not result in a discussion on the efficient use of the equipment. The result of the distribution of tasks by the company was that the most suitable equipment received less attention.

When reversing, determination of the position became a problem. The digital chart is well visible in the wing of the bridge. The positioning was exact and the indicator also had information on the direction and speed of the wind. No one looked at the chart, because the instruction of the company did not allow its use in the port area. An anti-technical attitude comes from the history of navigation. Electronic navigation equipment is called "aids" in the STCW-95 Imo Convention[26]. This contains the idea that no single piece of equipment can be trusted[27]. According to the IMO, different equipment has to be compared with one another. The instruction of the company followed the idea of the IMO and the maritime authority had approved the instruction. The instruction of the master followed suit. This is a common practice in seafaring, and it has not officially been doomed as dangerous.

26 STCW CODE-95, Table A-II/1 pg. 28 and table A-II/2 pg. 42. As a technical provision, SOLAS uses the terms 'navigation equipment',

27 STCW CODE-95, A-VIII/2 paragraph 47. Coastal and congested waters. ‘Fixes shall be taken at frequent intervals, and shall be carried out by more than one method whenever circumstances allow.’

The master based his position fix on the facade light at the end of the quay, which lit the steep shore. The master necessarily had to see the beacon and then to steer the vessel so that it would pass the end of the quay as close as possible. The wind was almost from the bow. In this situation the danger is that the vessel will turn too much to port or that a wind gust will turn to starboard. In that case the tugboats are no longer able to assist the vessel by pulling. The wind turned and grabbed starboard side of the vessel. The wind limit had been exceeded.

When comparing the actions of the master with the operating instruction of the company, one has to state that the master complied with it. If the wind limit had been known, the decision to sail into port would have been different.

The instruction of the company nailed the distribution of work to official rank so that the tasks were distributed beforehand irrespective of the circumstances. An exceptionally strong storm had no effect on a re-definition of the tasks. The extra mate could not be of assistance, because he did not fit the task distribution ordered in advance. There was no flexible distribution of work. In every preparation, it is advisable to rotate tasks. The aim has to be that everyone reaches the same performance. By varying the distribution of labour the work becomes interesting. No one would be left without a task. The instruction restricted the development of work and a discussion on the efficient use of technology. The distribution of labour by the company facilitated the fact that no one looked at the digital chart nor checked the direction of the wind in the wind gauge. Nor was Joystick steering used. The equipment best suited for the situation was not used at all.

Decision made by the Accident Investigation Board

After this accident the Accident Investigation Board of Finland has agreed on executive assistance with other authorities to make the data recorded by the VDR and other technical equipment available to it.

4 RECOMMENDATIONS

The distribution of labour on the bridge was rigid and failed to take into consideration changing circumstances. Tasks should not be tied to rank. The instruction should activate the distribution of labour so that the tasks are listed on the basis of the movement areas, such as open sea, fairways and harbour manoeuvring. This way also exceptional circumstances would be better taken into consideration.

The Investigation Commission recommends that

1) *The company review its instructions to correspond to the bridge equipment of the SUPERFAST VII. In addition, the aim of the instruction should be a situation where the mates are capable of the same performance in different situations.*

The ISM Code requires that the company define safe practice in normal operation in all circumstances. Steering in a storm is a very ordinary situation, which, under the ISM Code, requires safe practice. The personnel of the company can define wind limits using a desk-top computer simulator. This requires a mathematical model of the vessel, a wind-tunnel experiment and suitable simulation software. In addition it requires a wind model of the port in order to determine the wind limit of the vessel more accurately.[28]

The Investigation Commission recommends that

2) *The company have a mathematical model made and acquire suitable simulation software, which can be used to determine wind limits.*

The crew of the vessel has to be familiar with the storage of data recorded by the VDR equipment as well as when the storage should especially be taken care of.

The Investigation Commission recommends that

3) *The company supplement its instruction with an instruction on the storage of the VDR. The storage shall be made after every danger incident. Under the ISM Code, dangerous and close-by situations have to be investigated by the company and the crew.*

Helsinki 24.3.2006

Juha Sjölund Karl Loveson Kari Larjo

28 The Investigation Commission of the CITY OF SUNDERLAND C2/2002 M recommended to Hanko Port that it prepare a wind model. In its statement, the port took a negative attitude to the recommendation.

LIST OF SOURCES

The following sources are stored at the Accident Investigation Board:

1. General information on the vessel
2. The Maritime Accident Notification with Appendices
3. The bridge instruction of the company
4. The standing orders of the master
5. A list of the vessel's certificates
6. The records of the hearing of the vessel's crew, the pilot and the masters of the tug-boats.
7. VTS operator's report
8. The crew list and the information on the qualifications of the bridge crew
9. Cargo, stability and strength calculations of the voyage
10. Equipment list of the bridge
11. The print-out of the course recorder and print-outs of the electronic chart
12. The alarm list of the engine room
13. Wheelhouse poster
14. Pilot card
15. Structural drawing of the rudder
16. Calculation of the wind area of the vessel
17. The Harbour Entry Check Lists of the Bridge and the Engine Room
18. The Check List of the Pilot
19. The sounding chart of the accident area
20. Extraxt of the Radio Log of Turku Radio as well as Navtex weather forecasts
21. Wind information of the Finnish Meteorological Institute on Tulliniemi
22. Gulf of Finland Coast Guard list of measures on 12 November 2004
23. Emergency Report No. 927 of the Tammisaari Emergency Services
24. Correspondence

ANNEX

GUIDELINES ON VOYAGE DATA RECORDER (VDR) OWNERSHIP AND RECOVERY

Ownership of VDR information

1 The ship owner will, in all circumstances and at all times, own the VDR and its information. However, in the event of an accident the following guidelines would apply. The owner of the ship should make available and maintain all decoding instructions necessary to recover the recorded information.

Recovery of VDR and relevant information

2 Recovery of the VDR is conditional on the accessibility of the VDR or the information contained therein.

.1 Recovery of the VDR information should be undertaken as soon as possible after an accident to best preserve the relevant evidence for use by both the investigator[1] and the ship owner. As the investigator is very unlikely to be in a position to instigate this action soon enough after the accident, the owner must be responsible, through its on-board standing orders, for ensuring the timely preservation of this evidence.

.2 In the case of abandonment of a vessel during an emergency, masters should, where time and other responsibilities permit, take the necessary steps to preserve the VDR information until it can be passed to the investigator.

.3 Where the VDR is inaccessible and the information has not been retrieved prior to abandonment, a decision will need to be taken by the flag State in co-operation with any other substantially interested States[2] on the viability and cost of recovering the VDR balanced against the potential use of the information. If it is decided to recover the VDR the investigator should be responsible for co-ordinating its recovery. The possibility of the capsule having sustained damage must be considered and specialist expertise will be required to ensure the best chance of recovering and preserving the evidence. In addition, the assistance and co-operation of the owners, insurers and the manufacturers of the VDR and those of the protective capsule may be required.

Custody of VDR information:

3 In all circumstances, during the course of an investigation, the investigator should have custody of the original VDR information in the same way that the investigator would have custody of other records or evidence under the Code for the Investigation of Marine Casualties and Incidents.

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1 The term *investigator* refers to the Marine Casualty Investigator as per the terms of the Code for Investigation of Marine Casualties and Incidents.

2 Refer to paragraph 4.11 of the Code for the Investigation of Marine Casualties and Incidents, as adopted by resolution A.849(20).

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Ref. T1/2.02

MSC/Circ.1024
29 May 2002

GUIDELINES ON VOYAGE DATA RECORDER (VDR) OWNERSHIP AND RECOVERY

1 The Maritime Safety Committee, at its seventy-fifth session (15 to 24 May 2002), approved the annexed Guidelines on voyage data recorder (VDR) ownership and recovery which have been developed to support provisions of the revised SOLAS regulation V/15, as amended by resolution MSC.99(73), and, in particular, to support the carriage requirements for voyage data recorders contained in the revised SOLAS regulation V/20, which are expected to enter into force on 1 July 2002.

2 These Guidelines reflect the five basic issues relevant to VDR ownership and recovery, which are ownership, custody, recovery, read-out and access to the VDR information, as envisaged by the revised SOLAS chapter V.

3 In view of the complexity of the matter, close co-ordination and co-operation among interested parties, as appropriate, in any recovery operation of a VDR is encouraged.

4 Member Governments are invited to bring the annexed Guidelines to the attention of all parties concerned.

***

Read-out of VDR information:

4 In all circumstances the investigator is responsible to arrange down loading and read-out of the information and should keep the ship owner fully informed. In some cases, the assistance of specialist expertise may be required.

Access to the VDR information:

5 A copy of the VDR information must be provided to the ship owner at an early stage in all circumstances.

6 Further access to the information will be governed by the applicable domestic legislation of the flag State, coastal State and other substantially interested States as appropriate and the guidelines given in the Code for the Investigation of Marine Casualties and Incidents.

7 Any disclosure of VDR information should be in accordance with section 10 of the Code for the Investigation of Marine Casualties and Incidents.

SUPERFAST FERRIES
A PREMIUM ALLIANCE MEMBER

SAAPUNUT
08. 05. 2006
148/5M

ea/ISM 017/06

05, May 2006

To
Onnettomuustutkintakeskus,
Sornaisten rantatie 33 C
FIN – 00580 Helsinki
FINLAND

Attn: Mr. Juha Sjolund

Subject: ***SUPERFAST VII – GROUNDING OFF HANKO ON 12/11/04***

Dear Sirs,

We have received your reports regarding the investigation of the accidents occurred onboard Superfast VII and Superfast VIII, both in Hanko port.
Having consulted investigation reports issued by your organization regarding accidents occurred in the past involving other vessels, we were looking forward in receiving the reports concerning our vessels.
Improving safety standards is always the main goal of our company; thus your valuable experience on that issue is expected to be of our benefit.
We have studied your report carefully and we have to admit that a number of your recommendations have been adopted in our safety management system by utilizing new guidelines and procedures or amending existing ones.
Our comments to your accident investigation report of Superfast VII, after carefully evaluation are mentioned below. Regarding Superfast VIII, we will forward our comments the latest 12.5.06,as your report received lately.

Page 8 "The joystick was not used before...."

Captains have been trained during ship hand over period. Instructions for joystick operation can be found onboard.

Page 9 "The safety management system did not support the use of modern technology".

Superfast Ferries S.A have equipped its vessels with the most high tech navigation aids, existed in construction period, expecting to benefit from its use. The company has established procedures in order our officers to get proper familiarization with its use during their first joining the vessel as well as during their service period onboard.

157,C.Karamanli Avenue, 16673 Voula, Athens, Greece, Tel.: +30 210 8919000, Fax: +30 210 891 9029
e-mail: superfast@superfast.com, www.superfast.com

Attica

On the other had we have draw their attention to the potential possible false deviation that we all have experienced occasionally on board vessels; thus the use of such equipment and systems is encouraged to be in parallel with good seamanship practice. (Fleet operation manual 4.12.1).
Our policy on this issue is mainly based on the over-reliance of the watchkeeping officers on the automated features; it was one of the probable cause contributed to the grounding of the cruise vessel Royal Majesty in the USA on 10 June 1995, according to USA National Transportation Safety Board.

Page 10 "...does not contain instructions for the storing of VDR data".

Besides the maker's instructions, specific and clear instruction now incorporated in our SMS, please sea attached company's circular.

Page 15 "Nothing was agreed on the division of the tasks on the when the piloting started".

From our investigation derived that the Master and the pilot exchanged all necessary information including, as you have also mentioned, the maximum reverse speed of the vessel, tug boat assigned duties; the most powerful tug assigned on the bow, pilot was in contact with the tugs captains. Relevant check list is not signed as it is common practice to confirm this operation in the log book. Based on your remark it is reconsidered to amend this procedure in order to full fill relevant checklist instead of only making entry in the log book.

Page 16 "...arrival Bridge check list was not filled in" and "...pilot's check list was not filled".

Daily checklists are not filled in. Instead after carrying out the described checks an entry is entered in the bridge log book according to the Greek authorities.

Page 16 "...no stand to the wind limits or the handling of the vessel in port in a storm".

Detailed data analysis is included in the maneuvering booklet mentioned below.

Page 21 "The company has not defined.... in a strong wind".

The company has issued relevant instruction for sailing in bad weather condition (also incorporates storm weather) however, based on your input specific instructions for handling the vessel at port under storm weather condition will be included in the SMS. Masters and bridge officers are well aware of maneuvering characteristics of our vessels. A familiarization is carried out during in-house briefing with the superintendents and on board prior duties assignment.
The vessel is provided with a calculation of wind force specially performed for those vessels taking into account ship's thrust capability under various wind conditions and various angles of attack. From that information derives that the vessel can withstand a

wind force of about 12 m/sec at 60 degrees angle of attack (worst scenario). The captain based on that information requested tug assistance well in advance. Attached please find relevant pages of the maneuvering characteristic booklet.
The company has also defined safe practices and relevant instructions have been included in the SMS; instructions regarding navigation, cargo handling, safe work practices are some examples.

Page 23. "The instruction of the company did not give the master any support to wait for the wind decrease".

To this issue the company has clearly marked and stipulated the master overriding authority to request any assistance he considered necessary.
During office familiarisation the master overriding authority is clearly stated.

Page 24 "Regarding the installation of the GPS, the instruction gives dangerous advice".

We have asked the manufacturer "Raytheon" to provide us with further clarification. Nevertheless, as we have already mentioned, the main contribution factor of the Royal Majesty accident was the watch officers overreliance on the automated features as well as the inability of the watch officer to identify that the GPS switched to dead reckoning function.

Page 24 "The attitude of the company... the instruction categorically forbade the use of electronic charts in position determination".

Such conclusion doesn't derive from any SMS instructions, it is rather investigators opinion and in no case represent company's attitude. What is mentioned in the F.O.M 4.14.5 is that the ECDIS should never be used to determine a **fix** position. This message is also appears on the ECDIS screen when the system is put in operation (No official chart, use paper chart). Additionally in F.O.M 4.3.1.4 (position of vessel) is mentioned that the position of the vessel should be determined in regular interval and to be co-ordinated with ECDIS. In the same chapter 4.12.1 is mentioned "too much confidence (overreliance) in a single navigational system or method should be avoided. The use of technologically advanced systems and equipment must be in parallel (double-check) with traditional navigational methods". The scope of those instructions is to prevent a potential incident of the same nature as Royal Majesty.

Page 24 "The digital chart and GPS were not used when the vessel reversed toward the port".

Both mentioned equipment was in operation and they were at Master's disposal. While approaching to the quay, under good visibility conditions, the position of the vessel and consequently her drift is determined based on seamanship practices, using available visual objects which are considered more reliable (buoys, lights, breakwater e.t.c).

Page 25 "No one looked at the digital chart ... with the instruction of the company"

While the ship is in the entrance of the Hanko port the captain immediately noticed, through the electronic devices and other available sources to him, the rapid change of wind direction but it was already very close to the breakwater before being able to implement fully relevant corrective action.

Page 25 " Regarding the handling of the vessel....would have prevented it".

The prediction feature of the ECDIS is considered a useful tool to the master. All our other vessels which are equipped with STN ATLAS equipment support that function. We will investigate together with Raytheon the possibility to enhance such feature to its equipment as well.

Page 26. The company has partly repeated ... to instruct the crew of the vessel as clearly as possibly".

In our point of view that is totally inaccurate. The company considers the safety of navigation as a crucial onboard operation. It has equipped it's vessels with all navigation equipment required by the international regulations and maintains them to the highest standards. Bridge officers are aware of the use of relevant equipment and its limitation following company's familiarization program.
The company has also identified the potential risk might resulted from bridge officers overreliance to electronic equipment and properly advised them to crosscheck such equipment output with other available means.

Page 26. "The digital chart was not used due to the SMS instruction".

This statement is also incorrect and based exclusively on investigator personal opinion. Electronic charts on board company's vessels are widely used in conjunction with ordinary nautical charts as required by the manufacturer and relevant regulations.

Page 30 "The joystick steering ... the necessary familiarization and confidence ...by sailing out of port".

Please see above relevant comments regarding the same matter.

Page 30 "Wind limit".

The company has fully supported the master in determining the wind limits of the vessel by providing all necessary information included in the maneuvering booklet, relevant pages are attached to this letter. The captain based on that information as well as on his experience, evaluating the prevailing weather condition had timely requested tug assistance.

The bow thrusters' performance was well determined and it was taken into account in harbor maneuverings. That was the reason that the most capable tug was asked to assist the bow.

Page 35 "Conclusions"

Once again we mention that the instructions of the SMS concerning the use of the electronic equipment considered being in line with applicable regulations. The company has identified the potential risk of the overreliance on this equipment (which was a contribution factor in many accidents in the past including Royal Majesty) and properly advised bridge officers.

On that particular accident and at that stage of the maneuvering operation (harbor entrance) the electronic equipment would have rather proved helpful to the master in order to determine vessels ability to proceed safely to her dock. Such crucial information also obtained by noticing vessels position in conjunction with surrounded space and fixed object.

The procedure agreed with the pilots and followed, is that after made tug boats fast, while vessel still in turning area and before attempting astern movement toward the dock, we determined while the vessel, under prevailing wind condition and tug assistance, was able to safely proceed to the dock.
With north-northeast wind we used to proceed close to the YB buoy and with south-southeast wind close to the YBY buoy. That was identified as the most critical stage, determining whether it would be feasibly to proceed further. If the vessel wasn't drifting in the direction of the wind, we were proceeding astern in a speed of 3-4 knots maximum in order to obtain the maximum bow thrusters as well as tugs performance output. If the vessel was drifting in the direction of the wind we used to let go the tugs and proceeded in the open sea until weather condition improvement. That is the procedure extensively discussed with all masters serviced on the particular trade during their familiarization, and successfully followed by all vessels in stormy weather in Hanko port and in that particular case. It is worth to mention that no any near accident has been arisen during vessel departure - arrival to Hanko.

The company has investigated the accident, initiating DNV's M-SCAT (Marine Investigation Cause Analysis Technique). From this investigation derived that the major contribution factor to the accident was the sudden and unexpected change of the wind direction. The vessel due to the southerly wind prevailed in the initial stage of the maneuverings was proceeding astern close to the YBY buoy and the breakwater. At the moment where the vessel was at the port entrance close to the breakwater, the wind blew from the north and her starboard bow. The master immediately noticed the change of the wind direction but due to vessel's close approach to the breakwater had no any chance to attempt forward movement of the vessel and proceed out of the port, action which would probably have caused severe damages to the hull and put passenger and vessel in danger. Instead he preferred to let the vessel, as much as possibly, smoothly touch the fouling minimizing damages and exposing vessel and passengers in the less possible danger.

Page 4 " Recommendations".

1. The company will review its instructions for bridge equipment in order those instructions to be more clearly and easily understood by involved personnel. The possibility to obtain a vessel's prediction movement through electronic chart will be also investigated with Raytheon manufacturer. The importance of the electronic equipment use will be also emphasized but the policy concerning the potential risk of misleading information derived from that equipment and the importance of cross-checking with other available means is not considered necessary to be revised as it is in line with relevant regulation and seamanship practice.
   Regarding the safe practice of maneuvering the vessel at port under stormy weather, will be more specifically and clearly addressed in the SMS, with specific reference to the maneuvering booklet data.

   Regarding the responsibilities of bridge officers we intent to provide additional bridge management and emergency response training. After our cross evaluation of your comments on this issue, although we consider adequate all responsibilities listed in our SMS, we will asses our bridge procedures and if any need identified relevant procedure will be incorporated in our system.

2. It is not considered necessary to further determine wind limits as this has already done in the most proper and reliable manner. Nevertheless, the development of simulation software and its potential contribution to improve safe practices will be considered.

3. Besides existing information mentioned in the maker's instruction booklet, we have now incorporated specific instructions in our SMS.

Best Regards,

P. Makrigiannis
D.P.A

CC: Mr. J. Skoutas
Mr. C. Kaintatzis
Mr. G. Karkas

Attach: 1. Wind Moment Calculation (10 pages)
2. Company's Circular No 32 (1page)

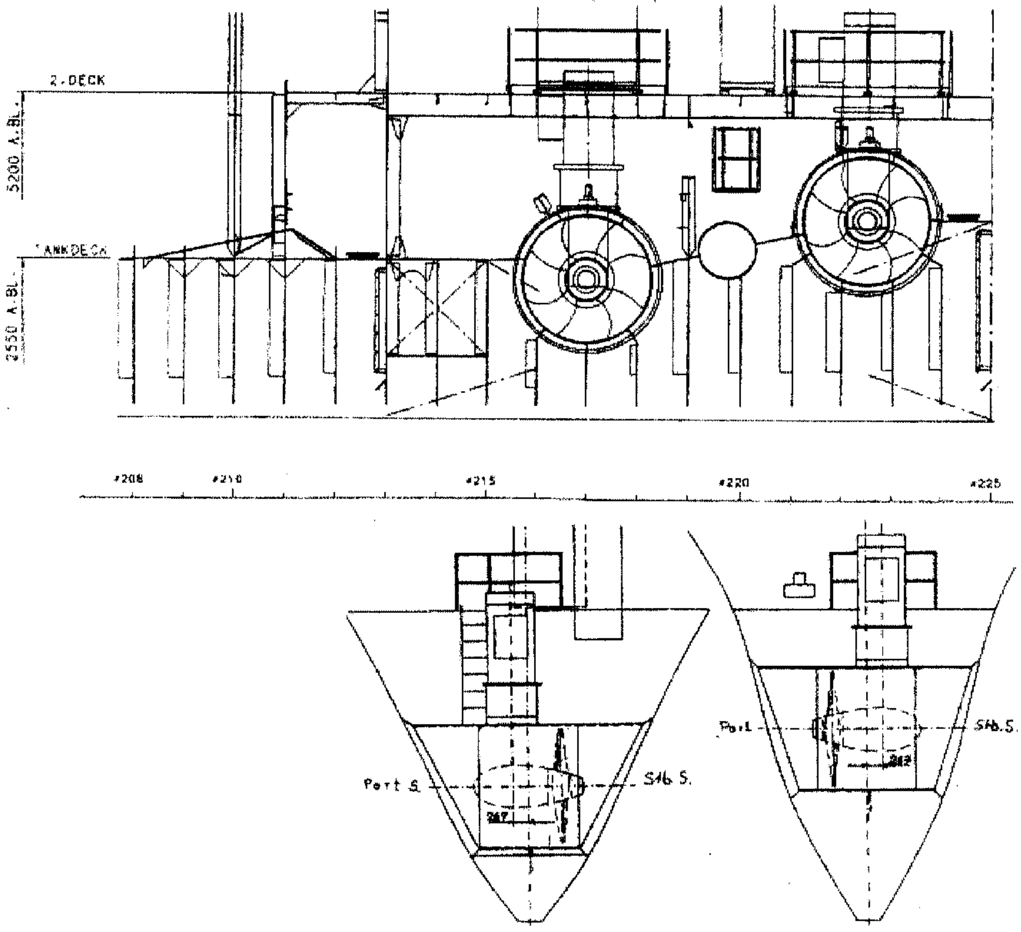
HDW	Ship: RoRo-Passenger Ferry, SUPERFAST HDW Hull Nos : 357/358/359/360	Manoeuvring Booklet Items concerned : 1.1.7

Bow Thrusters

Position :

forward thruster	:	frame no 222.5 = 10.4 m aft F.P. propeller towards PS
Aft thruster	:	frame no 217 = 14.8 m aft F.P. propeller towards SB

Maker : KAMEWA / Sweden, Type TT 2000-CP-Kil
Motor : 925 kW, 1180 rpm
Propeller : Diameter = 2 m, 4 Blades, 245 rpm
Thrust : abt. 145 kN (14.8 t)

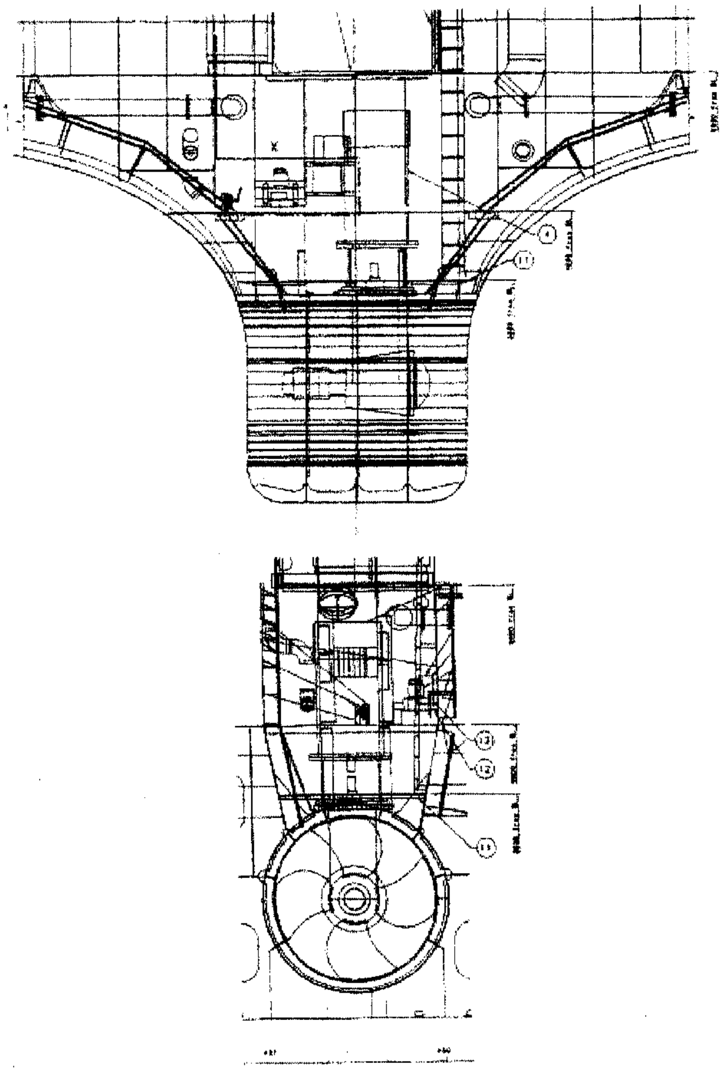


HDW	Ship: RoRo-Pasenger Ferry, SUPERFAST HDW Hull Nos : 357/358/359/360	Manoeuvring Booklet Items concerned : 1.1.7

Stern Thrusters

Position : frame no 28.5 = 20 m from A.P

Maker : KAMEWA / Sweden, Type TT 2200-CP-KII
Motor : 1 3500 kW. 1190 rpm
Propeller : Diameter = 2.2 m. 4 Blades, 245 rpm
Thrust : abt. 193 kN (19.7 t)

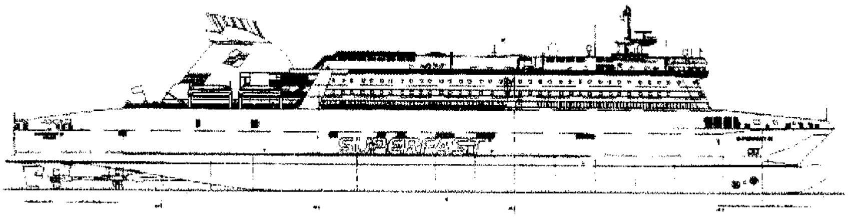


HDW	Ship: RoRo-Passenger Ferry, SUPERFAST HDW Hull Nos : 357/358/359/360	Manoeuvring Booklet Items concerned : 1.1.10

Wind Areas

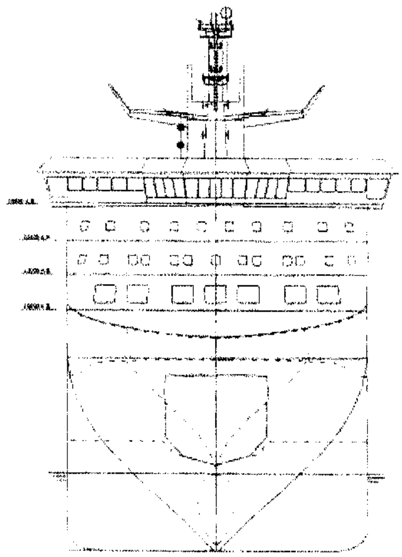
(Above waterline 6,6 m)

Lateral View:



Area A_L = 4 377 m2 Centre of the Area = 94.5 m before A.P.
= 19.0 m above B.L.
= 12.4 m above W.L. 6.6 m

Cross Section:



Area A_X = 730 m2 Centre of the Area = 21.5 m above B.L.
= 14.8 m above W.L.6.6 m

HDW	Yard No. 360 NAUTICAL MANOEUVRES BOW / STERN THRUSTER MANOEUVRES DESCRIPTION	Page No.: 2.7.1 Manoeuvring Booklet Items concerned: **2.6.1/2.6.2**

With both **bow thrusters** operating measurements were performed with 30 degrees course deviation to port and starboard with ship at rest.
Then the test was repeated with the **stern thruster.**

The course deviations of the vessel were recorded for full thruster output (bow abt. 1530+1480 kW, stern thruster abt. 2050 kW) starting with wind from ahead.

Wind was blowing from W with Beaufort scale force 6 during bow thruster test and B4 during stern thruster test.

The rudder was kept in midship position.

Bow Thruster Operation (2002-01-28):

Speed of ship knots	Rate of turn degrees / minute	
	to port	to starboard
0	20	23

Stern Thruster Operation (2002-01-30:

Speed of ship knots	Rate of turn degrees / minute	
	to port	to starboard
0	18	15

The recorded values are listed on pages 2.7.3.1 to 2.7.3.2.

Page 2.7.3.3 show graphs of the thruster manoeuvres.

Times for full power:		Bow Thruster	Stern Thruster
	0 – Full :	7 sec.	8 sec.
	Full - 0 – Full :	14 sec.	14 sec.

Kiel, 2002-02-03
HKP

HDW	**Yard No. 357** **NAUTICAL MANOEUVRES**	Page No.: 2.7.1
	BOW / STERN THRUSTER MANOEUVRES DESCRIPTION	Manoeuvring Booklet items concerned : **2.6.1/2.6.2**

With both **bow thrusters** operating measurements were performed with 30 degrees course deviation to port and starboard with ship at rest and initial speeds of about 3 and 5 knots . Then the test was repeated with the **stern thruster.**

The course deviations of the vessel were recorded for full thruster output (bow abt. 2 x 925 kW , stern thruster abt. 1350 kW) starting with wind from ahead.

Wind was blowing from NW with Beaufort scale force 5 - 6.

The rudder was kept in midship position.

Bow Thruster Operation :

Speed of ship knots	**Rate of turn degrees / minute**	
	to port	**to starboard**
0	24,0	23,5
abt. 3	23,0	20,5
abt. 5	13,0	20,0

Stern Thruster Operation :

Speed of ship knots	**Rate of turn degrees / minute**	
	to port	**to starboard**
0	20,0	22,5
abt. 3	13,5	17,5
abt. 5	-	-

The recorded values are listed on pages 2.7.3.1 to 2.7.3.6.

Pages 2.7.3.7 and 2.7.3.9 show graphs of the thruster manoeuvres.

Times for full power:		Bow Thruster	Stern Thruster
	0 – Full :	8 sec.	7 sec.
	Full - 0 – Full :	15 sec.	13 sec.

Kiel, 2001-05-04
HKP

	Ship:	Manoeuvring Booklet Items concerned :
HDW	RoRo-Passenger Ferry, SUPERFAST HDW Hull Nos : 357/358/359/360	5.1.1

Information about Wind Forces and Moments

Wind forces and moments can be calculated for all conditions of interest according to the procedure described in the following pages.

The coefficients were taken from wind tunnel tests specially performed for this vessel.

The table below gives forces and wind moments for draught 6,60 m at zero ship speed :

Wind Force Beauft., m/s	Epsilon [°] (angle of attack)	0	30	60	90	120	150	180
B - 2 2.5	Fx [kN]	-1	-1	0	1	0	2	2
	Fy [kN]	0	9	15	12	13	9	0
	Mx [kN m]	1	121	195	157	153	115	-2
	Heel Angle [°]	0.0	0.1	0.2	0.2	0.2	0.1	0.0
	Mz [kN m]	3	258	227	-80	-268	-342	7
B - 4 6.7	Fx [kN]	-10	-9	3	4	3	13	13
	Fy [kN]	1	66	108	89	95	68	-1
	Mx [kN m]	11	867	1400	1128	1102	822	-13
	Heel Angle [°]	0.0	0.9	1.5	1.2	1.2	0.9	0.0
	Mz [kN m]	25	1853	1628	-576	-1928	-2454	50
B - 6 12.3	Fx [kN]	-34	-29	10	15	11	45	44
	Fy [kN]	2	223	363	300	320	229	-3
	Mx [kN m]	36	2923	4718	3803	3714	2772	-44
	Heel Angle [°]	0.0	3.1	5.0	4.1	4.0	3.0	0.0
	Mz [kN m]	84	6245	5485	-1941	-6498	-8270	169
B - 8 19	Fx [kN]	-81	-69	23	35	26	108	104
	Fy [kN]	6	531	867	716	763	547	-7
	Mx [kN m]	85	6975	11257	9073	8861	6614	-106
	Heel Angle [°]	0.1	7.5	12.1	9.7	9.5	7.1	-0.1
	Mz [kN m]	201	14901	13089	-4631	-15505	-19734	403

(T= 6,60 m, Displ.= 18838 t, GM= 2,85 m)

Explanations :

Epsilon : angle of attack, 0° = wind from ahead

Fx : force in longitudinal direction of ship
(-) = wind force in forward - aft direction
(+) = wind force in aft - forward direction

Fy : force athwartships

Mx : heeling momentum / heel angle leewards

Mz : wind momentum about vertical axis
(+) = turning starboard at wind force from portside ahead
(-) = turning portside at wind force from portside astern
The signs will be reversed correspondingly if wind force is from starboard side.

Kiel, 2001-04-14
HKP

	Ship:	RoRo-Passenger Ferry, SUPERFAST HDW Hull Nos : 357/358/359/360	Manoeuvring Booklet Items concerned : 5.1.1
HDW			

Calculation of Wind Forces HDW Hull Nos. 357/358/359/360

Wind is apparent wind at the vessel.

Forces depending on (apparent) angle of attack
Forces depending on wind areas (draught)
Heel depending on Displ. and GM-value

Force in longitudinal direction :
Fx = rho / 2 * V² * Axx * Cxx [kN]

Force in athwart direction :
Fy = rho / 2 * V² * Ay * Cy [kN]

Wind momentum about vertical axis in Lpp / 2 :
Mz = Loa * rho / 2 * V² * Ay * Cmz [kN m]

Heel momentum about waterline :
Mx = rho / 2 * V² * Ay² / Loa * Cmx [kN m]
Heel angle = 180/Pi * arc sin (Mx / Displ * GM)

Coefficients Cxx, Cy, Cm from diagrams

with :

rho, spec. mass of air : 1,25 kg / m³

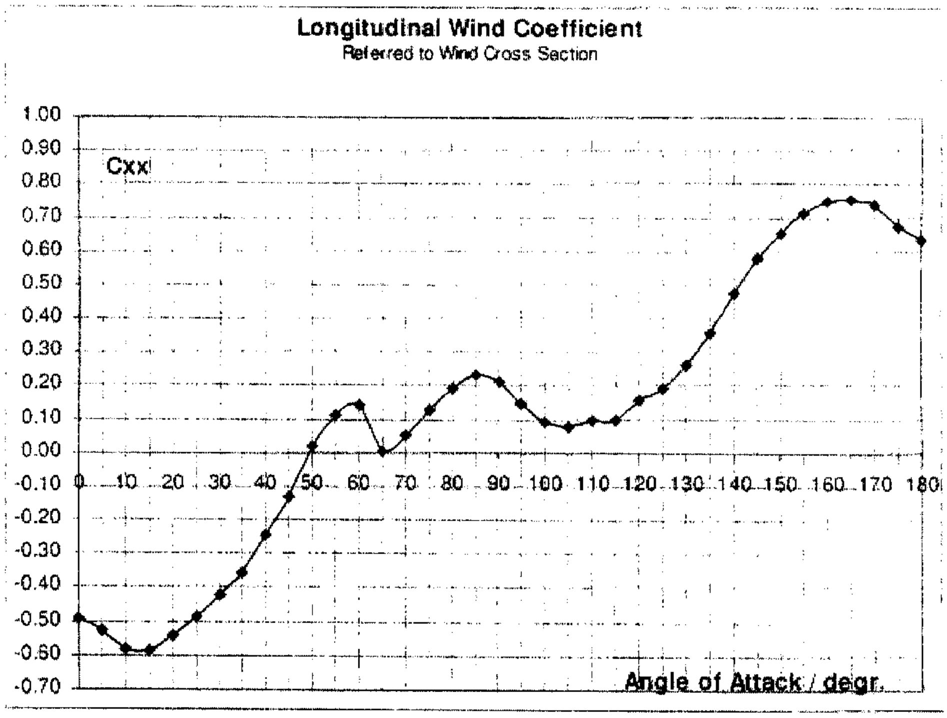
V , (apparent) wind speed in : m / s

Loa , ship length over all : m

Axx , wind cross section in : m²

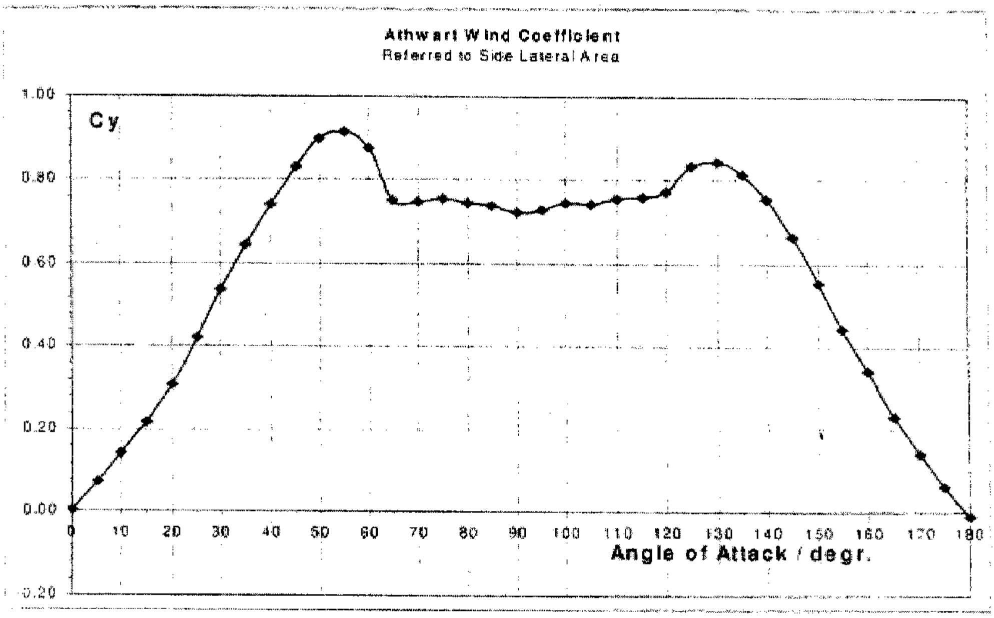
Ay , wind lateral area in : m²

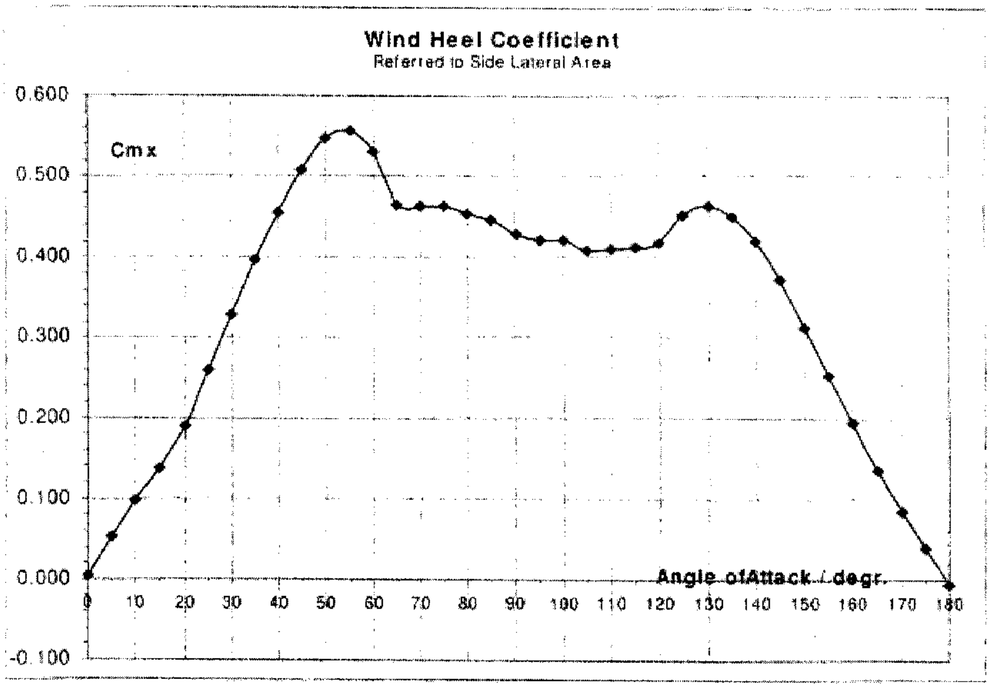
Draught	Axx	Ay
5,80 m	770	4525
6,40 m	735	4414
6,60 m	730	4377



Kiel, 2001-04-14
HKP

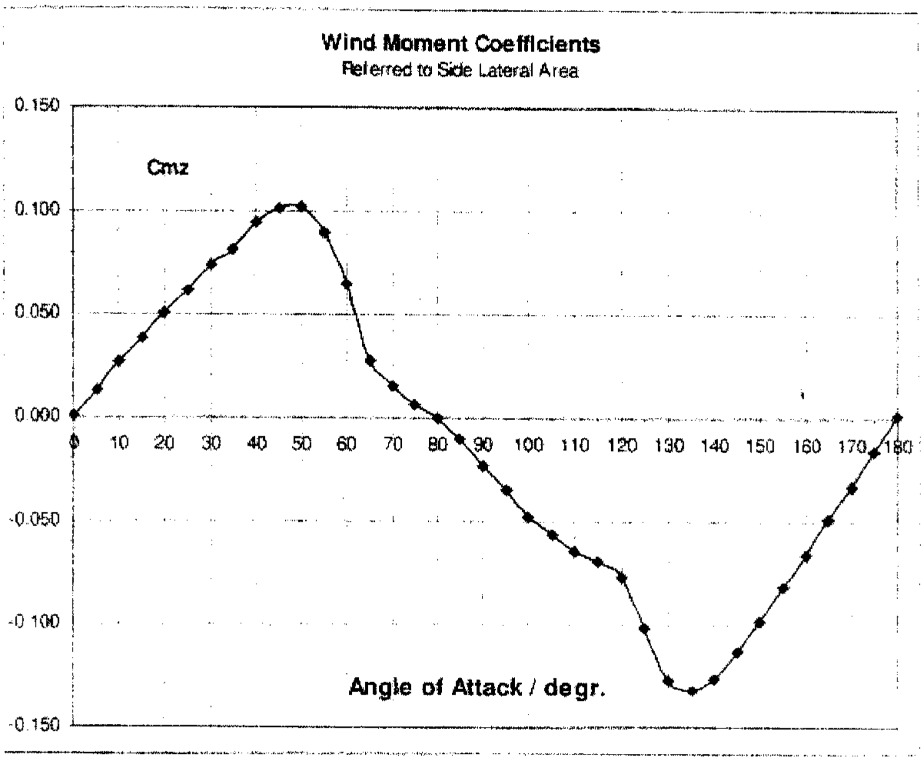
	Ship:	RoRo-Passenger Ferry, SUPERFAST HDW Hull Nos : 357/358/359/360	Manoeuvring Booklet Items concerned : 5.1.1





Kiel, 2001-04-14
HKP

	Ship:	RoRo-Passenger Ferry, SUPERFAST HDW Hull Nos : 357/358/359/360	Manoeuvring Booklet Items concerned : 5.1.1



Kiel, 2001-04-14
HKP

HDW	Yard No. 357 NAUTICAL MANOEUVRES SPECIAL - MANOEUVRES STEERABILITY TEST	Page No.: 2.8.3 Manoeuvring Booklet Items concerned: 7

CRABBING TEST (Transversing)

Date: 2001 - 04 – 23

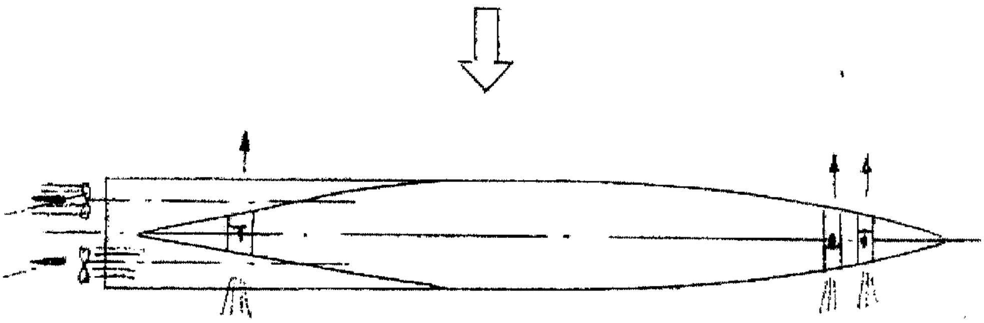
SEA AREA: Baltic Sea , Kiel Bay

DEPTH OF WATER: 21 m
WEATHER COND.: WIND : SW
SEA : B – 2
DRAFT AFT.: 5,80 m
FWD: 5,80 m

MAX. RUDDER ANGLE : 15 DEG.

COURSE DEVIATION : 10 DEG.

PROP. SPEED : Abt. 120 1/min
SPEED OF SHIP : 0.0 kn
RUDDER PUMP IN OPERATION: 2x1



TEST No	I	Lev. Pos.	II	Lev. Pos.	III	Lev. Pos.	IV	Lev. Pos.
Propeller Port S.	0	0	Slow Ahead	2				
Propeller SB S.	0	0	Half Astern	-4,5				
Rudder(s)	0	deg	11 SB	deg		deg		deg
Stern Thruster	60	%	0	%		%		%
Bow Thr. aft	0	%	50	%		%		%
Bow Thr. forwd.	55	%	50	%		%		%
Cross Speed	abt. 0,5	kn	abt. 0,8	kn				

Commments :

Test no. I : Transversing could be demonstrated, maximum cross speed not yet attained

Test no. II : Transversing could be demonstrated, maximum cross speed not yet attained

Kiel, 2001-05-04
HKP

Observer: Capt. Denaxas (Owner)
Dr. Yan (HDW)

SUPERFAST FERRIES
A PREMIUM ALLIANCE MEMBER

ea/ISM 016/06

13, April 2006

To
Master
SUPERFAST V, VI, X, XI, XII

Circular No 32

SUBJECT: VOYAGE DATA RECORDER OPERATION INSTRUCTION

Dear Captain,

In order to fulfil with the requirements of MSC/Circular 1024 "guidelines on the Voyage Data Recorder", we issue the following company circular.

The master and the bridge officers have to be familiar with the following procedures as well as the Marine Event Recorder manufacturer operation manual.In case of an accident or near accident the master is responsible to activate the emergency backup of the MER.

In order to activate the emergency backup, the protection cover of the push button has to be lifted up and the "backup button" has to be pushed until the red light activates. The light confirms the start of the backup and continues to light until storage is completed. When the backup is completed the light will extinguish. The emergency backup can be started again if needed. In that case the stored data will be deleted and the new actual data will be stored.

It is very important to start the emergency backup **not** at the beginning of an emergency situation, but at the end. This is important in order all information about the actions taken after the occurrence of the emergency situation, to be recorded.

The system can store information for the last 12 hours after the backup button is activated.

The soonest, after the emergency situation is over, the stored backup information has to be transferred to the computer's hard disk. (See manufacturer instruction manual).

The company will, in all circumstances and at all times, owns the VDR and its information.

In all circumstances the investigator is responsible to arrange down loading and read-out of the information and should keep the ship owner fully informed. In some cases, the assistance of specialist expertise may be required.

Maintenance:

The maintenance of the equipment will be carried out by the manufacturer in the specified time intervals. Whenever an ALARM appears in the control panel, the reset button has to be pushed. If the alarm persists the office has to be informed.

Please confirm receipt,

Best regards,

P. Makrigiannis

CC: Mr. J. Skoutas
Mr. C. Kaintatzis
Mr. G. Kazepidis

MASTER

DATE

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Attica