

THE GERMAN 'GROUP OF EXPERTS'

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THE GERMAN 'GROUP OF EXPERTS'



The Investigation Report is  
dedicated to those  
who lost their lives,  
those who are still missing,  
their relatives and  
the survivors.

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THE GERMAN 'GROUP OF EXPERTS'



## PREFACE

The German 'Group of Experts' has now - as far as possible - completed its investigation of the foundering of the M. V. ESTONIA, a disaster that has taken the greatest toll of human life in the Baltic Sea in times of peace. The German 'Group of Experts' has during the past five years performed a difficult investigation in a partly hostile and reluctant environment. The work was carried out during the first two years - 1995/1996 - in close co-operation with the Swedish leader of the Technical Group of the Joint Accident Investigation Commission of Estonia, Finland and Sweden (JAIC), Börje Stenström († February 1997), and also with the Finnish member of the Technical Group, Dr. Tuomo Karppinen and the expert Dr. Klaus Rahka. All the investigation results of this 'Group of Experts' were submitted either verbally in joint meetings with the members and the experts from Estonia, Finland and Sweden attending or in letters with attached photos and/or video film documentation to the JAIC. This documentation and information concerned the design, construction and building of M. V. ESTONIA in general and the locking devices of the bow visor in particular, including the load calculations, the co-operation with the Classification Society Bureau Veritas, and the Owners. Furthermore, detailed evaluations of all survivors' statements, statements and other documentation such as photos and videos showing the condition of safety relevant parts of the ferry before the casualty obtained from previous passengers and crew members were submitted. In response, the JAIC submitted information and documentation, and up until the end of 1996 a relatively intense exchange of views and technical discussions took place which died away with Börje Stenström. A very detailed evaluation of the condition of the visor performed by metallurgical experts, of the objects recovered from the wreck or cut off from the visor, of the video films from the wreck made by ROVs and divers, of the testimony of shipyard employees having participated in the design, construction and building of VIKING SALLY, of previous passengers and crew members of the ferry as well as of survivors of the disaster form the backbone of this Investigation Report and are the basis for its conclusions. Breaking tests with mock-ups of the Atlantic lock were carried out by the Institute for Shipbuilding of the Hamburg University in co-operation with a member and an expert from the Finnish part of the JAIC. During the first half of 1997 it became evident that the JAIC would not change its first technical findings and conclusions published in the so-called Part-Report in April 1995 in spite of all the evidence submitted by this 'Group of Experts' and others which indicate a totally different chain of causation and sequence of events. Therefore it was decided to demonstrate the own investigation results to the Swedish public in two Exhibitions in the heart of the City of Stockholm, because it was Sweden who had paid the highest death toll in the disaster and consequently the Swedish public followed our investigations very closely. As from the Exhibitions - especially after the second - considerable support was received from Swedish citizens and further contact was made with a number of very important witnesses of fact. This Investigation Report covers all the evidence available to this 'Group of Experts' until 27.11.1999. Whenever considered relevant the attention of the reader will be drawn to the findings of the JAIC in comparison to the findings of this 'Group of Experts'. During the course of the investigation and, in particular, during the two exhibitions in Stockholm, many meetings with survivors and relatives of the casualty victims took place, which left deep impressions. Many of the relatives and survivors pleaded to assist them in the finding of the truth. This authors of this Report have attempted to comply with this plea.

*In summary this investigation reveals that,*

- M.V. ESTONIA was unseaworthy when she left Tallinn on the evening of the 27.9.1994 for her last voyage and
- this condition was due to reckless operation and careless inspections and
- the report of the JAIC misleads its readers, whether purposely or due to the incompetence of its authors, is left to the decision of the readers of this report.

## THE GERMAN 'GROUP OF EXPERTS'

### Appointment

The German 'Group of Experts' was formed in the beginning of February 1995 in accordance with a decision of the Managing Director of Jos. L. Meyer GmbH, in Papenburg - Dipl. Ing. Bernard Meyer.

### Chairman

Dr. Peter Holtappels, marine lawyer and senior partner of the law firm Ahlers & Vogel, Hamburg.

### Members

Captain Werner Hummel, marine consultant and managing director of Marine Claims Partner (Germany) GmbH, Hamburg. Captain Håkan Karlsson († February 1997), former master of MV VIKING SALLY, SILJA STAR and WASA KING from June 1980 - October 1992.  
Prof.-Dr. mult. Eike Lehmann, Technical University of Hamburg-Harburg until 30.06.95 (at which time Prof. Dr. Lehmann was appointed CEO of the Board of Germanischer Lloyd, Hamburg and became thus unable to participate in the ongoing investigation). Dipl.-Ing. Tomas Wilkendorf, naval architect employed by Messrs. Jos. L. Meyer GmbH, Papenburg.

### Experts

Prof. Dr.-Ing. Hans Hoffmeister, of the University of the Armed Forces, Hamburg.  
 Prof. Dr.-Ing. Walter Abicht, Institute for Shipbuilding of the University of Hamburg.  
 Prof. Dr.-Ing. Hansjörg Petershagen, Institute for Shipbuilding of the University of Hamburg.  
 Dr.-Ing. Zenon Hirsch, naval architect, Hamburg.  
 Captain Peter Jansson, Helsinki/Finland.  
 Veli-Matti Junnila, stability expert, Turku/Finland.  
 Swedish observer - Captain Erland von Hofsten, chairman of the Swedish  
 Sailor's Foundation, Gothenburg/Sweden.  
 Bryan E.W. Roberts - reconnaissance expert, Churchgate/UK.  
 Brian Braidwood - diving and explosives expert, Weymouth/UK.  
 Jonathon Bisson - video expert, Axminster/UK.

## Status

The German 'Group of Experts' was set up to find out the causes of the accident.

The chairman of the German 'Group of Experts', Dr. Peter Holtappels, accepted the appointment only under the condition that the Group could act independently, i.e. without any interference by the management of Jos. L. Meyer GmbH. This total independence was granted and strictly adhered to.

## Work Schedule

The main work was done by Dr. Peter Holtappels, Captain Werner Hummel and Dipl. Ing. Tomas Wilkendorf in the office of Marine Claims Partner (Germany) GmbH, Hamburg and, to a certain extent, at the Meyer Werft, Papenburg.

The other experts came in and went out as the situation required. Numerous trips to Sweden, Finland and the United Kingdom were made and from time to time Estonia and/or Latvia have been visited.

A considerable amount of time was spent on the evaluation of the investigation results of the visor, the ROV and diver videos and the recovered objects. Also the evaluation of the numerous statements of the 137 official survivors, the collection of evidence from previous passengers, the review of the files of the Swedish and Finnish parts of the JAIC as well as from the Public Prosecutor in Stockholm and the subsequent follow up took quite some time.

## Summary

This report consists of four parts. The first part - A - gives factual information about the design and construction of the ferry, her builders, owners, some of the subcontractors, the Classification Society and the National Maritime Administrations, her operation under the Finnish and Estonian flags and the status of her certificates as well as her maintenance and damage condition and the circumstances of ESTONIA's last voyage, the investigations after the sinking, the casualty scenario and the unexplained damage/unexplained evidence. The second part - B - presents associated facts such as bow door failures and incidents of other Ro-Ro vessels before the ESTONIA casualty and the reactions respectively non-reaction of Maritime Administrations/Classification Societies and furthermore, the results of separate investigations performed by various universities, institutes and independent experts in Germany and abroad. The third part - C - contains an analysis of the Final-Report of the JAIC in the light of the own investigation results. In the fourth part - D - the conclusions with reference to the particular subchapters are drawn.

## PART A FACTUAL INFORMATION

### CHAPTER 1

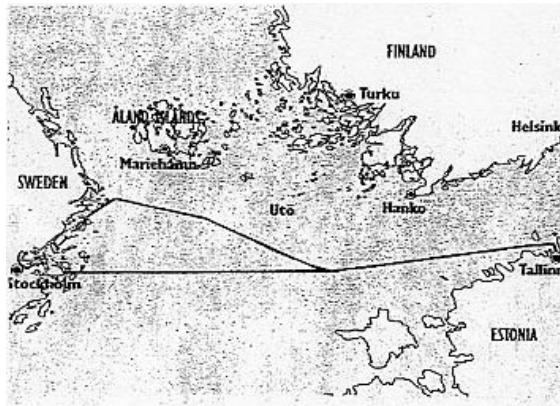
The Estonian flag car/passenger ferry ESTONIA - pictured below - departed from Tallinn on 27 September 1994 at about 19.15\* to 19.30 hours for a scheduled voyage to Stockholm. Reportedly she was carrying 989 people - 803 passengers and 186 crew members - as well as 40 trucks/trailers, 25 passenger cars, 9 vans and 2 buses. Despite the completely filled port heelung tank she had a 1° starboard list at departure.

#### The Ro-Ro Passenger Ferry ESTONIA



\* = All times are in Estonian time (Swedish time + 1 hour) unless stated otherwise.

#### The ESTONIA's route and the site of the accident



MV ESTONIA left Tallinn with all four main engines running. When she was clear of the breakwater full service speed was set. The four engines were hence set to produce 90% of their maximum continuous rating of 17,600 kW, corresponding to a speed of 19.5-20.0 kn. The wind was southerly 8-10 m/s. Visibility was good, with occasional rain showers.

At 20.00 hours the watch on the bridge was taken over by the second officer Peeter Kannussaar and the third officer Andres Tammes. The voyage proceeded normally. Sea conditions along the Estonian coast were moderate, but became more rough when the ship left the sheltered waters. The ferry was now heeling between 2°- 4° to starboard due to increasing wind pressure on the port side.

As the voyage continued the wind velocity increased gradually and the wind veered to south-west. Visibility was generally more than 10 nautical miles. At midnight the wind had increased to south-westerly 15-20 m/s with a corresponding increase of the wave height to now 3-4 m significant. The rolling and pitching of the vessel increased substantially. Many passengers became seasick, but everybody on board felt the extremely hard pitching which caused the ferry to shake and vibrate as she was driven through the rough sea with full power. Low banging noises from the bow area were continuously heard by many passengers.

ESTONIA followed her normal route along the Estonian North coast on course 262° to a waypoint of 59°20' N; 22°00' E which is confirmed by the observations of survivor Anders Ericson, the watch mate of the meeting vessel AMBER and the trainee mate Einar Kukk having been on the bridge until ca. 00.35 hours.

After the waypoint, at about 00.30 hours, the bridge ordered the engine room to activate the stabiliser fins, however, there were again problems with the starboard fin.

At about 00.45/50 hours one or two crashes/dull bangs were heard from the forward part of the car deck whereafter very hard metallic banging noises were heard and felt in the forepart of the ferry. Shortly afterwards it was felt that the speed had been reduced and the vessel was now making much softer pitch movements and also started to roll, less to port and more to starboard. Noises of the racing propellers were heard and respective vibrations felt.

At about this time a first - weak - "Mayday" call from ESTONIA was heard by those on the bridge of a Swedish ferry in the vicinity, however, no action was initiated since the call apparently was not repeated.

At about 01.00 hours a sharp bang was heard and a slight shock felt, the vessel's hull vibrated. Passengers from the 1st deck started to rush upwards, others were alarmed. Water was noted escaping under pressure from 0-deck to 1st deck. A little later, the second and much heavier impact followed by the third one occurred. The vessel stopped abruptly while turning to port. At 01.02 hours the ferry heeled - very wide - probably 50° or more - to starboard and came back to almost upright condition whereafter she heeled again very wide to starboard and came back to about 10° starboard but then heeled in steps to starboard.

The vessel was now on a south-easterly heading with wind and sea from starboard abeam within a very short time and all 4 main engines were automatically shut off, while the auxiliary diesels kept running/generating electricity some time longer.

Passengers started to rush up the staircases and panic developed in many places. Many passengers were apparently trapped in their cabins where they were later found by the divers. Lifejackets were distributed to those passengers who managed to reach the boat deck. They jumped or were washed into the sea. Some managed to climb into liferafts which had been released from the vessel. Reportedly only the starboard lifeboats were launched but could not be used except for the emergency motor boat No. 1 which was later seen by some survivors proceeding away from those in the water.

At a heel of approximately 40° the diesel generators also automatically shut off and the emergency generator took over the power supply to a limited number of consumers including illumination of alleyways and decks, when a weak female voice was heard calling "Häire, häire, laevel on häire" the Estonian words for "Alarm, alarm, there is alarm on the ship" over the public address system. Just a moment later the internal alarm code for the crew - "Mr. Skylight to No. 1 and 2" meaning "Go to fire stations No. 1 and No. 2" - was transmitted over the public address system followed by the general lifeboat alarm.

The first officially registered Mayday call from MV ESTONIA was received at 01.22 hours. A second Mayday call was transmitted shortly afterwards and by 01.24 hours fourteen ship- and shore-based radio stations, including the Maritime Rescue Coordination Centre (MRCC) in Turku, had received respectively automatically recorded the Mayday message.

The heeling to starboard increased stepwise further and water continued to enter the accommodation decks and the car deck through the partly open bow ramp and the starboard stern ramp with increasing speed. The starboard side of the ship was submerged at about 01.30 hours, with the visor still attached to bow ramp and forepeak deck. During the final stage of flooding the ferry was completely upside down. The visor fell off the ferry at a heel of approximately 130°/140° while the ship sank stern first and disappeared from the radar screens of ships in the area at about 01.53 hours.

Rescue efforts were initiated by the ferries in the vicinity while MRCC Turku reacted only rather late. About one hour after ESTONIA had sunk, the first of the four passenger ferries in the vicinity - M.V. MARIELLA - arrived on the scene of the casualty. Rescue helicopters were activated and the first one arrived at 03.05 hours.

During the night and early morning, helicopters and assisting ships rescued the official number of 138 people, of whom one later died in hospital. During the day and on the two following days 92 bodies were recovered, thus it has to be assumed that most of the missing persons are still inside the wreck.

The wreck was found in international waters within Finland's Search and Rescue Area, resting on the seabed at a water depth of about 80 m on a heading of 95° and with a starboard list of about 120°. The visor was missing and the bow ramp as well as the starboard stern ramp were found to be slightly open.

The position of the wreck was established to be 59°22.9' N, 21°41.9' E, while the visor was allegedly found on position 59°23.0' N, 21°39.4' E, i.e. about 1500 m to the West of the wreck.

**CHAPTER 2****THE VESSEL "VIKING SALLY"****2.1****The Builders - Meyer Werft, Papenburg**

The Meyer Werft - Jos. L. Meyer GmbH - at Papenburg/Ems was founded already in 1795 and has been owned by the Meyer family ever since. During the last decades Meyer Werft has achieved an excellent reputation for the building of special-purpose vessels, in particular, passenger ships, luxury car/passenger ferries and Ro-Ro vessels.

Up to date more than 60 of the above types of vessels have been built by Meyer Werft. Furthermore, the Yard is specialised in the building of passenger-ships and gas carriers for the transport of liquid and chemical gases. Presently about 60 passengerships/ferries and 47 gas carriers have been delivered. Shiprepair activities are mainly concentrated on jumboizing and converting ferries, passenger ships, freighters, and tankers. In addition, the Yard is the world's leader in converting freighters and tankers into livestock carriers. Up to now 25 vessels of this type have been converted for the transport of sheep and cows as well as camels and horses. Apart from the above-mentioned activities the Meyer Werft is also engaged in structural construction and engine building, which includes the fabrication of pressure tanks and special aluminium constructions. In 1975 a new shipyard was built which belongs to the most modern in Europe. In November 1987 the largest graving dock under roof was inaugurated which had to be lengthened by 100 m already in 1990/91. Presently about 2000 staff are employed.

So far the Yard has built respectively has under construction/on order:

Cruise vessels	16
Cruise ferries	1
Passenger vessels	20
Car/passenger ferries	30
Ro-Ro vessels	7
Gas carriers	47
Livestock carriers	26

It is obvious that survival in a very competitive, tough market was and is only possible by fine workmanship and delivery according to promise. For this the Meyer Werft is well known. The "Reference Lists for Ferries and Gastankers" - attached as Enclosures 2.1.1 / 2.1.2 - confirm this.

On this basis, as well as having very good relationships to Sweden and Finland, the Meyer Werft has succeeded since 1969 in obtaining orders to build a series of car/passenger ferries for AB Slite/Stockholm and AB Sally/ Mariehamn and - apart from the guarantee disputes usual for technically complicated newbuildings - delivering these to the entire satisfaction of the buyers.

All these vessels - except for the last one: SILJA EUROPA - have been employed in the Viking Line Service, either between Turku - Mariehamn - Stockholm or between Helsinki and Stockholm. This service was then operated by a consortium consisting of the Swedish AB Slite as well as the Finnish companies AB Sally and SF-Line.

The first ferry of these series by the name APOLLO was delivered in 1970 to AB Slite, followed by MV DIANA for the same owners, and VIKING 1, 3, 4 and 5 for AB Sally.

The third partner of the Viking Line consortium, SF-Line, ordered their newbuildings with other yards, e.g. the TURELLA was built by Sietas Yard, Hamburg and other ferries were built in Yugoslavia as well as by the then Wärtsilä Yard in Turku, Finland (e.g. MARIELLA).

All of the vessels built by Meyer Werft for AB Slite and AB Sally were classed by Bureau Veritas (B.V.) and built under the supervision of the respective National Shipping Administration, i.e. for the Slite vessels the Swedish Sjöfartsverket and for the AB Sally vessels the Finnish Sjöfartsstyrelsen, the Finnish Board of Navigation (F.B.N.). The 6 ferries were sister vessels, apart from VIKING 5 which had the same breadth but was 13.8 m longer. All vessels were constructed with visor, bow and stern ramps.

The building files of Meyer Werft reveal that due to the continued close co-operation lasting for years between the Yard, supervisors of owners as well as representatives of class and Sjöfartsverket respectively F.B.N. a relationship of confidence had developed between the participating persons.

On behalf of Bureau Veritas this was their inspector Günther Lohmann, who was engaged with Meyer Werft newbuildings for many years, whilst Sjöfartsverket was represented by the then Rotterdam office manager, H. Sjöholm and the representatives for F.B.N. were Gunnar Edelmann (shipbuilding matters/stability), Perti Haatainen (lifesaving) and Jan Jansson (fire-fighting).

All 6 vessels had the connection visor/bow ramp, i.e. the upper part of the closed bow ramp extended into a box-shaped structure on the forecastle which was part of the visor. None of the vessels had the upper extension of the collision bulkhead above the bulkhead deck, i.e. the car deck, installed at the location which was required by SOLAS since 1948, but the watertight bow ramp was generally considered to be the extension of the collision bulkhead.

Despite this deviation from the wording of SOLAS all these vessels, as well as more than 30 other ferries constructed similarly, were fully accepted by the Classification Societies and by the Maritime Administrations of the Nordic countries. According to the findings of the JAIC this practice was well known to insiders as the 'General Scandinavian Practice'.

**2.2 'The General Scandinavian Practice'**

This 'Group of Experts' has also looked into the origin of the so-called 'General Scandinavian Practice' which is meant to be the attitude of the Scandinavian National Maritime Administrations, in particular of the Swedish Sjöfartsverket and the Finnish Sjöfartsstyrelsen respectively the Finnish Board of Navigation (F.B.N.), in respect of the interpretation of and the dealing with certain SOLAS Rules. This refers, in particular, to the location of the upper extension of the collision bulkhead above bulkhead deck, which on the car/passenger ferries is the car deck. This is regulated by SOLAS 1974, Chapter II-1, Rule 9 (1979 Edition) and exemptions are only possible according to Rule 1 (c) if the route of the vessel does not lead more than 20 nm from the nearest land.

In the early years of the Ro-Ro ferries, i.e. end of the 1950's/beginning of the 1960's, the ferries were rather small and sailed only short distances and hence were never more than 20 nm off the nearest land. In this time the maritime administrations accepted the bow ramp in combination with the front bulkheads as the upper extension of the collision bulkhead above bulkhead deck, no matter where they were located.

In searching for the origin of the authorities' attitude it was found that apparently for the first time on the ferries PRINS BERTIL and PRINSESSAN CHRISTINA, built in Aarhus in 1960/61, the bow ramps had been accepted as the upper extension of the collision bulkhead above bulkhead deck by the National Maritime Authorities, most probably with the restriction not to proceed more than 20 nm from the nearest land.

In addition, it has to be noted that at least Sjöfartsverket and F.B.N. took the view already in 1959 that all structural matters - including the position of the upper extension of the collision bulkhead - would have to be dealt with by the Classification Societies, no matter whether SOLAS requirements, which actually were the responsibility of the Maritime Administrations, were involved or not. This attitude is revealed in a letter dated 07.04.59 written by the then Kungl. Sjöfartstyrelsen now Sjöfartsverket (attached as Enclosure 2.2.3) and in a statement which H. Valkonen of the F.B.N. gave at a meeting with this 'Group of Experts' on 27.10.95 (Memo attached as Enclosure 2.2.4). In other words, as soon as the Classification Society had issued the Class Certificates the National Maritime Administration issued the Passenger Ship Safety Certificate, thereby confirming that the ferry complied with SOLAS, although they did not know this for sure but merely assumed that the Classification Society had checked the compliance of the relevant vessel with SOLAS. This actually was the case only after the Classification Societies had incorporated SOLAS 1974 into their Rules, which, however, was not done simultaneously by all of them; for example Det norske Veritas (DnV) did it quite early while Bureau Veritas did it quite late. As most of the Swedish and Finnish ferries were classified by DnV, both Sjöfartsverket and F.B.N. were accustomed to having the Classification Societies take care of the structural SOLAS requirements. Bureau Veritas, however, incorporated SOLAS 1974 into its

Rules only in 1981, i.e. after DIANA II and VIKING SALLY had been built as will be explained in the subsequent chapters, and thus did not feel responsible for SOLAS matters during this time.

In the course of the investigation it was also discovered that the F.B.N. had issued an 'Exemption Certificate' to VIKING SALLY for a deviation from the SOLAS requirements in respect of the lifesaving appliances, however not for the wrongly placed upper extension of the collision bulkhead, being the bow ramp on this as well as on most of the car/passenger ferries trading in the Baltic in those years.

Revealing in this context is the correspondence in 1981 between a Swedish ferry operator, being in the process of taking over a foreign flag ferry, subsequently renamed KRONPRINSESSAN VICTORIA, and Sjöfartsverket wherfrom the following is quoted:

1.) Owners to Sjöfartsverket:

*«With reference to the previous exchange of communication we have noted that the bow ramp of this vessel is placed different than required by SOLAS 1974. We are requesting you to check this and reply by return whether the location of the ramp is wrong.»*

2.) Reply by Sjöfartsverket to owners:

*«The location of the inner bow ramp is in conformity with the national as well as international practice and is accepted by us in the present condition. The vessel has the required Swedish and international certificate which is also accepted by Denmark and West Germany, whilst Sweden in the same manner is also accepting the certificates of these countries. It is not the intention of Sjöfartsverket to take up these questions with the Maritime Administrations of said countries.»*

Copies of the respective telex exchange can be found as Supplement 215 to the Final Report of the JAIC.

Consequently it has to be assumed that in the course of the years and with ever growing ferries three alternatives concerning the bow ramp/upper extension of the collision bulkhead issue developed, viz.:

a) The bow ramp is the upper extension and is located in accordance with SOLAS requirements (the ferry could sail outside 20 nm range without restrictions).

b) The bow ramp is not the upper extension, but at the location on the car deck, as required by SOLAS, a "partial collision door" is installed (also this ferry could sail without restrictions).

c) The bow ramp (in combination with the front bulkheads) is the upper extension, but is not located at the proper place as required by SOLAS and no "partial collision door" is installed. (This ferry could sail inside the 20 nm range, but the National Maritime Administration would have to issue an 'Exemption Certificate' which would have to be renewed annually together with the PSSC.)

as to a)

This version complies fully with SOLAS and from this point of view creates no problems, however, the commercial side is treated badly because in order to take as many cars on the car deck as possible the bow ramp has to be as far forward as possible and this leads over to either version b.) or version c.).

as to b)

This version was already being built into ferries at the end of the 1970's operating in the Irish Sea, North Sea and the English Channel (although not on all of them). It complies fully with the respective SOLAS requirements. This version was also part of the initial quotations/specifications for DIANA II and VIKING SALLY submitted by Meyer Werft to the respective owners, whereafter - after consultations with Sjöfartsverket - respectively F.B.N. - the "partial collision doors" were deleted. The result was version c.).

as to c)

This version existed on DIANA II as well as on VIKING SALLY and on dozens of other ferries in the Baltic and elsewhere. The acceptance of this configuration by the National Maritime Administrations of Sweden and Finland, no matter whether the ferries sailed inside or outside of the 20-nm range and without issuing an Exemption Certificate to cover the wrong location of the upper extension is understood to be the 'General Scandinavian Practice'. It was followed for example by the Malmö office of Sjöfartsverket responsible for the DIANA II when she was sailing between Trelleborg and Rostock, still in 1994 when the Manager - Ake Sjöblom - signed the PSSC thereby confirming that she fully complied with SOLAS, which she did not, because her bow ramp (with the front bulkheads) was the upper extension but as such located too much forward. As she stayed within the 20-nm range in the course of her route the simple issuance of an Exemption Certificate would have put the PSSC in compliance with SOLAS, however, it was not issued. The same refers to VIKING SALLY and SILJA STAR whereas the situation as to the WASA KING and ESTONIA was quite different, as will be explained in subsequent chapters.

In this respect it is remarkable to note that the predecessor of the ESTONIA in the Stockholm-Tallinn service, the Swedish flag NORD ESTONIA, owned by Nordström & Thulin, the technical managers and part-owners of the ESTONIA, had sailed between Stockholm and Tallinn for about 2 years under the strict supervision of Sjöfartsverket without having the upper extension of the collision bulkhead above bulkhead deck at the location required by SOLAS and without having a "partial collision door" at the location required by SOLAS but with an unrestricted PSSC issued and annually renewed by Sjöfartsverket.

In the light of the explanations above it can be concluded that definitely in the years 1978/80 it corresponded to the state-of-the-art as well as to the 'rules of the art' that on car/passenger ferries operating in the Baltic Sea not more than 20 nm from the nearest land the watertight-built bow ramps were accepted as upper extension of the collision bulkhead above bulkhead deck, and compliance with the SOLAS requirements was assumed even without the issuance of an Exemption Certificate.

## 2.3.

### DIANA II THE FORERUNNER DIANA II - SUBSEQUENTLY RENAMED

#### MARE BALTICUM / MELODY



In 1979 - subsequent to the previously described series of 6 ferries - the DIANA II (Hull No. S 592) was delivered to the Viking Line partner, AB Slite, Stockholm. Not only the tonnage of 11 700 GRT but also the fitments of this vessel demonstrate the speedy development of ferry-shipping in this part of the world, which became known as the 'Baltic phenomenon'. Both DIANA II and her near-sister, the following newbuilding from Meyer Werft VIKING SALLY, were products of the 'Baltic phenomenon' and considered to be trend setters for the ever growing 'jumbo' ferries in this trading area. (See further Chapter 4.)

### 2.3.1

#### Newbuilding contract and approval procedure

As far as could be ascertained DIANA II was designed by the Stockholm consulting office Simson Ship in close co-operation with AB Slite and Meyer Werft as an enlarged version of the predecessors APPOLO and DIANA. According to the newbuilding contract (see [Enclosure 2.3.1.5](#)) - written in German - Meyer Werft was inter alia obliged to build the vessel according to SOLAS 1974. Consequently, an upper extension of the collision bulkhead above bulkhead deck = car deck at the minimum distance from the forward perpendicular as required by SOLAS 1974 - Chapter II-1, Rule 9, was imperative. Exemptions could be granted by the National Maritime Administration of the flag state - in this case the Swedish Sjöfartsverket - should the vessel operate exclusively in "sheltered waters", i.e. not more than 20 nm from the nearest land (SOLAS 1974 - Chapter II-1, Rule 1 (C)). The position of Sjöfartsverket in this respect has already been explained in this report in the preceding Chapter 2.2. It reveals that the bow ramp was accepted by the National Maritime Administration as the upper extension of the collision bulkhead above bulkhead deck.

The same refers to Bureau Veritas according to the memo concerning a discussion in the BV-Hamburg office on 23 June 1978 ([Enclosure 2.3.1.6](#)). This office is responsible for the plan approval of vessels built in Germany to B.V. classification rules. In this memo it is stated under item 1:

*»The collision bulkhead has to be extended up to the C-deck by a watertight ramp. The location of the ramp as to the forward perpendicular can be determined by means of the geometrical means in the obliquity. Agreement with B.V. and the Swedish Maritime Administration.«*

In addition, the building files reveal that the Yard subsequently endeavoured to obtain this agreement directly from the Swedish Sjöfartsverket. This was basically done verbally in discussions and/or telephone conversations, which, however, were recorded in the diary of the Meyer Werft project manager H.Wahnes.

So it is stated for example in a note dated 23 October 1978 under item 2:

»K.S.S. collision bulkhead.«

Note: K.S.S. = Royal Swedish Shipping Authority, i.e. today's Sjöfartsverket ([Enclosure 2.3.1.7](#)).

In a further memo dated 20 November 1978 it is stated inter alia :

»Participants: Mr. C.B. Myrsten, Mrs. B.M. Myrsten, Mr. Kure, Mr. Tillberg, Mr. L. Andersson, Mr. H. Sjöholm collision bulkhead = bow ramp (N.S. 23.06.78)« ([Enclosure 2.3.1.8](#)).

#### Note:

- H. Sjöholm was then the manager of the Rotterdam office of Sjöfartsverket and DIANA II was built in his area of responsibility.
- C.B. Myrsten was the owner of AB Slite and Mr. Kure was his technical adviser.

By the above quoted notes of project manager H.Wahnes it is documented that:

- a) According to an agreement with Bureau Veritas and Sjöfartsverket the collision bulkhead was to be extended above bulkhead deck to C-deck by means of a watertight ramp, the location of which was to be determined by the geometrical mean in the obliquity (freeboard-deck = car deck = A-deck).
- b.) In the presence of the owner, C.B. Myrsten, and his technical consultant Kure, it was discussed and agreed by the representative of Sjöfartsverket, Sjöholm, that the bow ramp should act as upper extension of the collision bulkhead above bulkhead deck, i.e. as such there was a deviation from the requirements of SOLAS 1974.

In hindsight the cited documentation in respect of such an important deviation from the SOLAS 1974 requirements appears to be meagre. The following, however, has to be considered:

- The Yard had already delivered 6 vessels of similar design to the same owners trading in the same service for which also DIANA II was built. Upon application of the owners to the National Maritime Administrations of the respective flag states these had issued - without problems - the 'Passenger Ship Safety Certificates', thereby confirming that the vessels complied with 'SOLAS 1974' requirements.
- In the same manner the National Maritime Administration had dealt with a large number of other car/passenger ferries in the Baltic. This was in conformity with the 'General Scandinavian Practice' described in the preceding Chapter 2.2.
- In the 'pre-computer age' it was uncommon to confirm every agreement in writing. Verbal agreements and handwritten notes or memos were accepted and honoured.

It is the considered opinion of the members of this 'Group of Experts' that on basis of the above explained notes/memos in connection with own knowledge and experience the deviation from SOLAS 1974 in regard to the location of the upper extension of the collision bulkhead above bulkhead deck was approved by the competent Swedish Maritime Administration - Sjöfartsverket - already in the planning stage of the vessel in accordance with accepted customs.

After all, this is confirmed by the fact that the 'Sjöfartsverket' upon delivery of DIANA II issued to her owners the 'Passenger Ship Safety Certificate' (PSSC) and has, ever since, renewed it annually without a trading restriction and without issuing an Exemption Certificate. The PSSC valid at the time of the ESTONIA casualty was issued on 10.06.1994 by the Malmö office of Sjöfartsverket and is attached as [Enclosure 2.3.1.9](#). The certificate was signed by chief inspector Ake Sjöblom who also inspected ESTONIA during her last afternoon in Tallinn (see Chapter 15).

The locking devices of the visor and bow ramp were calculated by the subcontractor von Tell AB, Gothenburg and - most probably - also by the Yard. Although the von Tell archive in Gothenburg - subsequently taken over by Kvaerner Shipsequipment AB - contains considerable design and calculation material concerning DIANA II, the respective calculations relating to the locking devices of the visor and bow ramp are, however, missing. - See [Enclosure 2.4.2.25](#).

At the time when these calculations were made, i.e. in 1978, the B.V. Rules still did not contain any specific requirements for the dimensioning of the locking devices for visors of Ro-Ro vessels in general and also not for car/passenger ferries in particular, and although B.V. classed Ro-Ro vessels had had a number of serious bow door incidents in previous years - see Chapter 33 - for example:

The Swedish flag STENA SAILOR, commissioned only in 1973, broke the locking devices of her bow door already on 16.01.74 and called at a port of refuge. The subsequent investigation by Sjöfartsverket revealed that sister-vessels had had similar incidents before and that the locking devices were underdimensioned for the loads to be absorbed. Since Sjöfartsverket as well as the other maritime administrations of the Nordic countries were lacking technical staff and facilities to carry out load calculations themselves, this was delegated to a number of acknowledged Classification Societies, among them B.V., who had to do these calculations anyway, respectively had to check the calculations performed by the Yard and/or its subcontractor.

Sjöfartsverket informed B.V. about the results of the STENA SAILOR incident investigation, viz. that the locking devices of this less than one year old vessel had been too weak. B.V. replied at the end of July 1974 that it was their intention to increase the requirement for the locking devices of bow doors. Since Sjöfartsverket's internal system at that time did not contain a follow-up of such promises, it was apparently left to the respective class of a vessel, in this case B.V., to determine the strengthening of the locking devices and it was not cross-checked by Sjöfartsverket whether this had really been carried out (see Investigation Report of Magnus Sjöberg - [Enclosure 6.3.116](#)).

This was the situation in 1978 when DIANA II - including the locking devices of her bow visor - was designed and subsequently approved by B.V.

## 2.4

## Contracting and Construction



The vessel was built under Hull No. S 590 by Meyer Werft as a car/ passenger ferry for the Finnish AB Sally, Mariehamn under the supervision of the Classification Society Bureau Veritas and the Finnish Board of Navigation. She was delivered to her owners in June 1980.

## Technical details in comparison to her near-sister DIANA II:

	VIKING SALLY	DIANA II
Hull No.	S 590	S 592
GRT	15 566	11 537
NRT	8 372	6 156
tdw	3 345	2 400
length (upon delivery)	155,40 m	137,0 m
breadth	24,20 m	24,20 m
draught (max.)	5,60 m	5,45 m
engine output	17 563 kW	17 609 kW
speed	21,0 kn	21,5 kn
propellers	2 pitch propellers (KAMEWA)	2 pitch propellers (KAMEWA)

In the foreship area the vessels were more or less identical. Only the bulbous bow and consequently also the bow ramp of VIKING SALLY were longer. As usual with this type of vessel and in conformity with the state-of-the-art prevalent at that time the upper part of the closed bow ramp extended into the so-called ramp house on the forecastle which was part of the visor. As the bow ramp of VIKING SALLY was longer than the bow ramp of the DIANA II the ramp house had to be built comparatively higher.

Also VIKING SALLY was built for the Viking Line service between Turku, Mariehamn and Stockholm, i.e. the longer part of the voyage was leading through the archipelago off the Finnish west coast, respectively off the Åland Islands. The longest distance across the open sea was between the exit of the Åland archipelago and the northern entrance to the Stockholm archipelago (Söderarm) viz. 28 nm, i.e. the vessels were never more than 14 nm away from the nearest land or, in SOLAS terms, the vessels were always sailing in "sheltered waters".

More details about VIKING SALLY can be taken from the article in the maritime publication 'Hansa' No. 19/1980, pages 1507-1511, attached as [Enclosure 2.4.10](#).

## 2.4.1

## Building contract and specification

The vessel was built as a lengthened sister vessel of DIANA II on the basis of a specification dated 5 September 1979 ([Enclosure 2.4.1.11](#)) with General Arrangement Drawing No. 5675/79 ([Enclosure 2.4.1.12](#)) attached thereto, both of which had been developed in close co-operation between AB Sally, Mariehamn and Meyer Werft. Specification and General Arrangement Plan No. 5675/79 were finally made part of the building contract signed on 11 September 1979 by the owners and the Yard ([Enclosure 2.4.1.13](#)).

As the Building Contract required the Yard to build the vessel in conformity with the requirements of SOLAS 1974 the initial set of drawings contained a "partial collision door" (upper extension of the collision bulkhead above bulkhead deck = car deck) at a location according to those requirements. Reference is made to part of a drawing dated 20.12.79 with the edges marked yellow at both longitudinal bulkheads where the "partial collision door" was planned to fit in at frame 150 - see [Enclosure 2.4.1.14](#). Part of the General Arrangement Plan - attached as [Enclosure 2.4.1.15](#) - shows what was actually built for the following reasons:

Already during the negotiations of the building contract agreement was reached concerning the function and location of the bow ramp. This is revealed in a telex sent on 30.08.79 by Peter Motikat of Meyer Werft to Alf Johansson of AB Sally - attached as [Enclosure 2.4.1.16](#) - where it is stated under item 6:  
»6. Bow and stern ramp arrangements according to DIANA II.«

**Note:**

Peter Motikat was negotiating the building contract on behalf of Meyer Werft, whilst Alf Johansson was negotiating on behalf of AB Sally, then owned by the Johansson family.

As it was the intention to build the foreship of both vessels identically the location of the bow ramp and its relevance as upper extension of the collision bulkhead above bulkhead deck was consequently therewith established. This is revealed also from item 3123 of the specification, where it is stated:

»Bow Ramp One watertight bow ramp with longitudinal stiffeners arranged to give a free opening of 5.5 m width and 5.0 m height. In lowered position, the bow ramp to reach minimum 1.5 m forward of bulbous bow's front. At the end of the ramp hinged flaps to be arranged. The bow ramp cannot be operated if the bow door

*is not in open position.«*

Also during the negotiations with these owners the upper extension of the collision bulkhead above bulkhead deck had been discussed. The yard management knew from the simultaneous negotiations concerning the conversion of VIKING 4 into EARL GRANVILLE ([Enclosure 2.4.1.17](#)) that the English Maritime Authorities, DOT = Department of Trade, as well as Lloyd's Register demanded the installation of the upper extension of the collision bulkhead at the location required by SOLAS 1974 before the vessel was permitted to operate under English flag. During the conversion the upper extension was installed as "partial collision door" at the location required. Consequently Mr. Motikat informed Alf Johansson accordingly offering the installation of a similar "partial collision door" on VIKING SALLY and, as a matter of fact, the installation was included in the original quotation. Alf Johansson, however, stated to have the agreement of F.B.N. to comply also in the case of VIKING SALLY again with the 'General Scandinavian Practice', i.e. bow ramp = upper extension of collision bulkhead and no separate "partial collision door" required. Mr. Motikat insisted on having this agreement entered into the building specification, where it can be found under item 3123:

»Partial Collision Door For the intended service not required by F.B.N.«

This 'Group of Experts' is therefore convinced that it had been the wish of owners, and was approved by the Classification Society as well as by the National Shipping Administration, F.B.N., already during the planning stage of the newbuilding that the bow ramp should act as upper extension of the collision bulkhead above bulkhead deck, although its location did not comply with the respective requirements of SOLAS 1974.

In this connection attention is drawn to the fact that the installation of a "partial collision door" had been included in the initial quotation with DM 45.000,-. This amount was subsequently credited to the owners as revealed by an entry in the 'More/Less' list of project manager H.Wahnes ([see Enclosure 2.4.1.18](#)).

**Note:**

In the 'More/Less' list all items differing from the quotation are listed for final discussion with the owners.

Since the position of the bow ramp of ESTONIA did not satisfy the SOLAS requirements for an upper extension of the collision bulkhead an exemption certificate should have been issued on the condition that the vessel in the course of its voyages did not proceed more than 20 nautical miles from the nearest land. This was the intention when the ferry was built and actually she sailed in "sheltered waters" with certainty for the first 101/2 years of her life. According to Germanischer Lloyd it was common practice in the early 1980's not to issue exemption certificates, but a respective remark was made in the PSSC. It was said to be only in 1985/86 that IMO required the issuance of exemption certificates in case the National Maritime Administration made use of the right given to them by Rule 1(c) respectively Regulation 1.4 preceding each SOLAS chapter, viz. to exempt owners from compulsory obligations in case the vessel did not proceed more than 20 nm from the nearest land in the course of her voyage, i.e. remained in "sheltered waters". Consequently from the point of view of the newbuilding yard, nothing more could be done.

This 'Group of Experts' has also investigated the reasons why the location of the wheelhouse on VIKING SALLY is different in comparison to DIANA II. The General Arrangement Plan No. 5675/79 dated 05.09.79, and being part of the building contract, still shows the wheelhouse in the same location as on DIANA II, i.e. above the front of the superstructures. In the specification - also being part of the building contract, however it is already stated on page 4-16 under item 4513 - Wheelhouse and Chartroom - inter alia:

»Yard investigates to arrange wheelhouse 11 m to stern.« Owners had thus already at an early stage considered having the bridge installed somewhat further aft. According to Mr. Bernard Meyer this, as well as the altered shape of the funnel, is to be attributed to the proposal of a Finnish architect who wanted to give the vessel a better silhouette with these changes. Against additional costs, Meyer Werft carried out both changes according to the wishes of the owners and with the approval of the class and the F.B.N.

Due to the new location of the bridge it was no more possible to see the forecastle deck, i.e. the bow visor from the middle of the wheelhouse, the command centre of the vessel. Therefore at both sides in way of the connection between wheelhouse and closed wings one window was installed just above the floor of the wheelhouse. Through these windows the forward part of the visor was visible. In addition, at the top of the visor a flag pole was installed with a blue light fitted on top which was shining aft only. This flag pole with the blue light also acted as a steering aid for pilot, watch officer and helmsman. This installation cannot be found in the specification of the building contract as the decision to move the location of the bridge aft was made only after signing of the contract.

**Note:**

Due to the presence of the flag pole with aft-shining blue light on top, up-and-down movements of the visor would have been very well visible from the bridge in the darkness unless the light was defect. - See page 110. Upon inspection of the visor in Hangö the flag pole was found broken from the visor, but it is still connected to the visor by means of the cable and is hanging below its initial position underneath the visor. (Visor is resting on steel blocks in upside down position.)

The change of the bridge location was approved by the Classification Society as well as by the F.B.N., as can be seen from part of the drawing 1116 "Arrangement of Top Lanterns" - [Enclosure 2.4.1.19](#) - which was approved by Sjöfartsstyrelsen (F.B.N.) on 09.01.80.

## 2.4.2 Subcontractor von Tell GmbH, Hamburg / von Tell Trading & Co. AB, Gothenburg

As with DIANA II the Yard had also subcontracted for VIKING SALLY the supply and installation of the hydraulic arrangements and locking devices of among other things the visor and bow ramp to von Tell GmbH, Sophienallee 24, Hamburg.

Von Tell GmbH, Hamburg was founded in 1963 by the main shareholder of von Tell Trading & Co. AB, Gothenburg, Mr. Dahlien, and the E. Rottmann KG, Hamburg. The company basically acted as sales office for von Tell Trading & Co. AB, Gothenburg which was then acting as design/ construction office and spare-part supplier for hydraulic installations, hatch covers and the like. Based on a respective contract von Tell GmbH, Hamburg was obliged to order everything which they were able to contract in Germany exclusively with von Tell Trading & Co. AB, Gothenburg. Accordingly the technicians of von Tell Trading & Co. AB worked out quotations, took part in technical discussions - also at Meyer Werft - and carried out all necessary calculations, furnished the respective drawings to the relevant Classification Society and Maritime Administration, obtained the required approvals, etc. Once the installation phase had commenced, it was the duty of von Tell GmbH, Hamburg among other things to make available to the Yard a qualified technician who assisted the Yard in all technical matters concerning the equipment supplied by von Tell and who, at the same time, took care that the parts supplied by von Tell were properly installed.

As to VIKING SALLY, Meyer Werft ordered under order no. 3344/79-S 590 dated 27 September 1979 among other things:

**»1 Hydraulic Installation for One Bow Visor**

*The visor has an assumed weight of 56 mts and is moved by 2 directly acting hydraulic cylinders. The cylinders have to be fitted with flexible bearings to compensate possible misalignments. The lowering speed is to be adjusted by 2 throttle non-return valves, 2 ice-breaking cylinders support the opening procedure at the beginning and are softening the closing procedure at the end.*

*Locking of the closed visor shall be hydraulically. The system has to be constructed in such a way that the locking devices remain in locked position even if the hydraulic is switched off. Contact switches have to be fitted to the locking devices which activate the lamps at the control panel and on the bridge when the locking devices are in closed position. An additional device has to be supplied for the Atlantic lock. An hydraulically operated fixing device has to be fitted which will be engaged at the end of the opening procedure. The bow ramp has to be hydraulically interlocked against the visor.*

*Your extent of supply for this installation is as follows:*

*You are further supplying the hydraulic and, as far as required, also the electrical wiring diagram for the above explained movements of the visor, including drawings showing arrangements of hydraulic cylinders and locking devices, whereby the loads to be absorbed by vessel's construction have to be stated. At non-accessible locations or at locations accessible only with difficulties, automatic oil nipples have to be fitted.*

*The above price includes the furnishing of 1 technician for structural engineering for 35 days at normal working time and travelling to the yard and back home. Further the furnishing of 1 technician free of charge for inspection and adjustment of the installation.«*

The complete order no. 3344/79 - S 590 is attached as [Enclosure 2.4.2.20](#).

Within the agreed time frame von Tell supplied the required drawings to the Bureau Veritas plan approval office in Hamburg as well as to the Yard and also supplied the ordered material to the Yard for installation.

The installations as such were supervised by two technicians on behalf of von Tell, i.e. Günther Todsen, an employee of HDW-Kiel, who was leased by von Tell whenever required, and Herbert Brand from von Tell Trading & Co. AB, Gothenburg. As the major part of the supervision was carried out by Todsen, his statement has been taken and is attached as [Enclosure 2.4.2.21](#) together with an office translation. It explains in detail the installation of the visor hinges and locking devices up to the final acceptance of the visor documented by the so-called Receipt or Transfer Certificate signed by representatives of the owners, B.V., the shipyard, and von Tell ([Enclosure 2.4.2.22](#)). Consequently the following might be concluded:

According to Purchase Order No. 3344/79-S 590 dated 27.09.79, page 3, third paragraph, von Tell had to supply among other things:

*».... also the control scheme for the above described movements of the bow visor including drawings showing positioning of the hydraulic cylinder and locking devices also quoting the loads to be absorbed by vessel's construction.«*

As far as can be reconstructed von Tell calculated the loads developing during the opening and closing of visor and also the loads on the locking devices to be absorbed by vessel's construction.

These were apparently submitted by von Tell AB, Gothenburg to and discussed with the Bureau Veritas Hamburg office (see telex von Tell AB, Gothenburg to BV-Hamburg dated 18.03.80 - [Enclosure 2.4.2.23](#)).

In addition, the Yard made its own calculations to ascertain the load requirements for the locking devices and hinges of the visor, which were subsequently submitted to von Tell and obviously approved by them (see [Enclosure 2.4.2.24](#) - 4 pages).

Since the then applicable B.V. Rules did not contain requirements for the calculation of sea-loads on visors, the Yard used the "pressure heights" stated in the so-called "Note Documentaire" issued by B.V. on 05.04.1976 for these load calculations.

The visor loads assumed in the calculations as well as the way of calculating the loads to be distributed to the fixing points of the visor were, however, in agreement with assumed loads and calculation methods applied at that time by other Classification Societies.

As far as it could be determined, the design load calculations were made by von Tell AB, Gothenburg, on the basis of the Lloyd's Register requirements, the results were submitted to BV-Hamburg (see [Enclosure 2.4.2.23](#) - telex von Tell AB, Gothenburg to BV-Hamburg dated 18.03.80) and finally approved. It has not been possible to establish with certainty whether the calculations made by the design office of the Yard were submitted also to B.V. for examination because these calculations were just carried out as a sort of internal control of what the subcontractor von Tell had calculated. This is part of the standard procedure at Meyer Werft. As there is no date on any of the 4 sheets of the Yard's calculations, it is unknown whether these calculations actually reflect the last stage.

Also a recent check of what is left in the old von Tell AB files has only revealed that the respective folders with the calculations for the visor locking devices for both DIANA II and VIKING SALLY are empty. The memo concerning this file check is attached as [Enclosure 2.4.2.25](#).

The development of the locking devices of the visor from design to production and assembly on board shall be made clear by explaining in detail the sequence of events from the design in Gothenburg to the production and assembly in Papenburg. When evaluating the comments stated below it should be borne in mind that they are based on the interviews of

- Karsten and Dieter Rottmann - von Tell GmbH, Hamburg (then von Tell AB, Gothenburg, sales office for Germany),
- Günther Todsen - von Tell representative,
- Günther Lohmann - Bureau Veritas surveyor,
- Eng. Lars Karlsson - Coordinator of owners' superintendent during new-building phase and subsequently chief engineer on board VIKING SALLY, SILJA STAR and WASA KING until 30.04.1992, i.e. for 12 years;
- Managers, foremen, fitters, and welders of the Yard responsible for: design and load calculations, shipyard drawings, distribution of von Tell and Yard drawings to the project manager, managers and foremen of different workshops and production areas of the vessel;
- Quality control and available documentation.

The result is summarised as follows:

#### A. von Tell AB, Gothenburg

- performed load calculations on basis of L.R. Rules requirements;
- submitted calculation results, i.e. load requirements to BV-Hamburg office for approval;
- obviously such approval was obtained after some discussions concerning cross-sections, number and arrangement of lugs, dimension and type of steel of bolt, etc., and von Tell AB, Gothenburg designed the locking devices accordingly;
- made drawings, large and in detail and sent them to von Tell GmbH, Hamburg;
- visited the Yard in addition to services rendered by their Hamburg office as found necessary.

#### B. von Tell GmbH, Hamburg

- submitted drawings received from Gothenburg to BV-Hamburg office for approval;
- submitted 2nd set to Yard for production;
- submitted 3rd set to von Tell representative G.Todsen for information and control;
- furnished the services of their representative G.Todsen to the Yard on basis of a separate contract, whereby Todsen rendered every assistance to the Yard in respect of building and assembly of the structural elements until final acceptance by owners, Classification Society, F.B.N.;
- regularly visited the Yard and subsequently reported to Gothenburg.

#### C. Meyer Werft

- performed own load calculations to ascertain that locking devices to be installed had sufficient strength;
- compared von Tell design requirements with own results;
- transferred the von Tell design requirements into vessel's structure, i.e. incorporated von Tell design requirements into the respective load calculations and constructions for the structural surrounding;
- submitted respective drawings to B.V. for approval and obtained such approval;
- distributed respective drawings, where necessary in detail, called 'sketches', to the project manager of the vessel to be built, to the department heads responsible for the different parts to be built respectively installed, to the fitters and foremen of the different workshops and on board.

#### D. Welding Seams

The von Tell detail drawings contain remarks about the welding seam thickness in general or in reference to particular parts to be welded. The Yard drawings do not contain such remarks as to the thickness of welding seams for the following reasons:

- 1.) Meyer Werft designers do not state the required thickness of welding seams individually on the respective drawings, but draw up a so-called "welding table" for each newbuilding. In this table the minimum thickness of welding seams for particular structural parts is stated. The table is approved by the Classification Society and available to all welders/foremen.
- 2.) In case the particular structural part to be welded does not fall under the categories listed in the welding table, the welder follows the Yard's general welding standard.
- 3.) The Yard's general welding standard requires for the welding of structural parts, accessible from both sides, a seam thickness of minimum fifty to seventy per cent of the thickness of the part to be welded. This assures that the structural part to be welded to another part is connected by welding seams with a thickness of at least 100% of its own cross-section. As to the welding seams connecting the bushings with the lugs of the Atlantic lock on the forepeak deck they were 7-8 mm thick on each side because the thickness of the lugs was 15 mm.

**E. Production**

As far as the locking devices and the hinges of the visor are concerned the line of production was:

## 1.) 1:10 shop:

Based on the original drawings, 1:10 scaled "burning sketches" were made and fed into the photo-electric scanner steering the cutting machine, which subsequently cut-out lugs for Atlantic lock, hinge plates and side locks, which thereafter were transported to the locksmith shop. Atlantic lock lugs were 15 mm and 60 mm, side locks and hinge plates 60 mm. The parts of lugs and hinge plates subsequently to be welded to the vessel's structure were oversized.

## 2.) Locksmith shop:

Holes with diameters according to drawings supplied were drilled into lugs and hinge plates, and transported to the

## 3.) Welders shop:

One bushing supplied by von Tell was welded into the centre and port lugs, and another smaller bushing was welded into the starboard lug supported by a bracket. Both bushings were welded into the lugs by means of 7-8 mm seams from both sides in accordance with Yard standard and according to the von Tell drawings whilst the lugs were lying flat. Performance was closely supervised by the von Tell representative G.Todsen, who specifically stated that he would never have accepted the 3 mm welds visible on the pictures showing the remains of the Atlantic lugs after the casualty.

After welding the parts were again transported to the locksmith shop for cleaning and grinding of the welds.

## 4.) Fitting on board:

After the visor had been properly adjusted and fitted to its hinges, the lugs of the Atlantic lock were adjusted by cutting off the oversize part as required to obtain alignment with the hydraulic cylinder and closing bolt, and, also with the big visor lug.

Welding of the lugs and the supporting plates (also 15 mm) carrying the hydraulic cylinder was performed by 7-8 mm seams at each side according to the testimony of the welder and his foreman, which is confirmed by the von Tell representative G.Todsen. For further details please see 2.4.6. below.

**F. Acceptance**

According to the attached pages 5a), 7, and 9 ([Enclosure 2.4.2.26](#)) of the time schedule concerning the final building phase of VIKING SALLY the following remarks regarding the bow visor are of relevance:

p.5a): Friday, 13.6.80	- bow visor ready for operation
p.7: Thursday, 19.6.80	- function test of among others things bow ramp and bow visor

responsible:	acceptance by	
Wecke (yard) von	FSS = Finska	building
Tell Schl. (yard)	Sjöfartsstyrelsen	supervision of owners
p.9: Wednesday, 25.6.80	- transfer of vessel to Emden and subsequent trial acceptance by	
	FSS . owners B.V. superintendent	

Checking and testing of the bow visor, its functions, and watertightness is further confirmed by the "Receipt or Transfer Certificate" dated 20.06.80,

signed by Stig Lindström	on behalf of owners
signed by G. Lohmann	on behalf of B.V. and F.B.N.
signed by M. Wendt	on behalf of Meyer Werft
signed by H. Brandt	on behalf of von Tell

[\(Enclosure 2.4.2.22\)](#)

Based on the above it has to be concluded that the welds connecting the bushings with the lugs of the Atlantic lock were made full load-carrying joints by using appropriate manufacturing techniques, and that therefore the load carrying cross-section of this locking device did satisfy the applied design and was incorporated into the actual installation.

It furthermore has to be concluded that based on the above outlined evidence the ca. 3 mm welds visible on the remains of the Atlantic lugs do not originate from the Meyer Werft production and must have been laid at some later occasion.

As stated above, the order from Meyer Werft to von Tell GmbH, Hamburg is dated 27 September 1979. As the relevant parts of the visor and bow ramp were meant to be identical to the DIANA II design, the first drawings were ready at an early stage and sent by von Tell AB, Gothenburg to von Tell GmbH, Hamburg and from there to the BV-Hamburg office for approval and to the Yard for subsequent production.

Thus the von Tell drawing 49111-330 - 'General Arrangement of Visor and Bow Ramp' - was already approved by B.V. on 5 November 1979, however, with the following remarks in red handwriting:

*"Arrangement of locking devices subject to the approval of the National Authorities."*

(The other remarks will be dealt with in the following chapter.)

Due to this remark von Tell AB wrote to the Finnish Sjöfartsstyrelsen (F.B.N.) on the 14 December 1979 informing them about the newbuilding and requesting details of the drawings to be submitted for approval. ([Enclosure 2.4.2.27](#))

F.B.N. replied that they assumed that B.V. would examine the drawings of, among other things, the visor and bow ramp and that only in case the Classification Society should be in doubt about the interpretation of the SOLAS Convention details by F.B.N. should drawings be sent to their office. In such case the problem should be clearly defined.

It is not exactly known what von Tell AB did as a result of these comments from F.B.N. In any event, according to the F.B.N. there was no more correspondence in this respect in their files.

It has, however, to be assumed that von Tell AB spoke thereafter to B.V. Hamburg, who apparently were prepared to do the approval of the locking devices as well as of the surrounding ship construction. This is confirmed by the exchange of communication between von Tell AB / von Tell GmbH / BV-Hamburg as stated below:

**(1) Telex von Tell AB / BV-Hamburg dated 18.03.80:**

»attn. mr. desouza// we refer to phone conversation with mr desouza. in lack of B.V. rules we have used the LR rules and got total horizontal force abt 230 tonnes  
total vertical force abt 470 tonnes  
we have calculated with the two side cleatings and the atlantic securing device and will then have a load of abt 80 tonne for each device. // calculated shear stress will be 800 kp/cm<sup>2</sup> and bending stress 2400 kp/cm<sup>2</sup>. // we think we are slightly above the stress permitted by LR and we could change the present steel with min breaking strength of 50 kp/mm<sup>2</sup> to a material with a breaking strength of 90 kp/mm<sup>2</sup>. please advise++ regards // von tell // a eriksson«

**Note:** For clarification purposes attention has to be drawn to the following:

1 kp/cm<sup>2</sup> = 0,1 N/mm<sup>2</sup>  
1 kp/mm<sup>2</sup> = 10 N/mm<sup>2</sup>

**(2) von Tell AB/ von Tell GmbH on 24.03.80:**

»According to Desouza the yard is using 20 mm instead of 60 mm lugs as required by us. Have spoken to Desouza who will come back with his final wishes tomorrow.«

**(3) von Tell GmbH / von Tell AB on 28.03.80:**

»Have visited the yard on 26.03.80. BV requires strengthening of locking devices of bow visor. The yard is not convinced that the class requirement has to be complied with. It has to be borne in mind that upon strengthening the bolts to ST 90 the then necessary strengthening of lugs cannot be carried out. Your statement that the yard is using 20 mm instead of 60 mm lugs is not understandable. The yards states to use 60 mm lugs. In case the bolts should be changed to ST 90 the yard is afraid that the lugs will have to be changed to 120 mm and more, which in regard to the connection to the vessel is anyway not possible. In case the class should insist on the strengthening the yard is of the opinion that von Tell should bear the extra costs. It would thus in any event be useful to change the class's opinion.«

**(4) von Tell AB/ von Tell GmbH on 08.04.80:**

»Have spoken to Desouza. Our locking bolts are sufficient as well as our other parts. He has requested drawings of the surrounding from the yard and is as yet unable to state whether alterations shall be necessary.«

**(5) von Tell GmbH/ von Tell AB on 10.04.80:**

»Desouza is requesting drawings 372/2 and 373/2. Ok?«

Gothenburg gave green light and he got the drawings.

**Note:** Both drawings are detail drawings showing enlarged details of the master drawings 49111-372 resp. 373, for production purposes, i.e. 372/2 shows the bushing of the hydraulic side locks in detail (see [Enclosure 2.4.2.28](#)) and 373/2 the bushing of the Atlantic lock to be fitted between the port and centre lugs ([Enclosure 2.4.2.29](#)). Thereby it turns out that 373/2 is obviously the same as 372/2, i.e. the bushings of the Atlantic lock and the side locks have the same dimensions and are of the same steel quality.

**(6) von Tell GmbH / von Tell AB on 11.04.80:**

»Have visited the yard and spoken to Desouza. BV is not prepared to follow the tightened up requirements of Germanischer Lloyd. Lloyd's Register is said to have taken over the tightened up requirements of GL without own research, whilst BV is of the opinion that the GL calculations contain elements which have to be considered in a different way.«

Apparently Desouza was satisfied after the final checks and submission of the requested additional drawing because von Tell AB completed the drawings 372 and 373 and did send them to BV-Hamburg for approval by letter of 20.04.1980, whilst the drawings were sent back - with remarks - only by letter of 02.07.1980 - See [Enclosure 2.4.2.30](#) and Subchapter 2.4.3 - where these remarks are being discussed.

## G. Manuals

Finally it should be mentioned that von Tell provided the vessel with a Manual containing :

OPERATION INSTRUCTIONS  
SPARE PARTS  
SPECIFICATION HYDRAULIC CYLINDERS

for, among other things, the bow visor and the bow ramp, which is attached as [Enclosure 2.4.2.31](#).

Attention is drawn to the extracts from the Manual stated below which are of relevance to the investigation and refer to the visor/bow ramp.

**> BOW VISOR :**

• CONSTRUCTION:

»The visor has a weight of abt 54.5 tons and forms the (watertight) W.T. front closure of the ship. The bow visor is pivoted at the upper deck. It opens in upward direction.«

• MAINTENANCE :

»Under circumstances when temperature reaches 0°C or below check that the limit switches and other equipment on weather deck are not getting covered with ice.«

**Conclusion:**

According to the manual the inside of the visor was to be kept watertight, i.e. in the same condition it had been delivered by the yard. The same refers to the remark that the limit switches should not be covered by ice (limit switches = sensors of Atlantic lock).

• RUBBER PACKINGS :

»The rubber packings should be treated with Tellin or similar mixture containing graphite and tallow in order to reduce the wear of the rubber. When a defect rubber packing is going to be replaced the packing channel has to be sufficiently cleaned before the new packing is fitted with glue. von Tell UK 2 glue or glue of the same quality has to be used. In closed position the rubber packing is compressed by the sole weight of the bow visor. The rubber packing is fixed with bolts.«

**Conclusion:**

According to the manual rubber packings should be maintained in good condition, i.e. treated with Tellin or grease to reduce wear and, if nevertheless damaged, the packing elements should be replaced to ensure watertightness, in particular in winter.

• LOCKING DEVICE :

»In closed position the visor is locked by two locking pins which are operated by one hydraulic cylinder each. As a reserve the visor can also be locked by two manually operated locking devices. There is also one hydraulic operated "atlantic locking device".

In open position the bow visor is locked by 2 locking pins which are hydraulic operated with one hydraulic cylinder each.«

**Conclusion:**

Attention is drawn to the 2 manually operated locking devices - called "reserve" - which might be used in addition to the hydraulically operated locking pins and the Atlantic lock.

**Note:**

Representatives of von Tell, Hamburg have explained that "reserve" has to be understood as "additional", i.e. these manual securities should be used in heavy weather as "additional" locks.

### 2.4.3 Classification and newbuilding supervision by Bureau Veritas - The Class Certificates

Based on the "Request for Classification" dated 27 September 1979 ([Enclosure 2.4.3.32](#)) - 2 pages - Meyer Werft requested Bureau Veritas to proceed with the operations required by their Rules for the purpose of obtaining the classification under Special Survey, i.e. construction drawings were to be checked against the rules and the building of the vessel was to be supervised, same as one year before the DIANA II.

On page 2 of this particular form among other things it is stated:

*»Certificates to be issued by the Society on behalf of the National Authorities.  
Load-Line  
Statutory Safety Construction, Safety Equipment, Safety Radio  
Tonnage National, Suez Canal, Panama Canal«*

each possibility having a 'YES/NO' box attached.

On the above-mentioned form filled in by Meyer Werft the 'NO' box referring to the load-line is marked, whilst in all other cases the 'YES' boxes are marked.

According to the interpretation of the B.V. head office this means that the Yard has requested B.V. just to issue the Load Line Certificate and to specifically exclude any Statutory Certificates. Actually Meyer Werft had filed a further application dated 21 April 1980 with Bureau Veritas, viz. "Application for an International Freeboard Certificate or for an International Load Line Exemption Certificate within the Scope of the International Convention on Load Lines 1966" which would mean that the Yard applied for the same services a second time ([Enclosure 2.4.3.33](#)). The Load Line Certificate was in fact issued by B.V.

In 1979/1980 the "1977 Rules of B.V." were in force. According to §§ 11-44, indentations 2 and 3 of those rules the following applied to bow visors:

*»2 - Bow and stern doors  
21 - When the ship is equipped with a bow door, to allow access to garage, the collision bulkhead must have a removable part. This design is acceptable only above bulkhead deck and only if the removable part has a watertightness and a strength equivalent to those of fixed rule bulkhead.  
A movable access ramp may be used for this purpose.  
22 - Scantlings of plating and stiffeners of a bow door are to be equivalent to those of adjacent shell structure.«*

(See [Enclosure 2.4.3.34](#))

This means that the bow ramp, located above bulkhead deck = car deck, served as the upper extension of the collision bulkhead no matter what the distance to the forward perpendicular was, provided the bow ramp was watertight and had a strength equivalent to those of fixed collision bulkheads.

These conditions were fulfilled by the bow ramp of VIKING SALLY, thus the construction complied with the B.V. Rules in force at the time the vessel was built. Only one year later, in 1981, the SOLAS 1974 Rules were incorporated into the B.V. Rules which had no more effect on VIKING SALLY because she had already been delivered in June 1980.

*»3 - Securing of doors  
31 - Doors and screen-doors have to be firmly secured by use of cleats conveniently spaced or other similar devices. Particularly it has to be provided one of these devices at each corner of opening. Structure reinforcements have to be realised on door and adjacent shell plating to attached points of cleats, hinges, jacks, etc.«*

(See [Enclosure 2.4.3.34](#))

The BV-Hamburg office, in charge of plan approval, received already soon after the signing of the contract a continuous flow of drawings from the Yard and von Tell. According to the B.V. head office all drawings received with approval date and status are listed in the attached [Enclosure 2.4.3.35](#), whilst according to another list sent by B.V. head office by letter of 10 January 1995 to the JAIC - [Enclosure 2.4.3.36](#) - further drawings referring to bow visor/bow ramp area, which are not noted in the first list, are noted and have been approved by BV-Hamburg, i.e. drawings 1103-Bow Visor, 1106-Locking Devices of Bow Visor and 1101-Foreship Frame 149-forward.

In their letter to the JAIC dated 10.01.95 B.V. explains the approval procedure including the above-mentioned drawings as follows:

*»The bow door drawings of the MV ESTONIA were reviewed by the Hamburg local office of Bureau Veritas which was in charge of the review. List of reviewed drawings is given as annex 4.«*

([Enclosure 2.4.3.37](#))

*»The drawings were checked against the Bureau Veritas 1977 rules which did not contain formula for the rule strength of securing devices of shell doors opening outwards. Information was received from the bow door designer, Messrs. von Tell, which stated in their telex dated 18 March 1980 to the local Bureau Veritas office in Hamburg that they had designed according to the Lloyd's Register rules.«*

What actually happened during the approval phase of the relevant drawings concerning the bow visor and the locking devices is already explained in Subchapter 2.4.2, but is also demonstrated by the approval dates of those drawings, i.e.

Drawing No.	Subject	Date of approval	Whereabouts of vessel
1103	- Bow visor	20.06.80	yard trials
1106	- Interlock of bow visor	20.06.80	yard trials
49111-373	- Atlantic Lock	02.07.80	vessel already in Finland
49111-372	- Automatic and manual locking devices of bow visor	02.07.80	vessel already in Finland

Actually the senior B.V. surveyor G.Lohmann, entrusted with the newbuilding supervision of DIANA II / VIKING SALLY and also with their predeces-sors, had accepted the bow visor in its entirety already on 20.06.80 by his signature on the Receipt/Transfer Certificate ([Enclosure 2.4.2.22](#)).

In their letter to the JAIC dated 10.01.95 ([Enclosure 2.4.3.37](#)) B.V. also draws the attention to the remarks made in red on drawings 1103 and 49111-330, i.e.

on drawing 1103 - Bow Visor - : Remarks on the drawing  
*»1. Arrangements of locking devices subject to the approval of the national Authorities.  
2. Watertightness of the ramp and local reinforcements of the ship's structures in way of locking devices, cylinders and hinges to Surveyor's satisfaction.  
3. Jack lifting eye on arms, atlantic lock eye, side lock eyes, requested in steel grade St52-3.  
4. Local reinforcements requested and indicated under the side locks active in y-direction (transverse).«*

As stated above, this drawing was approved only on 20.06.80 - the day the vessel went out for trials - thus shortly before her delivery - and returned to the Yard subsequently, and it is indeed the question of what use such remarks are if they are made on drawings which are returned to the Yard only after the vessel has already left.

This is slightly different with the von Tell drawing 49111-330 - General Arrangement of Bow Visor and Bow Ramp - which was approved already on 05.11.79 and subsequently returned to von Tell with the following remarks in red:

- »1. Arrangement of locking devices and protection against shifting cargoes subject to the approval of the National Authorities.
- 2. Watertightness of the ramp and bow visor to Surveyor's satisfaction.
- 3. Local reinforcement of the ship's structure in way of - locking devices - cylinders - hinges to Surveyor's satisfaction.
- 4. High pressure flexible pipes must be approved by B.V.«

B.V.'s explanation for these remarks in their letter of 10.01.95:

*»By the remark concerning the National Authorities it was made clear that locking devices were considered as an item subject to the examination and approval of the Finnish Authorities issuing the Passenger Ship Safety Certificate of the vessel.«*

In order to obtain clarification how this was actually to be interpreted the official opinion of B.V. was requested via their Stockholm lawyer - Bengt-Åke Johnson - who has commented as follows:

*»With regard to the wording in German on the drawing 590/1103 to which you refer in your fax of 20 February 1995, I have learned that Bureau Veritas inserted the wording just to clarify that the approval of Bureau Veritas did only concern the parts of the construction that were covered by the rules of Bureau Veritas then applicable in 1979 and that Bureau Veritas made the remark on the drawings in order to remove doubts and to direct the attention of the shipyard and the Finnish authorities to the fact that the locking devices were to be considered and approved by the Finnish authorities. Accordingly, Bureau Veritas approved the drawings to the extent the arrangements were generally complying with the Bureau Veritas rules, but wanted to draw the attention of the shipyard and the Finnish authorities to the fact, that Bureau Veritas could not approve something, i.e. the locking devices, which were not specifically covered by Bureau Veritas' rules of 1979.«*

It is quite obvious by the remark quoted above in their letter to the JAIC of 10.01.95, as well as by the comments of Bengt-Åke Johnson, that B.V. wants to create the impression that the final approval of the locking devices is the responsibility of the National Maritime Administration, i.e. the F.B.N., because they issue the Passenger Ship Safety Certificate.

As a result of this investigation it has to be concluded that this is wrong because

- (a) Rule 3 of the 1977 B.V. Rules requires, among others, that "Doors ... have to be firmly secured by use of cleats conventionally spaced or other similar devices." It reveals from the B.V. letter to the JAIC dated 10.01.95 - Enclosure 2.4.3.37 - that cleats = cleating = locking devices consequently the locking devices of the bow door = visor were part of the B.V. approval;
- (b) B.V. had anyway to carry out the approval even if it would have been the responsibility of the F.B.N., because it was a "structural matter" which B.V. had to carry out on behalf of F.B.N. due to the respective contract between the organisations. - See also Subchapter 2.4.4.

The above is confirmed by the acting of B.V. surveyor Lohmann as well as by the statement of the principal surveyor of the B.V. Stockholm office, Lars-Olof Ålander, according to which he felt responsible for the locking devices and sensors. - See Enclosure 9.1.134.

Furthermore the B.V. head office was asked to explain by what means, for example, could a plan approver make sure that a "door", i.e. bow visor, would be "firmly secured by use of cleats", i.e. locking devices, dimensioned as per drawing which he is asked to approve? The answer was that B.V. relied on the design office (von Tell AB) and the Yard, respectively their calculations, but made no own calculations.

This means that the relevant drawings were approved on basis of the von Tell AB calculations carried out according to the Lloyd's Register requirements, the result of which was submitted to BV-Hamburg by telex of 18.03.80 (Enclosure 2.4.2.23). The Yard carried out own calculations with about the same result. Consequently both the Yard and its subcontractor individually performed calculations, whilst B.V. and F.B.N. did not.

The B.V. head office was further asked by what means did the B.V. surveyor on site make sure that the Yard/von Tell installed locking devices according to the approved drawings. The answer: »By random inspections.«

Upon request of the B.V. head office after the ESTONIA catastrophe the senior B.V. surveyor G.Lohmann wrote down the remarks made in his notebook during the newbuilding phase in relation to the bow visor (with English translation made by himself indicating what he would like to have noted) - see Enclosure 2.4.3.38

Actually the only notes he made in respect of the bow visor were:

#### 28.03.80 -

"Bugklappenanschluß an Hinterkante" by G.Lo., i.e. "Connection of bow visor to aft part" but was translated by Lohmann with:  
*"Inspection of hull construction according to the remarks made on drawings of Messrs. Tell during approval."* The only von Tell drawing he could have had by then was 49111-330 - "General Arrangement of Bow Visor and Bow Ramp" which shows details of the bow ramp hinges only. Actually it has to be assumed that the remark in the notebook: "Connection of bow visor to aft part" refers to connecting the visor to the vessel, i.e. fitting the hinges together which was done at about that time.

#### 23.04.80 -

"Allgemeine Besichtigung Freibord" by J.D. = J.Drazenowic (the assistant to G.Lohmann), i.e. "General Freeboard Survey" which was translated by G.Lohmann with:  
*"Checking of closing arrangements for the Freeboard Report Form Mod. 195."*  
 This Freeboard Survey was apparently carried out as a result of the "Application for an International Freeboard Certificate" (Enclosure 2.4.3.33) dated 21.04.1980. The respective Report on Form 195 is attached as Enclosure 2.4.3.39.

#### 11.06.80 -

"Kontrolle der Seitenhäuser vorn und achtern sowie des achteren Mittelhauses auf dem Hauptdeck - Geringe Restarbeiten"  
 i.e. "Control of side houses forward and aft as well as the aft centre casing on main deck - minor remaining work", which is translated as:  
*"Checkings in way of car deck forward including bow ramp and bow visor - resting and connection."*  
 Actually the side houses forward and aft at both sides are the B-deck spaces between A-deck and C-deck which contain stairways, chain lockers, but also the void spaces from which the manual side locks can be operated and where the hydraulic side locks are located.

#### 26.06.80 -

"Fortsetzung des Programms vom 25. Juni 1980 in See, u.a. Kontrolle des Bugvisiers", i.e.  
 "At sea, continuing the program from 25 June 1980, among other things, bow visor", which is translated as:  
*"During trials at sea under normal running conditions the space between bow visor and bow ramp has been inspected for tightness."*

In this respect reference is also made to the statement of G.Todsen - Enclosure 2.4.2.21 - where this check is explained in detail.

The extracts from G.Lohmann's notebook closes with the Note:

*»For inspections, tests, and trials yard protocols are made from the yard and signed by the parties concerned.«*

Both surveyors - G.Lohmann and J.Drazenowic - were then the Oldenburg Field office of B.V..

As the signed statement of G.Lohmann made to this 'Group of Experts' has not been returned by B.V. and thus cannot be made an enclosure to this report, his career and involvement in Meyer Werft newbuildings including VIKING SALLY shall be outlined as follows:

Günther Lohmann was born in 1929 and started his professional career in 1944 as shipbuilding apprentice with HDW-Hamburg and stayed with this yard until 1956.

On 01.05.1956 he started as consulting engineer with engineer H. Rössler VD at Oldenburg and carried out newbuilding inspection and superintendent work for various owners, also non-exclusive surveyor work for B.V. (expert adjoint N.E.) until end of December 1976. From 01.01.1977 he was senior surveyor and exclusive surveyor for B.V. in charge, i.e. responsible, for the Oldenburg office. His district extended from Cuxhaven to Bodenwerder and to the Dutch border, i.e. the Meyer Werft in Papenburg belonged to his area.

He remained in this position until the end of March 1994, whereafter he retired, however, was recommissioned shortly afterwards as a field surveyor.

In his capacity as senior surveyor of the BV-Oldenburg office he supervised to a varying extent the newbuildings APOLLO, DIANA, VIKING 1, 3, 4 & 5, DIANA II, and VIKING SALLY on behalf of Bureau Veritas. Over the years he developed a very good relationship to the responsible people of the Meyer Werft. This included for example the work force who used to consult him whenever they had technical questions to make matters acceptable to class. He also had close contact with representatives of the National Authorities as well as owners' representatives who, as far as VIKING SALLY is concerned, were members of the Johansson family, Captain Brunström, and chief engineer Lars Karlsson.

His main duties were to make sure that the vessels were built according to the approved drawings in relation to the rules and in accordance with sound workmanship.

In line with these activities he had also carefully inspected the construction of the bow visor of VIKING SALLY, its installation, fitting of hinges, and welding of bushings. Furthermore, he did attend the watertightness test before and during trials. He recalls having been in the inner side of the visor during trials out in the North Sea together with the von Tell representative, somebody from the owners and also from the Yard, when it was discovered at full speed that some water was leaking through the rubber packings. Consequently local adjustments of the rubber packings were considered necessary and were made after the return to Emden, whereafter a hose-test confirmed watertightness of the visor.

He has been shown various pictures of the visor hinges with severe burning marks as found after the casualty and confirmed that what is visible on the pictures would never have been accepted by him, because it does not conform to the standard workmanship of the Meyer Werft, and further, is not in agreement with what he had seen. This also relates to the visor lug. The vessel would never have left the Yard in this condition.

He drew attention to the fact that at the same time when VIKING SALLY was under construction the yard was also building tanks for gas tankers which he also inspected on behalf of B.V., in particular the welding seams, where the requirements are very strict. Frequently the same welders were working on VIKING SALLY as well as on the gas tanks. Therefore, he was known to have the tendency to overstress his requirements as to the quality of welding seams in general. He was sometimes criticised for applying the same standard when checking the quality of the welding seams for gas tanks and normal vessels such as VIKING SALLY.

As to the Atlantic lock he stated the same as he did above in respect of the hinges: The welding seams visible on the pictures shown to him would never have been accepted by him, because they do not conform to the standard workmanship of Meyer Werft which he did survey.

In summary, senior surveyor G.Lohmann and his assistant J.Drazenovic did carry out the newbuilding supervision, apparently as required and as necessary in good co-operation with yard workers, F.B.N. inspectors, and subcontractors, e.g. G.Todsen and H.Brandt representing von Tell AG. Reportedly they made sure by random checking that the vessel was built in accordance with the approved drawings, the requirements of the rules and the standard workmanship of Meyer Werft.

The Yard, as well as von Tell, were sending 4 copies of each drawing to be approved to BV-Hamburg of which

- 1 was returned with approval
- 1 was sent to head office Paris
- 1 was sent to Oldenburg office
- 1 was kept in Hamburg office

As the B.V. surveyors were at the yard practically every day where they had their own office they also received drawings directly from the yard before these drawings were received from BV-Hamburg with the approval stamp.

Due to the fact that during the first weeks after contract signing it was generally assumed that the entire foreship area would be more or less identical to DIANA II lots of drawings were just copied and marked 590. This refers also to drawing 1106 - Interlock of Bow Visor - which shows the visor hinge construction on both sides of visor and vessel including the hinge plates. Also this drawing was taken over from DIANA II, consequently showed the hinge plate construction as installed on board this vessel, i.e. with 4 hinge plates each side on the vessel, each being 30 mm thick, i.e. in total 120 mm, with fixed bolts. (See attached photo showing DIANA II - [Enclosure 2.4.3.40](#)) The drawing 1106 showing the above explained DIANA II construction was sent to BV-Hamburg for approval by letter of 07.11.79. Due to owners' wishes and with the consent of the B.V. surveyor, this hinge plate design was changed in December 1979 from 4 to 2 hinge plates of 60 mm thickness each, and the fixed bolts were changed to the floating-bolts system. In consequence the total thickness of 120 mm (initially 4 x 30 mm, subsequently 2 x 60 mm) remained unchanged ([Enclosure 2.4.3.41](#)). Drawing 1106 and the respective detail drawings for production were changed on 02.01.80 as per [Enclosure 2.4.3.42](#).

The revised drawing 1106 was sent by letter of 09.01.80 ([Enclosure 2.4.3.43](#)) to von Tell GmbH for approval and the same day to BV-Hamburg for approval ([Enclosure 2.4.3.44](#)). Moreover the drawing was also handed over to Lohmann at the yard. The drawing was returned by von Tell already by letter of 15.01.80 without comments, i.e. approved.

B.V. returned the approved drawing 1106 only on 30.06.80 (approval date 20.06.80), but the approved drawing was the one sent on 07.11.79 for approval with the DIANA II version of hinge plates.

It has to be assumed that upon return of the approved drawing 1106 - at a time when the vessel had been fully accepted by the class, was delivered to owners and had left for the Baltic already - the yard just looked for the approval and put the drawing into the archive not noting that it was the wrong one which had been approved.

What happened inside the B.V. organisation is unknown to this 'Group of Experts', however, it is a fact that the B.V. surveyors at the yard were provided with a continuous stream of new drawings simultaneously with the drawings being sent to BV-Hamburg or elsewhere. Therefore, this 'Group of Experts' concludes that senior surveyor G.Lohmann must have had drawing 1106 in the VIKING SALLY version, latest when he inspected the "connection of the visor to the vessel" on 28.03.80 according to his notebook ([Enclosure 2.4.3.38](#)) because there can be no doubt that a senior surveyor with the experience of G.Lohmann would have noted at once that there were just 2 instead of 4 hinge plates at each of the hinges unless he was aware of the changes and had the corrected drawing at hand.

Further reference is made to the letter of B.V. of 10.01.95 to the JAIC ([Enclosure 2.4.3.37](#)) where on page 4

- The appraisal for the selection of material
- Survey during construction
- Survey of bow visor welds
- Issuance of Statutory Certificates,

i.e. issued by B.V. and F.B.N. is commented. In this connection a "Summary of B.V. inspections during the newbuilding phase" is attached as [Enclosure 2.4.3.44.1](#).

On page 5, B.V. discusses the Monitoring of Bow Locking and states:

*»Also in 1991-1992 the bow door and bow ramp control and monitoring devices were checked by the Finnish Authorities against the new IMO requirements.«*

This is denied by the Finnish Authorities, i.e. the F.B.N., because in their opinion the locking devices of the visors are not their responsibility, but have to be looked after by the Classification Society (which was confirmed by the retired principal surveyor of the BV-Stockholm office - Lars Olof Ålander - see [Enclosure 2.4.3.44.2](#)). This will be discussed in more detail in Subchapter 2.4.4. B.V. further discusses in their letter of 10.01.95 the "Bow door clearing and monitoring arrangements" and remarks with regard to the manual side locks:

*»2 manually operated fasteners for heavy weather with limit switches on bolts (open and closed position).«*

Since it was confirmed by ESTONIA's 2nd engineer Peeter Tüür in his statement dated 03.10.94 - [Enclosure 12.5.183](#) - and also by the system engineer Henrik Sillaste and the motorman Tanel Moosaar during their interview on 10.03.95 - [Enclosure 21.2.4.278](#) - that it was the boatswain's duty to close these manual side locks whenever heavy weather was forecasted, it has to be assumed that this was common knowledge to both crews of ESTONIA.

The statement of B.V., that these manually operated fasteners were connected to limit switches, however, does not refer to the newbuilding condition when such switches were not installed. It has to be assumed that B.V. either mixed up the limit switch for the indication "visor closed", which is installed in way of the port manual securing device or the limit switches were installed subsequently, which is unlikely. Also the following statement of B.V. is partly wrong:

»The overall cleating was surveyable from a mimic panel (red and green lamps for each cleating group) both at the local control station and on the navigating bridge; video monitoring of the car deck included a view of the ramp closure.«

The overall cleating, i.e. locking devices, was surveyable only from a mimic panel with red and green lamps for each cleating group located in the control station (control panel) on car deck behind the bow ramp but not on the navi-gating bridge. The panel on the bridge just showed one red/ one green each for visor and bow ramp, i.e. the green lamp went on only when the visor was closed and secured, i.e. all respective limit switches had contact. The same refers to the bow ramp, i.e. the ramp had to be pulled tight against the rubber packings, and all 4 securing bolts had to fully engage the mating pockets and contact the sensors; only then would the green lamp indicate the bow ramp being closed and secured.

#### Note:

According to the wiring diagram for the locking devices the sensors of the Atlantic lock were not connected to the bridge panel which thus initially showed "green" when the visor was closed and just the side locks were closed. According to Captain Haakan Karlsson this had been rectified in 1990/91 when the ferry was taken over by Silja Line.

The remaining part of the B.V. letter refers to the time as ESTONIA and shall be discussed in the respective chapter.

After completion of the newbuilding and successful trial runs B.V. issued the class certificates and the vessel was assigned the class notations

**I 3/3 E**  
**XPassenger Ferry**  
**Deep Sea**  
**ICE CLASS I A**  
**X(AUT).**

The class certificates for WASA KING ex SILJA STAR ex VIKING SALLY valid from July 1990 to July 1995 is attached as Enclosure 2.4.3.45.

Upon issuance of the said certificate with the above class notation the then valid Rules of Bureau Veritas of 1980 did apply to VIKING SALLY. The Rules relevant for this investigation shall hereinafter be cited and, if required, be commented.

#### 1 - 11 Principle of Classification

**11 - Ships whose construction fully satisfies the requirements of the present Rules, or who are deemed to fulfil the requisite conditions of strength and safety, are registered with classification symbols, marks and notations.**

**12 - The classification symbols express the degree of confidence that the ship deserves.**

**13 - The marks and notations give some indication on the type of survey of construction, the type of service and navigation for which the ship has been classed, and the special arrangements or installations on board that add to the safety of the ship or cargo in specific conditions of operation.**

**14 - Classification symbols, marks and notations are assigned or confirmed after study of the survey reports drawn up by the Society's Surveyors and after consulting the Classification Committee.**

#### 1 - 14 Rules and regulations

**11 - The regulations set forth in these Rules cover ships used and loaded in a normal manner and having a qualified crew.**

#### 1 - 21 Classification symbols

**11 - Classification symbols comprise the division number, rating fraction and equipment symbol. They are grouped together on certificates and in the Register before any other mark or notation.**

Consequently the class symbol I 3/3 E etc. means the following:

**I = "division number"**

For division I ships Chapter 3 and following of the present Rules set forth the conditions for the construction and scantlings of the hull and the essential equipment relating to propulsion and safety. In the event that same construction or scantling requirements are not met but is deemed possible to enter the ship in the Register, she is classed with division II.

**3/3 = The rating fraction expresses the degree of confidence the ship deserves. Fraction 3/3 is assigned to ships in good condition (fraction 5/6 is assigned to ships in a less satisfactory condition).**

**E = The equipment symbol. It indicates that the ship's anchors and chain cables meet the applicable requirements of the present Rules.**

**X= This remark is assigned to ships built under the special survey of the Society in compliance with the requirements of the present Rules or any others deemed equivalent.**

#### passenger ferry

**= 41 - The service notations of passenger ships are as follows:**

**- passenger ships (navire à passagers) for ships intended to carry passengers in the meaning of the 1960 International Convention for the Safety of Life at Sea (SOLAS 1960), Chapter I, rule 2, paragraphs (e) and (f), when they meet the requirements of the present Rules.**

**- passenger ferry (transbordeur) for passenger ships, corresponding to the definition of the preceding paragraph, specially equipped to carry complete trains or vehicles with their loads shipped by rolling, when they meet the requirements of the present Rules and, in particular, those of section 11-4.**

**Note:** Section 11-4 deals with General - Hull structure - Car decks - Access.

#### deep sea

**= This navigation notation is assigned to self-propelled or non-propelled ships and units which are capable of deep sea navigation, in any area and at any period of the year.**

#### Ice Class IA

**= Ship strengthened for navigation in severe ice conditions in accordance with the Finnish-Swedish Ice Class Rules 1971 and subsequent amendments.**

This means, in summary, as to VIKING SALLY:

- The vessel met all conditions for the construction and scantlings of the hull and the essential components relating to propulsion and safety.
- The vessel was in good condition and deserved the highest degree of confidence.
- The ship's anchors and chain cables met the applicable requirements of the present Rules.
- The ship was built under the special survey of the Society in compliance with the requirements of the Rules in force.
- The ship was capable of deep sea navigation in any area and at any period of the year, i.e. the vessel might trade worldwide around the year.
- The ship was strengthened for navigation in severe ice conditions.

As to bow doors Rule 11-4 requires the following:

21 - When the ship is equipped with a bow door, to allow access to garage, the collision bulkhead must have a removable part. This design is acceptable only above bulkhead deck and only if the removable part has a watertightness and a strength equivalent to those of fixed rule bulkhead. A movable access ramp may be used for this purpose.

22 - Scantlings of plating and stiffeners of a bow door are to be equivalent to those of adjacent shell structure.

This means that VIKING SALLY fully complied with the B.V. Rules for car/ passenger ferries and could - from the class point of view - have been traded worldwide all year round.

#### 2.4.4

### Approval procedure by the Finnish Board of Navigation - Sjöfartsstyrelsen - and newbuilding supervision - The Passenger Ship Safety Certificate

The vessel was built for the operation under Finnish flag and consequently had to comply with the regulations of the National Maritime Administration, then the Finnish Board of Navigation respectively Sjöfartsstyrelsen. Approval of all safety relevant installations on board a vessel, in particular if required by SOLAS, as well as the issuance of the respective certificates, in particular the Passenger Ship Safety Certificate, fell under the responsibility of this authority. SOLAS requires that the necessary surveys and inspections of ships to enforce the provisions of the present Regulations shall be carried out by the authorities of the country in which the ship is or will be registered. It is possible, however, that these duties may be delegated to surveyors or organisations recognised by the respective government which, nevertheless, remains responsible for the performance.

In the light of this possibility to delegate and the development of the National Maritime Administrations of the Nordic countries after the war, i.e. also of the Finnish Board of Navigation (F.B.N.), it became an established practice that the respective Classification Society of a newbuilding designated for Finnish owners - in addition to their original duties as Classification Society - also carried out all structure related calculations and surveys and subsequently issued the respective certificates on behalf of the National Administration or supplied the data on the basis of which the Administration then issued the certificates. Such practice was, as such, followed by most Maritime Administrations in co-operation with the recognised classification societies. The co-operation is sometimes performed on basis of specific contracts, e.g. Estonian National Maritime Board/Bureau Veritas or just by a letter of confirmation from the National Administration to the Classification Society either in general or in relation to a particular vessel. With regard to the F.B.N., contracts do exist with the respective Classification Society regarding this co-operation, but these contracts are confidential.

In the opinion of F.B.N. they were not responsible in 1979/80 and are still not responsible today for the calculation of load requirements of locking devices nor for the SOLAS-conform location of upper extensions of collision bulkheads above bulkhead deck. It is their understanding that this is the responsibility of the Classification Society because both examples are related to the structure of the vessel - which as such is true. Further, according to the F.B.N. it had been agreed already decades ago between the Governments of the North European countries that the recognised classification societies should look after all structure related matters on behalf of the Maritime Administrations as otherwise the Administrations would be forced to build up similar organisations with respective staff, computers, etc., which the classification societies have anyway, and both would have to be paid by the owners. This principal decision was laid down in the Copenhagen Convention 1924 and is - according to the F.B.N. - still applicable. Therefore, they relied on Bureau Veritas in 1979/80 to carry out the necessary considerations and calculations, also in respect of SOLAS requirements, in particular with regard to the locking devices (which is denied by Bureau Veritas). As proof that their interpretation is correct, F.B.N. refers to the MARIELLA casualty which occurred in 1985 in their waters, but they were neither informed by owners nor by the Classification Society DnV, nor by the hull underwriters. The VIKING SAGA casualty in 1984 never came to their knowledge until we told them, although also this was a Finnish ferry in Finnish waters.

F.B.N. is convinced that their attitude is correct and that they basically just take care of lifeboat, fire-fighting, and navigational equipment, and leave the rest to the Classification Society. They have indicated that they have written and still write "Letters of Authorisation" to the Classification Societies whom they trust, e.g. to B.V. The last "Letter of Authorisation" is said to have been written to B.V. in 1982. Irrespective of the above, F.B.N. is aware of the fact that the ultimate responsibility for SOLAS matters, including failure of their servants, i.e. also class employees, rests with them. It should in this context however be observed, that also in the Copenhagen Convention it is explicitly stated, that the ultimate responsibility for the supervision of ships' safety matters always remains with the respective National administration.

In 1979/80 newbuilding supervision fell under the responsibility of the Technical Department of F.B.N., which then consisted of

G. Edelman	- naval architect	- stability and approval matters
P. Haatainen	- engineer	- fire-fighting appliances
J. Jansson	- captain	- lifesaving appliances

Once a new ferry was due for delivery to her owners they issued the Passenger Ship Safety Certificate (PSSC) as soon as they had received a copy of the class certificate. By issuing the PSSC they practically confirmed that the ferry complied with SOLAS requirements, although they had not convinced themselves that this was the case also in respect of structural matters, but relied on the Classification Society to have done it in line with the respective duties delegated to them.

This was the situation when VIKING SALLY was built in 1979/80.

The building contract was signed on 11 September 1979 and already two days later owners advised the yard by telex of 13 September 1979 (Enclosure 2.4.4.46) that the two F.B.N. inspectors Haatainen and Jansson would visit the yard on 27 September 1979 to discuss details concerning the newbuilding.

This is confirmed by notes of project manager H.Wahnes made in his logbook No. 3 ([Enclosure 2.4.4.47](#)), where the following (office translation) is stated about this meeting under the date of 27 September 1979:

- »J. Jansson (F.B.N.)
- P. Haatainen (F.B.N.)
- H. Gustavsson (owners' technical superintendent)
- Capt. Brunström (owners' nautical superintendent)
- H. Wahnes (Meyer Werft)
- 1) Equipment for liferafts, Regulation page 82, paragraph 35, and SOLAS.
- 2) J.Jansson advises soonest whether IMO recommendations to fulfil SOLAS 1974 have to be complied with (Chapter III).
- 3) Safety Ø steel in way of the skates?
- 4) Are there regulations for the thickness of glass in way of the forecastle? Will be informed.
- 5) Hydrostatic release - 1 for 3 liferafts? Will be informed.
- 6) Necessary area to embark lifeboats? Will be informed.
- 7) Which items will have to be approved by F.B.N. during the building phase? We will be advised.
- 8) Which drawings will have to be submitted for approval? List shall be sent.
- 9) C-deck forward:

150 Persons below  
208 Persons C-deck  
358 Persons o.k.

10) The aft exits have to be sufficient for

2628 persons in total  
1840 aft  
free stairways aft, 2 are sufficient.«

It is quite obvious that the subjects of the discussion were exclusively F.B.N. requirements according to F.B.N.'s interpretation of SOLAS (SOLAS - Chapter 3 = Lifesaving Appliances, etc.).

In addition to the information passed by F.B.N. to the Yard by telephone, also the Information Bulletin No. 10/78 dated 23.10.78 containing the "Application for Approval for Individual Vessels", was sent with reference to item 8 of the meeting held on 27.09.1979.

This document deals in detail with all drawings and other information to be submitted by owners and/or the Yard and/or the Classification Society to F.B.N. Paragraph 10. LOAD LINE CERTIFICATES reads:

*»The Load Line Certificates are issued by the Board of Navigation on receipt of a provisional certificate from the Classification Society together with the calculations on which the data of the certificates are based.«*

The document furthermore indicates that - at least during those years - the F.B.N. apparently only dealt with the following subjects:

Accommodation of crew  
Bridge Magnetic compasses  
Navigating lights  
Lifesaving equipment  
Fire protection  
Stability  
Carriage of grain  
LOAD LINE CERTIFICATES  
TONNAGE CERTIFICATES

A complete copy is attached as [Enclosure 2.4.4.48](#).

Locking devices are not mentioned at all and upper extensions of collision bulkheads above bulkhead decks are structural matters and therefore - according to the F.B.N. - to be dealt with by the Classification Society. During the building phase of VIKING SALLY all three employees of the Technical Department of F.B.N. - Gunnar Edelmann, Pertti Haatainen and Jan Jansson - were frequently at the Yard. The time schedule for approval inspections by owners and/or B.V. or F.B.N. (then called F.S.S. = Finska Sjöfartsstyrelsen) from 28.05.-25.06.1980 the day the vessel left the Yard, is attached as [Enclosure 2.4.2.26](#) and demonstrates what had to be approved by F.B.N. Thereby it has to be noted that some of the approval inspections which, according to SOLAS should have been performed by an F.B.N. inspector were carried out by B.V. surveyor Lohmann, who therefore had a double function. When visor and bow ramp were function tested on 19.06.1980, for example, he acted as Load Line surveyor on behalf of F.B.N. and as class surveyor for B.V. contrary to SOLAS but in line with standard/practice at the time.

After some additional work and a further test it was confirmed that the visor was watertight (weathertight) and in this condition handed over to owners ([Enclosure 2.4.2.22](#) - Receipt/Transfer Certificate signed by owners, surveyor Lohmann, von Tell and the Yard).

F.B.N. had also approved the drawings below, e.g.

- Fire Protection Plan 1	( <a href="#">Enclosure 2.4.4.50</a> )
- Evacuation Plan 1	( <a href="#">Enclosure 2.4.4.51</a> )
- Signal Lights	( <a href="#">Enclosure 2.4.4.52</a> )
- Arrangement of top lanterns	( <a href="#">Enclosure 2.4.1.19</a> )

which is confirmed by the respective approval stamps, dates, and signatures thereon.

It was also at about that time that the new location of the bridge and new shape of the funnel were accepted by the authorities.

On 21.06.80 Gunnar Edelmann attended the inclining experiment at Papenburg and approved the "Trim and Stability Booklet" on the 11.07.80 (the booklet is attached as [Enclosure 2.4.4.53](#)).

The F.B.N. attitude concerning the approval of structural SOLAS matters is also underlined by the letter of F.B.N. to von Tell AB, Gothenburg dated 27.12.79 in reply to their letter of 14.12.79 inquiring which drawings should be submitted for approval. The letters with translations are attached as [Enclosure 2.4.2.27](#) and have already been discussed in Subchapter 2.4.2 - Subcontractor von Tell GmbH, Hamburg / von Tell Trading & Co. AG, Gothenburg.

In principle F.B.N. confirmed again:

*»Regarding the bow and stern ramps, the side doors, and the visor we assume that the drawings are examined by Bureau Veritas. Only in case the class is uncertain about how any detail in the Load Line and SOLAS conventions is interpreted by the Finnish Administration should drawings be sent to this office. In such case the problem should be clearly defined in order to facilitate dealing with it. The Board is lacking resources for routine examination of all the drawings required in a modern newbuilding.«*

Since B.V. was not "uncertain about the interpretation of Load Line and SOLAS details by F.B.N.", but just wanted the approval of F.B.N. on the respective drawings, which F.B.N. was unable to give because their respective duty had been delegated to B.V. and they themselves had no means of carrying out these calculations, nothing more was done in this respect.

In a personal discussion the responsible director of F.B.N., H. Valkonen, stated - after having been presented with the above-mentioned correspondence between von Tell AB/F.B.N. - that the reply of F.B.N. demonstrated exactly the attitude during those years. He confirmed that at that time there were 3 men in the technical department, who were basically busy with their own (F.B.N.) vessels. Valkonen was then head of the inspection department.

#### F.B.N. 1980

Technical Bureau	Inspection Bureau
Edelmann	Valkonen
Haatainen	Jan Jansson
Wibeck	

They never calculated the required strength of locking devices, they had no means to do so at that time, it was part of the responsibility of the Classification Society and also of the Yard.

In addition, it had to be assumed that due to the fact that the same procedure had been performed one year before with the, in this respect, identical DIANA II by the Swedish Sjöfartsverket, this may also have contributed in convincing F.B.N. that no activity of their own was required.

As far as the Yard is concerned it has to be assumed that von Tell had sent a copy to the Yard of the approved drawing 49111-330 - General Arrangement of bow visor and ramp - with the respective remarks:

- »1. Arrangement of locking devices and protection against shifting cargoes subject to the approval of the National Authorities.
- 2. Watertightness of the ramp and bow visor to Surveyor's satisfaction.
- 3. Local reinforcement of the ship's structure in way of
  - locking devices
  - cylinders
  - hinges to Surveyor's satisfaction.
- 4. High pressure flexible pipes must be approved by B.V.«

As the remark just referred to the "Arrangement", i.e. number and placing, and not to the "Dimensioning" of the locking devices and as further it was the intention to use an identical installation to that installed a year before on the near-sister vessel DIANA II, which had been approved by B.V. and Sjöfartsverket, there was no reason for the Yard to do anything, in particular, there was no reason to talk to F.B.N.

As to the upper extension of the collision bulkhead there is apparently no correspondence between the Yard and F.B.N. This issue had been clarified beforehand between the owners and F.B.N., and it was confirmed by Director Valkonen that the bow ramp was considered to be the upper extension of the collision bulkhead above bulkhead deck, although located too much forward. This was allegedly permissible according to SOLAS since the intended trade would allow the vessel to stay within 20 nm off the nearest land and under such conditions it was within the discretion of the Maritime Administration to exempt the owners from otherwise mandatory obligations. This however required the issuance of an exemption certificate by F.B.N., which apparently was not done and reportedly also not customary in those years (see page 84).

#### In summary:

It was agreed between the Yard and owners that »bow and stern ramps' arrangement same as on DIANA II« (see Enclosure 2.4.1.16), and further it was specifically stated in the specification, being part of the building contract, that

»No partial collision door required for the intended trade by F.B.N.«

As the location of the bow ramp, being the upper extension of the collision bulkhead, was in line with the B.V. Rules and F.B.N. - having received all relevant drawings - did not raise objections either - there was thus no reason for the Yard to have doubts that this construction would not be in line with the SOLAS requirements for the intended trade.

After delivery, F.B.N. issued a temporary Passenger Ship Safety Certificate (PSSC) - Enclosures 2.4.4.55 (Finnish/Swedish) and Enclosure 2.4.4.56 (English) - for the voyage from Papenburg to Mariehamn without passengers, which was valid until 20 July 1980.

When the vessel came to Turku for the first time, the responsible F.B.N. Director H.Valkonen and the F.B.N. surveyor from Kotka, Gunnar Peippo, marked on a respective drawing all parts of the vessel not to be used by passengers and limited the number of passengers to 700. They further stated that the 20 nm limit was valid until the vessel was fully completed. At a subsequent meeting on 19.07.80 it was decided that the vessel was now completed and the first permanent PSSC was issued - Enclosure 2.4.4.57 (Finnish/Swedish) and Enclosure 2.4.4.58 (English) - however, restricted to "Kustfart mellan Finland och Sverige", i.e. "coastal trade between Finland and Sweden".

The PSSC was issued in two different versions, i.e.

- (a) in Finnish/Swedish language which was considered to be the original.
  - (b) in English language for foreigners.
- The English wording is to be considered as a translation only.

By the PSSC the F.B.N. confirmed the following:

- the vessel could be employed for "short international voyages" as defined in SOLAS 1974, Chapter 3 - Lifesaving Appliances, etc. Regulation 2 - Definition:

»Short international voyage signifies an international voyage in the course of which a ship is not more than 200 miles from a port or place where the passengers and crew could be placed in safety, and which does not exceed 600 miles in length between the last port of call in the country where the voyage begins and the final port of destination.«

- the vessel complied with »the requirements of the Regulations annexed to the said Convention as regards: 1. the structure ..«.

- the vessel may carry 2000 passengers »i kustfart mellan Finland och Sverige« which means translated: "in coastal trade between Finland and Sweden." Actually the respective (wrong) wording in the English certificates is: »For a short international voyage between Finland and Sweden«. This later led to considerable confusion because in particular the media only received the English version and interpreted the term "short international voyage" in this context as a reference to the SOLAS regulation cited above, which is wrong. Whilst "short international voyage" refers to SOLAS Chapter 3 "Lifesaving Appliances, etc.", the term "Kustfart" is a trading limit defined by the F.B.N. in their letter of 27 June 1995 - Enclosure 2.4.4.59 - as "not south of Latitude 59°30'N", which again is wrong. The term "Kustfart" appears only in the Finnish "Statute on Officers on Merchant Vessels 522/1964".

This statute governs the number of and the competence of officers onboard merchant vessels. Under section 2 the types of vessels are defined as well as the trading areas for purposes of this statute. E.g. by the coastal trade "kustfart" is, according to section 2, item 8 understood "trade outside the inner trading area on the Gulf of Finland as far as 23 degrees long, and on the Gulf of Bothnia and in the Baltic up to lat. 59 degrees 30 and trading within the Swedish Archipelago up to Söderköping". This statute comprises a number of general and specific rules (chapters 1 and 5), and also detailed rules on the certificates of engine and deck officers (chapters 2 and 3). Under chapter 4, the number of and the competence of deck officers is governed. E.g., under section 24 it is in very detail established what the number and competence of the deck officers onboard a vessel in coastal trade (kustfart) is. However, the statute does not refer to the vessel itself. The narrow scope of application of the statute is also described under section 40, which stipulates what pieces of legislation are cancelled by means of this new statute. Not a single statute referring to the construction, seaworthiness, equipment etc. of vessels is mentioned under that section. Consequently it has to be concluded that the definition "kustfart", "coastal trade" as mentioned in the PSSC is actually based on section 2, item 8 of the "statute on ship's officers 522/1964" and that the explanation given by F.B.N. in its letter signed by Mr. Jukka Häkämies (enclosure 2.4.4.59) clearly refers to this same section, comprising the definition of "kustfart" "as not south of latitude N 59 deg. 30 min". A similar definition is not to be found in any other pieces of legislation pertaining to vessels or navigation, there is not even a reference to coastal trade in such legislation. This definition is not based on a possible exemption as per Chapter II, Regulation 1 c) of the at the time with regard to Finnish vessels applicable SOLAS 1960 Convention.

It is another matter that the F.B.N. later in the above letter, is alleging that the background of "kustfart mellan Sverige och Finland" would somehow be the exemption rule of the SOLAS convention.

When looking upon the application of a definition comprised in various statutes, a general principle is that a certain definition is only applicable on matters regulated by a law comprising that specific definition.

Accordingly, the statute itself restricts the application of the definitions of that particular statute solely to the scope of application of the statute itself, that is on matters relating to number and competence of a vessel's officers. Therefore, the restricted trading area "kustfart", "coastal trade" has only been issued and it can only be used in matters relating to the number and competence of the officers onboard that is in connection with matters regulated by the statute of 1964.

The trading area "coastal trade between Sweden and Finland" (i kustfart mellan Sverige och Finland) has not been issued due to the construction of or particulars affecting the construction of the vessel but solely due to the composition of the crew, that is the restricted number of officers onboard. It only means that when the vessel is trading in coastal trade between Sweden and Finland - which it did - it has to be manned as per section 24 of the statute on ship's officers.

Thus, the restriction "coastal trade" does not relate to the construction of the vessel, however, if it is assumed that this particular restriction was intended to refer to the construction of the vessel, i.e. that the F.B.N. when issuing the certificate would have found that the vessel was only safe in coastal trade between Sweden and Finland, the conclusion would then be that the FBN should have made a respective remark in the PSSC which doubtless would have led to re-inspecting the vessel in case the trading area would be changed.

As stated in Subchapter 2.2 and as it has been confirmed by the SOLAS experts of Germanischer Lloyd it was common practice in those years for the National Maritime Authorities not to issue "Exemption Certificates", but that a respective handwritten remark by the inspector in the vessel's file was sufficient. In addition, however, this remark, that the trading area was restricted to "sheltered waters - 20 nm", should have been made in the PSSC as well, which could have been the case by the entry "i kustfart mellan Finland och Sverige".

It may thus be concluded that the F.B.N. issued the PSSC - after receipt of copies of the class certificates - in accordance with common practice in those years, i.e. it confirmed by the PSSC that the vessel complied with the SOLAS requirements, however, restricted the trade to "Kustfart mellan Sverige och Finland" = "coastal trade between Finland and Sweden". This should have ended, however, when the issuance of "exemption certificates" became mandatory in 1985/86 and copies had to be sent to IMO. At the latest then the F.B.N. should have issued an "Exemption Certificate" in respect of the wrong location of the bow ramp as upper extension of the collision bulkhead above bulkhead deck (carddeck)

and should have sent a copy to IMO in London as also required by SOLAS. This was not done. Even when the trading area was changed to the middle of the Gulf of Bothnia and the vessel's name was changed to WASA KING, the F.B.N. continued to issue the same PSSC's even though the vessel had left the "sheltered waters" on the leg Sundsvall-Vasa when she was regularly more than 20 nm from the nearest land, thus the granting of exemptions was no more permissible according to SOLAS and the F.B.N. should have required the installation of a "partial collision door" or similar in way of the proper location required by SOLAS for the "the upper extension of the collision bulkhead above bulkhead deck". Also this was not done and the vessel kept sailing in the same condition as delivered by her builders in 1980 and with the same worded PSSC as first issued in 1980. This was the situation when the vessel was sold in January 1993.

## 2.4.5 Newbuilding supervision by owners

Owners were represented during the building phase of VIKING SALLY by a total of 10 persons, although not simultaneously. These were

Alf Johansson	- managing director
Sven Erik Johansson	- managing director
Yngve Röblom	- technical superintendent
Nils Brunström	- nautical superintendent
later replaced by	
Lars Mäkki	- the subsequent master of the vessel
Bertil Hansson	- administration manager
Lars Karlsson	- chief engineer
Stig Strömberg	- 1st engineer
Stig Lindström	- chief officer
Lars Sjögren	- electrician

In addition, there were 2 architects frequently at the Yard:

Pekka Perjo	- internal architect
Heikki Sorvali	- external architect

Chief engineer Lars Karlsson arrived already at Papenburg three days after the contract was signed together with Captain Brunström (who was replaced five weeks later by Lars Mäkki, the subsequent master of VIKING SALLY), 1st engineer Stig Strömberg, and electrician Lars Sjögren. He had been in Papenburg already as owners' representative during the building of VIKING 3, 4 & 5, thus knew the Yard as well as the people including the B.V. inspectors (all vessels were classed by B.V.), spoke some German and was therefore nominated as "coordinator" of owners' superintendents. He stayed until the delivery and subsequently became chief engineer on VIKING SALLY. Apart from the usual leave periods he remained in that position until 30.03.92.

The following is an abstract of his statement concerning the building phase:

*«Three days after signing of the contract I came to Papenburg together with Capt. Brunström (was relieved after 5 weeks by Lars Mäkki), 1st engineer Stig Strömberg, and electrician Lars Sjögren. At the beginning I had only 1 small GA plan, deck and engine specifications were shown to me. Due to pressure of time we had to make a lot of compromises. In my opinion and experience the Meyer Werft was the only yard in Europe able to do such a job because of so little bureaucracy. This has, in my opinion, nothing to do with the catastrophe. Meyer Werft has very much experience. They have built all ships very strong, i.e. they were usually heavy. It is a well known fact that Meyer ships were stronger and behaved better in ice compared to e.g. Wärtsilä ships. With my team of supervisors I checked everything including, and in particular, weldings in close co-operation with B.V. surveyor Lohmann and his colleague. As far as I remember Lohmann was more active on VIKING 1-5, whilst on VIKING SALLY he was the boss and the other one did the routine work. Anyway Lohmann was always present when major items, such as ramp and visor, were presented by the yard and tested. My best contacts were Mr. Motikat and Mr. Wahnes. F.B.N representatives came from time to time, however, all paperwork was done by the Sally office in Mariehamn directly with F.B.N. Helsinki. I did some inspections with F.B.N. representatives in Papenburg, e.g.*

- stairways, lifts;
- boats, liferafts, etc.
- fire doors, fire-fighting equipment, etc.

*Chief officer Lindström came about 3 months before delivery. I also inspected visor/ramp etc. I checked the visor during building together with the 1st engineer. It was very hectic during the last days before launching because there were delays in delivery of equipment from Sweden due to a strike in this country. After launching the visor was lifted ashore again. It was before only welded to the vessel by steel-bars. At present I do not remember details of the bearing/bushing system of visor hinges.*

*The bow ramp was considered to be the collision bulkhead same as on all the predecessors built by Meyer Werft, but also the same as on e.g. TURELLA, ROSELLA, VIKING SONG, VIKING SAGA, and many other ferries.*

*On car deck there were 4 cameras installed, i.e. 1 forward to the forward ramp, 2 at the sides and 1 looking aft to the stern ramp. The cameras could be moved and had also zoom ability. Monitors were on the bridge (located at port side of the entrance to the chart room) and in the engine control room (ECR) above the instrument panel. The camera picture shown on the monitor could be changed to another camera either manually or automatically. The monitors on bridge and in ECR were showing the same picture. The main monitor with operating sticks was in the ECR, i.e. the bridge could not change to another camera.»*

The complete statement of Lars Karlsson can be found in [Enclosure 2.4.5.60](#).

The vessel was finally taken over by owners on the 29 June 1980 at 23.30 hours at Emden according to the Delivery Certificate attached as [Enclosure 2.4.5.61](#) and the "Handing Over Report" attached as [Enclosure 2.4.5.62](#).

## 2.4.6 The construction phase

In this subchapter only the construction respectively installation of those components shall be described which have actually played a role in the sequence of events having led to the sinking of the ESTONIA respectively which are considered to be of relevance by the JAIC. These are:

**(a) Bow visor:**

- hinges
- lifting cylinders
- locking devices
- rubber packings

**(b) Bow ramp:**

- locking devices
- hinges

The respective yard drawings are:

- 1101a: Foreship frame 149 forward to A-deck
- 1103 : Bow visor
- 1104 : A-deck to C-deck frames 138 - 160
- 1106 : Interlock of bow visor
- 1107 : Roofs for bow visor hinges
- 1108 : Bolts for bow visor hinges
- 1109 : Bushings for bow visor hinges
- 1109a: Bushings for bow visor hinges

**von Tell drawings:**

1. 49111-301a : Bow ramp
2. 49111-302 : Details for bow ramp
3. 49111-303 : Details for bow ramp
4. 49111-305 : Outer hinges of bow ramp
5. 49111-330 : Bow visor/ bow ramp general arrangement
6. 49111-360 : Arrangement of hydraulic locking devices of bow ramp
7. 49111-361 : Locking devices for bow ramp
8. 49111-371 : Locking devices for bow visor
9. 49111-372 : Arrangement of hydraulic and manual locking devices of visor
10. 49111-373 : Atlantic Lock
11. 49111-387 : Layout of pipes and hoses for actuators of visor and bow ramp
12. 49111-391 : Location of actuators for visor
13. 49111-801 : Hydraulic scheme for drive-on ramps, hanging decks, visor, bow ramp, stern ramps
14. 49111-804 : Pump station with connection scheme, stern aggregate
15. 49111-805 : Pump station w. connection scheme, forward aggregate
16. 49111-825 : Control panel for visor and bow ramp
17. 49111-871 : Location of sensors and limit switches

In addition to these "working drawings" there were numerous detail drawings which were required for production and control. The reference numbers can be found in the box at the upper right side of each drawing. Some of these detail drawings can also be found in the "Drawing file" behind the respective master drawing. In the "Drawing file", which is part of this documentation, all the above listed drawings as well as the General Arrangement Plan are compiled.

In detail:

(a) - The Bow Visor was built in the fabrication hall according to drawings of Messrs. von Tell AB, Gothenburg in the same way as already one year before the visor for DIANA II had been built. It was moved out of the hall into the open on 15.01.80 and remained there until it was fitted to the vessel between 01.03. and 15.3.80.

During the time the visor was in the open air storage the hinge plates to be fitted to the visor arms and at the forecastle deck were fabricated and the following line of production developed:

- 1:10 shop:

Based on the original drawings, 1:10 scaled "burning sketches" were made and fed into the photo electric scanner steering the cutting machine, which subsequently cut out lugs for Atlantic lock, hinge plates and side locks, which thereafter were transported to the locksmith shop. Atlantic lock lugs were 15 mm respectively 60 mm in diameter, side locks and hinge plates were 60 mm thick. All parts subsequently to be welded to vessel's structure were oversized in length. The colour of the basic primer was yellow as can be seen from the photos attached as [Enclosure 2.4.6.63](#).

- Locksmith shop:

Holes with diameters according to drawings supplied were drilled into lugs and hinge plates whereafter the parts were transported to the visor. - Welding of hinge plates: The hinge plates were welded to the visor. During the welding procedure its proper alignment was assured by the use of a pipe prepared specifically for this purpose having the exact diameter of the hinge plate bores. One photo shows the visor in open air with hinge plates already fitted ([Enclosure 2.4.6.64](#)).

- Transport of visor alongside vessel.

- Positioning of visor on the vessel, connection established by welding several steel bars between visor/vessel's hull as can be seen on the photo attached as [Enclosure 2.4.6.65](#). Please note the basic yellow primer.

- Hinge system made fit for functioning by cutting the hinge plates for vessel's side to the required length, welding hinge plates to forecastle deck after proper alignment had been ascertained by the use of the above-mentioned pipe tool. Welding of steel bushings into the bores of the visor's hinge plates always assuring proper alignment by means of the pipe tool, finally shrinking the bronze bushings into the steel bushings, fitting in the Nirosta bolts and fixing the securing plates. The visor hinge system is explained by the drawing attached as [Enclosure 2.4.6.66](#).

The von Tell representative G.Todsen had supervised and controlled the Yard's work with parts delivered by von Tell and with parts fabricated by the Yard according to von Tell drawings. He also assisted whenever required. This refers in particular to the installation of safety relevant parts, such as the hinges, the locking devices, the lifting cylinders, and rubber packings. In detail the activities of G.Todsen have been explained in his statement attached as [Enclosure 2.4.2.21](#).

The installation of the visor hinges have been carried out - according to Todsen - as follows:

»Installation of Hinges The bore holes for the bushings were made by means of a boring mill in the fabrication hall. I personally took a close look at the bore holes and touched them with my fingers before the bushings were installed and can confirm that by no means were they burned holes. I would never have accepted such dubbed work as can be seen on the photographs shown to me of the remnants of ESTONIA's hinge plate. In case the yard would not have taken notice of my objections, I would have left the ship and would have informed my principals accordingly.

Under my supervision on board the steel bushings were welded into the visor's arms and subsequently bored out to the extent that the bronze bushings did fit.

These bores were carried out with extreme precision in order that port side and starboard side were in alignment in order to avoid breaking tension when opening resp. closing of the visor. Subsequently the bolts were guided in whilst simultaneously the distance rings (2 mm thickness) were fitted. I recall this work especially because it was rather fumby work. The bolts were made of Nirosta steel and had a grease groove with grease nipple. By means of these grease nipples the hinges had to be greased at least once a week with grease gun.«

(b) The Lifting Cylinders (actuators) were also supplied by von Tell and installed under the supervision and upon instructions of G.Todsen. Thereby the same care was applied as had been done with the installation of the hinges.

(c) The Atlantic Lock was also of von Tell design and mainly also supply. The Yard fabricated only the 3 steel lugs at vessel's side plus the visor lug and carried out the installation under the supervision of the von Tell representative G.Todsen. The von Tell supply can be taken in detail from drawing 49111-373 - Atlantic Lock - to be found in the "Drawing file". The yard performed as follows:

The lugs of the Atlantic lock were cut out according to the respective burning sketches in the 1:10 shop. The thickness of the 3 lugs to be welded to the forepeak deck were 15 mm each and the visor lug was 60 mm. The parts subsequently to be welded to vessel's structure were oversized. Thereafter the lugs were transported to the locksmith shop, where the holes were drilled into the lugs according to the relevant drawings and were subsequently transported to the welders shop. Here one support bushing was welded into the starboard lug, whilst the centre and port lugs were connected by another bushing, called "bolt housing" by the JAIC, which was welded into the holes of both lugs.

Both bushings were welded into the lugs by means of 7-8 mm seams from both sides in accordance with yard standard and according to the von Tell drawings whilst the lugs

were lying flat. Performance was closely supervised by the von Tell representative G.Todsen, who specifically stated that he never would have accepted the 3 mm welds visible on the pictures showing the remains of the Atlantic lugs. In this connection G.Todsen explains (see his Statement - [Enclosure 2.4.2.21](#)):

»The three lugs, welded to the A-deck, as well as the lug at the aft part of the visor's bottom are yard-supply. The 3 first mentioned lugs had been constructed with overmeasure. It can be seen from the respective drawing that both bushings, the bolt, the cylinder including piston rod, and the limit switches (sensors) had been delivered by von Tell. The lug of the visor was welded and used as fixing point for the alignment of the other three lugs of the Atlantic lock. At the workshop both bushings had been welded into the lugs in such a way that the large bushing fitted between the middle and the port lug and the small bushing into the starboard lug with the support bracket. As already mentioned above, I have had detail drawings for all components from which among others also the thickness of the welding seams were revealed.

The installation of the Atlantic lock was carried out as follows when the visor was closed:

- The fixing point was the lug of the visor,

- accordingly hydraulic cylinder and the 3 lugs with already previously welded bushings were aligned, burned to fit and welded.

Thereby I paid special attention to the even welding of the 3 lugs to the A-deck, i.e. inner and outer side the same. Furthermore, I took care that below each lug, in the void space under A-deck, a reinforcement was fitted.«

(d) The Side Locks were of similar design and construction as the Atlantic Lock, with all components supplied by von Tell and the Yard only fabricating the steel parts and performing the installation under the supervision of von Tell. This was carried out as follows:

The visor was closed and the required length of the lugs measured, the lugs cut respectively. Location of lugs was marked at both bulkheads, the visor partly opened, and the lugs welded on to the bulkheads. Thereafter the cleats of the manual locks were also welded to the bulkheads. Flat bars welded at the inner side of the bulkheads according to class surveyor's requirements and under supervision and control of the von Tell representative G.Todsen.

(e) The Rubber Packings were installed on the forepeak deck to assure watertightness of the visor and a firm and tight connection between visor and vessel once the locking devices were closed. By this tight connection high frequency vibration of the visor with respective effects on its fixing points were avoided. In this connection G.Todsen explains:

»Prior to installing the 50 mm thick rubber gaskets every 300 - 400 mm the distance between the opposite parts visor/ship were measured by means of an inside calliper and the deviations ascertained were compensated by flat iron. This way guaranteed that the rubber gaskets installed afterwards had absolutely the same contact pressure, as the visor was pressed into the rubber gaskets up to 8-10 mm, which made the inside of the visor watertight (watertight).

During the trial trip to Helgoland, among other things also the visor was checked in respect of its tightness. The visor was totally locked, i.e. also the manual locking devices were closed.

During full speed - i.e. about 2.5 m high bow wave and slightly pitching vessel - myself, Mr. Lohmann, surveyor of Bureau Veritas, and a representative of the owners, whose name I do not remember, were inside the visor and noted that the visor was not totally watertight, but at some places water was slightly leaking through. After returning to Emden the rubber packings were marked with chalk, the visor was closed and opened again. Due to the remaining imprints the leakages were found out and the rubber packings were raised in these particular areas. During a subsequent tightness test the visor was found to be tight and finally accepted by the owners, the Classification Society and the Finnish Board of Navigation.

The official delivery took place already on 20 June 1980 - after successful function test on 19 June 1980. Afterwards the attached Delivery Certificate was filled in and signed by representatives of the owners, the B.V., the shipyard and my colleague Brandt.«

B.V. surveyor Lohmann also remembers that during trials some minor leakage was noted. He also remembers that after return to Emden the respective rubber packings were adjusted and a subsequent test revealed the visor to be watertight i.e. watertight in SOLAS terminology.

(f) The Bow Ramp was also installed under the control and supervision and with the assistance of G.Todsen. His comments are:

»The bow ramp as well had been installed and arranged under my supervision. The securing bolts were made to fit. During locking of the ramp at first each one hook on each side of the corresponding parts of the ramp lowered and pulled the ramp inwards, up until a special point had been reached and passed. Now the ramp was tight in position. Then two bolts on each side moved out of the ship into the corresponding pockets of the ramp.

The bolts snapped audibly into their end positions. As from the control console on the car deck neither visor nor ramp locking devices could be seen, the operator had to rely on the control lamps and his sense of hearing. It was clearly audible by the snapping noises when the bolts engaged the pockets. Only after the bolts had fully engaged did the sensors become activated, which - if all bolts and also the hooks were in contact with the sensors - led to the "green light" at the control console as well as on the bridge, i.e. the ramp was closed and locked.«

The complete statement of Günther Todsen is attached as [Enclosure 2.4.2.21](#).

The picture below shows the foreship during the construction phase.



## 2.5 General Description and Data

This section contains a general description and data of the vessel. Details of the various areas are dealt with separately.

### 2.5.1 General arrangement

The VIKING SALLY was built as a development from previous Ro-Ro ferry designs. She was built with a continuous vehicle-carrying space on the main deck (A-deck). Below the main deck an economy accommodation area was arranged on deck number 1 (tweendeck) and an extensive sauna and pool area on deck 0 (tank deck). The main passenger accommodation areas were on decks 4 (C-deck), 5 (D-deck) and 6 (E-deck). The crew accommodation was generally on decks 7 (F-deck) and 8 (G-deck) and the navigation bridge was on deck 9 (H-deck).

The ship was built with one bow loading ramp on the car deck, enclosed by a hinged bow visor that opened upwards, and two stern loading ramps. Passenger entrance doors were arranged on decks 4 and 5 and pilot and bunkering doors on the car deck.

The ship had the following main particulars according to building specification and certificates:

* Length, over all	155.40 m
* Length between perpendiculars	137.40 m
* Breadth, moulded	24.20 m
* Depth to bulkhead deck, moulded	7.65 m
* Maximum draft	5.60 m
* Deadweight at max. draft	3 345 dwt
* Light weight	9 733 t
* Gross tonnage	15 566
* Propulsion power	4 x 4 400 kW
* Electrical power	4 x 1 104 kW
* Bow thrusters	800 + 590 kW
* Maximum number of passengers	2 000
* Maximum service speed	21 knots
* IMO number	7921033

### 2.5.2 The hull and deck arrangement

The hull was built to Bureau Veritas rules and to the Load Line and SOLAS Conventions regarding watertight subdivision. It was designed with a slender forebody extending into a bulbous bow and a "pram type" afterbody with two propellers and two rudders. Two bow thrusters were installed. The afterbody was modified during drydocking in 1985 by a "duck tail" extension giving increased buoyancy in the afterbody and a better hydrodynamic flow condition, preventing the stern from setting down at high speed. This was a problem in the original configuration unless forward located ballast tanks were filled.

The forebody had an extensive "flare", especially below the knuckle line at the car deck level. Such flares were increasingly applied at the time to provide full width of the car deck and accommodation area as far forward as possible.

An active roll-stabilising system with fins was installed in January 1994. Provisions for such installation had been made already at the newbuilding stage.

The hull below the bulkhead deck was subdivided by fifteen watertight transverse bulkheads, equipped with watertight doors as required.

The double-bottom spaces were arranged for fuel oils and other liquids and some were designated as empty tanks. Fuel oil tanks were also placed above the inner bottom.

Deck 0, the tank deck, contained: from forward - the forepeak, the bow thruster room, an extensive sauna and swimming pool area, and in the aft half of the ship - the generator room, the engine room, the fuel purifier room and other machinery-related spaces. The deck next above, deck 1, contained - in the forward half - economy class cabins for 358 passengers. The aft half of the deck contained the engine control room, workshop, main engine room and various utility spaces.

The car deck was one open space, with the exception of a centre casing, located slightly to starboard. Loading ramps were arranged one at the forward end and two at the aft end of the deck. The centre casing contained staircases from the spaces below the car deck, lift trunks and various utility spaces for machinery and catering functions. Five lifts were installed, extending from the passenger spaces below the car deck and from the car deck to deck number 7. Six sets of stairs led from the lower passenger spaces to a common passageway inside the casing. Four sets of stairs led from this passageway to deck 4 and six sets led upwards to higher decks. Stairs were also arranged at the aft open-air deck spaces from deck 4 upwards to deck 8. Emergency escape trunks from the engine room area were arranged inside the casing.

Smaller service spaces for power supply to the ramp and bow visor operation and the hoistable car decks were arranged on the car deck port and starboard, forward and aft. An office for the cargo officer during loading and discharging was arranged in the aft service space.

Deck 4 contained many passenger cabins and, aft, conference rooms, a cafeteria and passenger seats. The enclosed deck area ended at two public exits to the open-air aft deck. Decks 5 and 6 had passenger cabins covering the forward third and the remaining parts were used for tax free shop, information desk, restaurants, bars and entertainment areas. Both decks had two double-door public exits to the open-air aft decks. The accommodation spaces on decks 4, 5 and 6 extended from side to side without any open-air passage or other open-air spaces except the aft decks.

Deck 7 contained the main part of the crew accommodation. This deck did not extend to the sides of the vessel, giving room for an open deck area on both sides. On the open deck there were the rescue stations and the embarkation area for lifeboats. The deck was accessible to passengers via two main staircases and between the aft open-air decks. The passageways contained cradles for liferafts and bins for lifejackets for passengers and crew. Forward on deck 8 was accommodation for the senior officers and, aft, additional crew accommodation spaces. The intermediate space was taken up by ventilation equipment and other service functions. The lifeboat davits and additional liferaft bins were located at the sides of this deck. Deck 8 was accessible to passengers only via external stairs from deck 7.

The navigation bridge was on deck 9.

### 2.5.3 Propulsion system and control

The propulsion system consisted of four medium-speed diesel engines, connected in pairs to two propeller shafts via gear boxes. The engines were four-stroke turbocharged engines with eight cylinders and a maximum continuous output of 4 400 kW each. They were designed to operate on heavy fuel oil. Maximum continuous operating revolutions of the engines were 600 rpm which corresponded to 188 rpm of the propellers.

Each propeller shaft carried one controllable-pitch propeller with a diameter of 4.0 m. The port-side propeller rotated clockwise and the starboard side one counter-clockwise.

The pitch control of the propellers was hydraulic, separate for each propeller. The control was effected electrically by power selector levers on the main control console on the bridge, on the bridge wings and in the engine control room. The control signal from the power selector affected the engine revolutions as well as the propeller pitch via an electro-hydraulic "combinator". Revolutions and pitch both increased at increasing power settings up to about 70% output, when the maximum continuous engine revolutions, i.e. 800 rpm were reached. After that, the output could be further increased to 90% by increasing the propeller pitch only while the revolutions of the engines remained at 600 rpm.

All the normal indicators, alarms and control devices were on the bridge and in the engine control room. The installation qualified for unmanned machinery space at sea in accordance with the classification requirements, but actual operation was at all times conducted with the engine control room manned by one engineer and one motorman.

The total fuel oil tank capacity was 940 m<sup>3</sup> of heavy fuel oil and 291 m<sup>3</sup> of marine diesel oil. Bunkering for a complete round trip was always done in Stockholm.

### **2.5.3 Propulsion system and control**

The propulsion system consisted of four medium-speed diesel engines, connected in pairs to two propeller shafts via gear boxes. The engines were four-stroke turbocharged engines with eight cylinders and a maximum continuous output of 4 400 kW each. They were designed to operate on heavy fuel oil. Maximum continuous operating revolutions of the engines were 600 rpm which corresponded to 188 rpm of the propellers.

Each propeller shaft carried one controllable-pitch propeller with a diameter of 4.0 m. The port-side propeller rotated clockwise and the starboard side one counter-clockwise.

The pitch control of the propellers was hydraulic, separate for each propeller. The control was effected electrically by power selector levers on the main control console on the bridge, on the bridge wings and in the engine control room. The control signal from the power selector affected the engine revolutions as well as the propeller pitch via an electro-hydraulic "combinator". Revolutions and pitch both increased at increasing power settings up to about 70% output, when the maximum continuous engine revolutions, i.e. 800 rpm were reached. After that, the output could be further increased to 90% by increasing the propeller pitch only while the revolutions of the engines remained at 600 rpm.

All the normal indicators, alarms and control devices were on the bridge and in the engine control room. The installation qualified for unmanned machinery space at sea in accordance with the classification requirements, but actual operation was at all times conducted with the engine control room manned by one engineer and one motorman.

The total fuel oil tank capacity was 940 m<sup>3</sup> of heavy fuel oil and 291 m<sup>3</sup> of marine diesel oil. Bunkering for a complete round trip was always done in Stockholm.

### **2.5.4 Electrical system**

The three-phase, 380 V, 50 Hz electrical system was fed by four main electrical generator sets. They had an output of 1065 kVA each and were capable of parallel operation. The generators were driven by four diesel engines, each supplying 1104 kW at 750 rpm.

Transformers provided 220 V single-phase power for lighting and utility functions. The main electrical switchboard was in the engine control room.

An emergency generator set in compliance with the SOLAS requirements was installed in a separate room on deck 8 near the engine casing. The generator was powered by a diesel engine with an output of 312 kW at 1500 rpm. It supplied the emergency lighting system and also essential bridge equipment, including engine control, steering system, radars, gyro-compass, logs, echo-sounder, navigation lights, search lights, radio station, telephone system and public address system.

The emergency generator unit was designed to start automatically in case of loss of electrical power in the main network. The total starting and switch-in time was about 15 seconds.

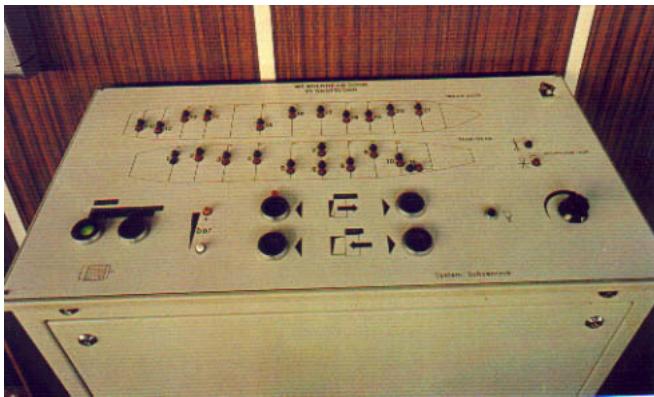
Accumulators for emergency power in case of loss of all other electrical supply were installed in compliance with the SOLAS requirements.

### **2.5.5 Ballast system**

Two centrifugal ballast pumps were installed, each with a capacity of 300 m<sup>3</sup>/h. The pumps served ballast tanks which were the forepeak tank, the forward trim tank, two double-bottom tanks, one pair of heeling tanks and the aft peak tank, giving a total capacity of 1212 m<sup>3</sup>.

The heeling tanks were side tanks with a capacity of 183 m<sup>3</sup> each and intended for adjusting a list of the vessel when needed. The list that could be compensated with one heeling tank full and the other empty was about eight degrees. A separate heeling tank pump could be operated from the deck office at the stern ramp and from the engine control room. The connection valve between the heeling tanks (cross-flooding valve) was designed to close in case of failure of electrical power. The open/close condition of this valve was indicated by red/green lights on the control panel for the watertight doors on the bridge. - See photo below.

Picture of control panel of WT bulkhead doors



### 2.5.6 Car deck arrangement

The vessel had a deck for loading trucks, cars and other wheeled cargo. The car deck was the vessel's freeboard deck and identified as deck number 2. It extended from side to side and from bow to stern, with a centre casing immediately starboard of the centre line. The available deck space was divided into four lanes on the port side and three on the starboard side. Lashing fittings were mounted along the lanes on the car deck.

Personnel access to the car deck was via stairs and lifts in the centre casing. Four of the lifts had doors leading to the starboard side of the car deck and one had doors to the port side. A total of eleven doors, six starboard and five port, led from the car deck to the stairs inside the casing. The doors were sliding-type steel doors, meeting the SOLAS fire resistance requirements. The locks of the doors were remotely operated from the Information desk on deck 5. The doors were not locked at sea.

The car deck space was ventilated by electrically driven fans, located on both sides at the forward and aft ends of the deck area. The air channels ended at the open deck 4, on the forecastle deck level in the front bulkhead of the superstructure.

Twelve closable 4" scuppers were installed along each side of the deck. The scuppers were normally left open.

Four TV cameras for monitoring the car deck area were mounted.

### 2.5.7 Bridge layout

The navigation bridge was on the uppermost deck (deck 9), 9.2 m aft of the forward end of the superstructure. The bridge wings extended over the ship's sides by about 1.5 m and were fully enclosed.

The central part of the bridge extended forward of the wings by about 2 m. In the original design there was a console containing all major navigation and control equipment at the front bulkhead, just below the windows. The steering console was located on the centre line, just behind the front windows. The bridge was rebuilt in January 1994 and some of the navigation equipment was renewed. The navigation console at the front bulkhead was partly removed, and a new conning station was installed to port of the centre-line. The design of the conning station was of the Pilot-Copilot type, commonly used in Baltic ferries.

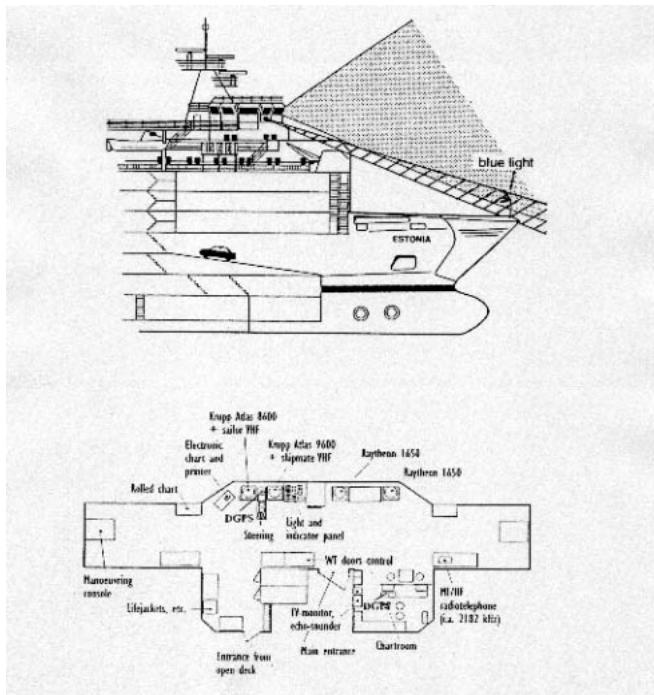
The new console contained two ARPA radars, DGP's (Differential Global Positioning System) receivers, the main auto-pilot, propulsion control levers, VHF telephones, mobile telephones and equipment for internal communications. From the two navigators' seats, and the captain's seat, normally placed to the port of the conning console, the panel with indicator lamps for visor and ramp was within sight.

The fin stabilisers and associated controls were also installed in 1994. The original "Roll-Nix" stabilisation system had been found inadequate. It was, however, not removed and had sometimes been used in strong following wind.

A separate chartroom was located on the starboard side, in the aft part of the bridge. The corresponding space on the port side was an open area containing the fire alarm centre and various cabinets for storage, etc.

The main entrance to the bridge, from the accommodation, was on the centre line at the aft end of the bridge, where a door to the staircase connected the bridge with the officer and crew accommodation on decks 8 and 7. On the port side at the aft end of the bridge there was a door to the open deck.

Because of the retracted position of the navigation bridge, only the flag pole on the bow of the vessel was visible from the conning station - see drawing below - whilst the most forward part of the visor could be seen through the two windows on deck level at both sides of the extended central part of the bridge, as can be seen on the drawing below. A monitor, showing among other things, the transmissions from the four car-deck cameras, was placed at the chartroom entrance and could not be seen from the conning station.



### 2.5.8 Navigation equipment and systems

The navigation equipment was of a high standard, and met the requirements for the intended trade.

The equipment had been upgraded and/or renewed on several occasions, and at the time of the accident the following equipment was installed on the bridge for navigation and vessel control:

- \* Radar, Atlas 9600 Arpa X-band - 3 cm
- \* Radar, Atlas 8600 Arpa S-band - 10 cm
- \* Radar, Raytheon 1650 12 SR Raycas
- \* Radar, Raytheon 1650 SR (slave to Radar set 1650 12 SR Raycas)
- \* 2 Gyro compasses, Sperry MK 36
- \* Magnetic compass, Plath
- \* Autopilot, Kockum Steermaster 2000
- \* Autopilot, Sperry Universal
- \* Speed Log, Raytheon Doppler Sonar (one axis)
- \* Echo-sounder, Simrad DSN 450
- \* Radio direction finder, Debeg ADF 7410
- \* Antiroll system, Roll Nix (SSPA)
- \* Stabilisers, Brown Brothers folding fins
- \* Navigation computer, Navi Master NM-100
- \* GPS receiver, Shipmate 5800 C
- \* DGPS receiver, Shipmate 5360
- \* DGPS receiver, Magnavox 200
- \* Speed/Fuel Consumption Optimisation Computer, ETA Pilot

### 2.5.9 Communication equipment

The communication equipment was divided between the bridge and the radio room.

The vessel's radio room was on deck 8, aft of the captain's cabin. The radio room was mainly used for commercial communication, and contained the following equipment:

- \* Main Transmitter, Standard Radio ST-1680 A
- \* Main Receiver, Skanti AS SR-51
- \* Emergency Transmitter, Standard Radio ST-86 B, A1, A2, A3
- \* Emergency Receiver, RL Drake RR-11
- \* Autoalarm IMR A4 734/SRT B-2290 1000

\* VHF Svensk Radio STR-40 - ME62 In addition to the equipment in the radio room, the following was installed on the bridge:

- \* MF/HF radio telephone
- \* VHF Svensk Radio STR-40 ME62
- \* VHF Sailor (1 master and 3 slaves)
- \* VHF Skanti
- \* Watch Receiver DC-300D
- \* NAVTEX receiver
- \* Lifeboat Radio IMR SOLAS III A
- \* Mobile Telephone NMT 450
- \* Weather Fax Receiver Two Emergency Position-Indicating Radio Beacons (EPIRB) were mounted, one at each side on top of the bridge.

## **2.6 Visor and Ramp Installations**

### **2.6.1 General**

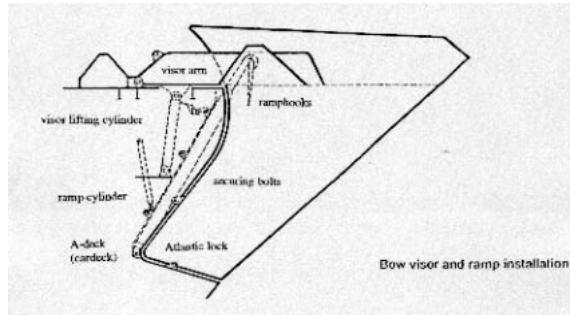
The visor and ramp installations of the ESTONIA were of a configuration common on ferries in traffic between Finland and Sweden at the time of her construction. The installations comprised an upward-opening bow visor and a loading ramp at the bow and two loading ramps at the stern, which were hinged at car deck level and closed when raised.

In closed position, the upper end of the bow ramp extended into a box-like housing on the deck of the visor, the ramp house. The complete bow ramp and the operating and locking devices for the visor as well as the stern ramps and the hanging decks were designed and delivered by an independent company, von Tell Trading & Co. AB, Gothenburg (hereafter called von Tell AB), an established supplier of hydraulically operated ship's installations. The design was based on a detailed specification by the shipyard. Von Tell AB used a subcontractor, Grimmereds Verkstads AB, Gothenburg for manufacturing complete sets of components for the ramps, the hanging decks and the locking devices, including those for the visor. The routine contacts between the Yard and the supplier were via von Tell GmbH, Hamburg, a subsidiary of von Tell AB. Incorporation of the system into the ship and manufacture of the attachment structure were shipyard work, although under the supervision of a von Tell representative. See Subchapter 2.4.2. The equipment delivered by von Tell was identical to that built for the preceding newbuilding, DIANA II, except for the slightly increased length of the bow ramp and the changes of the car platforms dictated by the greater length of the vessel. According to available information the visor operating and locking system for DIANA II was designed by von Tell AB staff who had experience with similar installations from their previous employments.

The Bureau Veritas rules valid at the time had no details regarding procedures for calculating sea loads on the bow visor. It was stated in general wording "that doors should be firmly secured and that structural reinforcements should be made to attachment points of cleats, hinges and jacks". The general wording in the rules also specified that the scantlings for the visor structure should be equivalent to that of the hull itself.

The vertical and longitudinal sea loads to which the bow visor could be exposed were calculated separately by the Yard and by von Tell AB. The Bureau Veritas rules gave no detailed guidance for such calculations. The Yard therefore used for this purpose the nominal "pressure heights" given by Bureau Veritas in the Note Documentaire BM2 of 05.04.1976, which was originally issued as a general guidance for determining the loads on the bows of large ships, whilst von Tell AB used nominal pressure heads per unit of projected area specified in the rules of Lloyd's Register Shipping, valid at the time ESTONIA was under construction. For further details see Subchapter 2.4.2.

### **2.6.2 Technical description of the visor**



Bow visor and ramp installation

### The Visor Construction and Functioning

The vessel was a Ro-Ro passenger ferry with visor, bow ramp and stern ramps. The visor was the most forward part of the vessel and pivoted around 2 hinges fitted at the forecastle deck, i.e. C-deck, having its opening and closing movements performed by 2 hydraulic lifting cylinders (actuators). The construction of the visor corresponded to the construction of the bow with material dimensioned according to the general requirements of the Classification Society (for details see Subchapter 2.4.3). The lower forward part was ice-strengthened. The visor consisted mainly of shell plating being an extension of the ship's shell plating and contour, the forecastle deck, the bottom part, the 2 aft bulkheads, the 3 horizontal stringers with the 5 bow pointers in between respectively on top of the 2 vertical partial bulkheads and transverse stiffeners. The two so-called visor arms (beams) extended about 3 m aft of the visor and ended in the two hinge arrangements by which the visor was connected to the vessel and which were the pivoting parts as well. The design weight of the visor was about 55 mts.

Between the two visor arms a box-shaped housing - the so-called ramp house - was fitted into which the upper end of the bow ramp extended in closed position. This was the interlock between visor and bow ramp, a configuration quite common at the time VIKING SALLY was designed and built (see [Enclosure 2.6.2.67](#) - photo VIKING SALLY). In closed position the visor was connected to the foreship by three hydraulically operated locking devices. One of these locking devices - the "Atlantic lock" - was mounted on the forepeak deck - A-deck - whilst the other 2 were side locks mounted in the front bulkheads of the vessel with the mating lugs at the lower parts of the aft bulkheads of the visor.

In addition, there were 2 mechanical locking devices - the so-called manual side locks - mounted on both sides below the hydraulic side locks. The manual side locks were - according to Bureau Veritas - "Heavy Weather Securings" (see [Enclosure 2.4.3.37](#) - letter B.V. to the JAIC dated 10.01.95 and [Enclosure 2.6.2.75](#) - photo showing mock-up of the manual side lock).

Three strong locating horns - one on the forepeak deck called "pyramid" and one at each front bulkhead of the vessel - engaged recesses in the visor bottom respectively on both aft bulkheads of the visor when in closed position and were intended to absorb lateral loads.

In closed position the visor bottom rested on the forepeak deck mainly in way of the strong stempost which took about 75% of its weight, whilst two steel pads welded to the forepeak deck at the aft part of the visor bottom took a further ca. 20% and the remaining 5% were absorbed by the rubber packings. The visor was kept down by its weight and the 3 (or 5) locking devices which pulled the visor tight against the rubber packings on forepeak deck and both front bulkheads. Thereby any possible play was eliminated and the visor's inside was kept watertight. Forces acting in the forward/aft direction on the visor were transferred by the hinges, the locking devices and the front bulkheads into the structure of the vessel.

In open position the visor was secured by 2 parking devices consisting of 2 hydraulically operated bolts with mating lugs at the aft end of both visor arms.

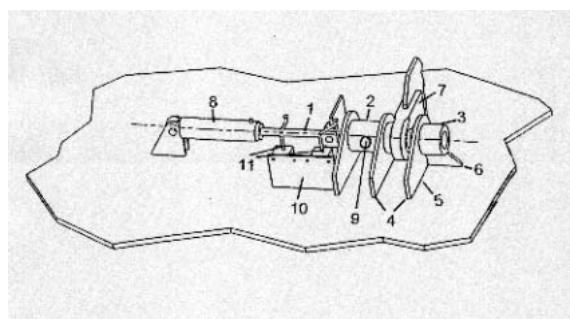
For further details of the visor, its maintenance, operation, opening and closing, etc. reference is made to the relevant parts of the von Tell Manual attached as [Enclosure 2.6.2.69](#).

### **Locking Devices of the Visor**

In closed condition the bow visor was connected to the vessel's hull by the hydraulic and manual locking devices, i.e.

- the Atlantic lock or bottom lock
- the 2 hydraulic side locks
- the 2 manual side locks.

Most important was the Atlantic lock or bottom lock. The arrangement is shown in the sketch below.



This locking device consisted of a locking bolt (1), movable horizontally in a transverse direction, guided in a bolt housing (2). In extended position the tip of the bolt engaged a support bushing (3). The bolt housing was fixed to the forepeak deck by means of two steel lugs (4) and the bushing was installed in a third similar lug (5), to which a support bracket (6) was fitted. A mating lug (7), attached to the visor itself, was located between the bolt housing and the support bushing when the visor was in the closed position and the extended bolt then engaged the hole in the mating lug.

The bolt was moved in the bolt housing between the retracted position and the extended position by means of an hydraulic actuator (8), operated from the control panel located behind the bow and the ramp on the car deck. A spring-loaded mechanical plunger (9), perpendicular to the bolt, engaged grooves in the bolt in the open and closed position, thereby securing the bolt mechanically in its extreme positions, regardless of hydraulic pressure. The bolt was also locked hydraulically at any time because the hydraulic fluid was trapped in the system, regardless of whether the hydraulic system was under pressure or not.

The mating lug at the aft end of the bottom of the visor consisted of a single steel lug, welded to a transverse beam of the visor bottom structure and supported by a bracket. The lug had a hole for the locking bolt with an original diameter of 85 millimetres (see [Enclosure 2.6.2.70](#) - drawing of Atlantic lock).

When the bolt was moving from open to closed position or the other way round, a vertical plate (10), fitted to the bolt initially, contacted 2 mechanical limit switches fitted to the sensor plate (11), which activated the indicator lights on the control panel on the car deck to show "red" when the bolt was open and "green" when the bolt was in closed position. In case the bolt would be in an intermittent position there would be no indicator light shining.

The control panel was located at the forepart of the car deck at port side (see [Enclosure 2.6.2.71](#) - Photo of ESTONIA with the open visor and control panel and [Enclosure 2.6.2.72](#) - Car deck with closed bow ramp). Details of the control panel can be taken from [Enclosure 2.6.4.81](#). The above description as well as the relevant drawing show the condition at the time the vessel was delivered to AB Sally in June 1980.

**The Hydraulic Side Locks** were installed at about 1/3 of the height of the visor and consisted of two lugs, mounted to the aft bulkheads of the visor and extending, when the visor was closed, into two openings in the front bulkheads of the hull, inside the rubber packings, whereafter hydraulically operated bolts engaged the holes of the visor lugs. The hydraulic bolt installations were similar to that of the Atlantic lock, i.e. a bolt moving in a bolt housing and, when extended, engaging a support bushing. The visor lug inserted between the bolt housing and the support bushing. The bolt was moved by a hydraulic actuator. The position of the bolt, fully retracted and fully extended, was sensed by magnetic type limit switches activating indicator lights.

Additional hydraulic cylinders - so-called ice-cylinders - were installed at each side to push in a forward direction on the visor lugs when the visor was to open. This installation was intended to assist in breaking the visor open in case it had become frozen fast in closed position.

Two vertical stiffeners were installed on the front side of the plating separated by a distance slightly larger than the thickness of the lug itself, to comply with the remark on drawing 49111-330 made by the plan approver of B.V., i.e.

»Local reinforcements of the ship's structure in way of locking devices to surveyor's satisfaction.« (see Subchapter 2.4.3. above).

Directly below these hydraulic side locks, at each side a further set of locking devices, the "manual side locks", were installed consisting of a strong bolt with nut at vessel's side and a strong hook at each side of the visor's aft bulkheads, which also extended through a similar narrow opening into the ship's side. The arrangements of hydraulic and manual side locks can be seen from a respective photo attached as [Enclosure 2.6.2.74](#). The photo shows the hydraulic lock closed, whilst the manual lock is not engaged. In order to demonstrate the dimensions a photo of the mock-up of the manual side lock is attached as [Enclosure 2.6.2.75](#).

After closing of the hydraulic side locks from the control panel on the A-deck the operator or somebody else had to walk into the port side house, up the stairs to B-deck, forward beside the chain locker, then climb through an opening in the deck down into the void space on A-deck from where both the hydraulic and manual side locks were accessible and the bolt of the manual lock could easily be moved between the hooks of the visor. The same procedure had to be repeated at starboard side. The distance to be covered from the control panel to close both port and starboard manual side locks is only about 38 m. The way to walk can be seen from [Enclosure 2.6.2.76](#) (2 pages).

The manual side locks are called "reserve" locking devices in the von Tell manual ([Enclosure 2.4.2.31](#)), but B.V. calls them in their letter to the JAIC dated 10.01.95 »2 manually operated fasteners for heavy weather« ([Enclosure 2.4.2.37](#)). - See also Subchapter 2.4.2 / 2.4.3.

#### The Visor Hinges

The hinges, around which the visor was opening and closing, consisted of a steel/bronze bushing system fitted through holes in the side plates of the visor arms and two steel lugs with a housing in between welded at both ends of the visor arms to the forecastle deck plating. A stainless steel bolt was leading through each of the assemblies at port and starboard side. Securing plates bolted to the outer respectively inner sides of all four steel bushings prevented moving out of the bolt.

The bearings were lubricated through drillings in the bolt and grease nipples at its ends.

Also the hinge arrangement was von Tell design and the bushings, and subsequently the bolts, were installed under the strict supervision of the von Tell representative Günther Todsen. His statement - attached as [Enclosure 2.4.2.21](#) - shall be quoted in connection with the hinge installation as follows:

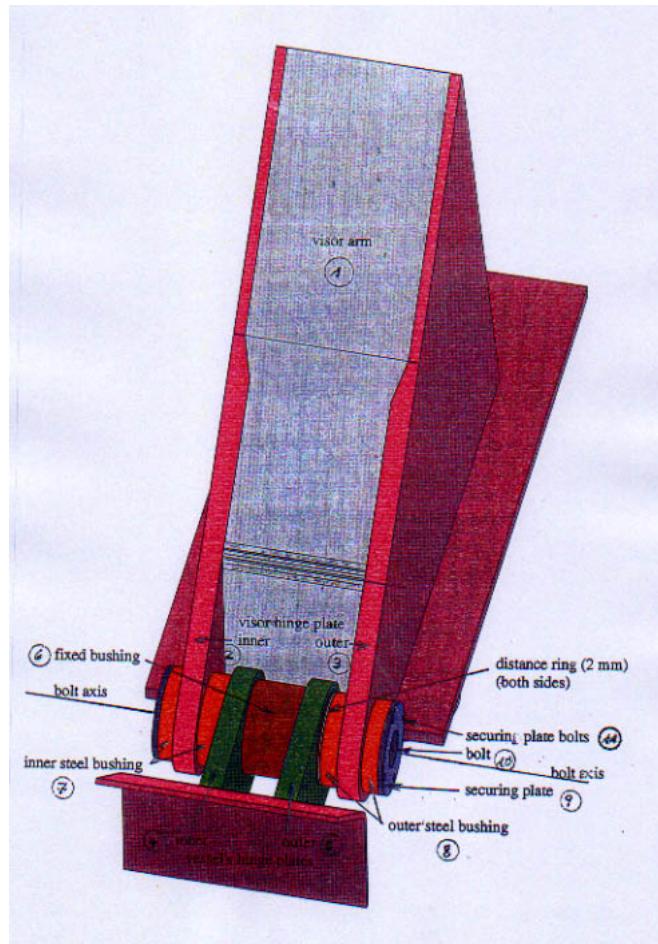
#### Installation of the Hinges

»The bore holes for the bushings were carried out in the shipbuilding hall by means of the a boring machine. I had personally checked and touched the bore holes before the bushings were installed and do confirm that the holes in the visor arms were by no means burnt out. Anyway, I never would have accepted such bungled work as can be on the photos showing the remains of the visor hinge plates of the ESTONIA. In such case that the Yard would not have accepted my objections, I would have left the vessel and informed my principals.

This happened for example on a vessel at Dunkirk. I was instructed to carry out repairs to some hatch covers. When the crew refused to supply me with the spare parts necessary to perform a proper repair (although these spare parts were on board) and a proper repair, based on my professional experience, would not have been possible otherwise, I refused to carry on working and returned to Kiel.

The steel bushings were welded into the visor arms under my supervision and subsequently milled to such an extent that the bronze bushings did fit. These bore holes were performed very exactly to assure that the port and starboard sides were in exact alignment in order to avoid excessive loads on the hinges during opening and closing of the visor. Thereafter the shafts were inserted, whereby also the distance rings were put in place (2 mm thick). I do remember this work in particular, because it was difficult, time consuming, and required a lot of care. The shafts were made of NIROSTA (stainless) steel and had grease grooves with grease nipples. By means of these grease nipples the hinges had to be greased at least once a week.«

Todsen as well as the Meyer Werft managers and employees have time and again confirmed that the bore holes in the visor arms for the steel bushings had been drilled and not burned and, as a matter of fact, the port outer part of the visor hinge plate still shows circumferential drilling marks. The sketch below shows the hinge arrangements in detail.



### 2.6.3 Technical description of the bow ramp

The bow ramp was designed as a grillage with 4 longitudinal and 6 transverse webplated beams. The ramp plating was reinforced by rolled stiffeners. The dimensions were:

Length = 8225 mm  
 Breadth = 5500 mm  
 Weight = ca. 12.1 ts

At the fore part of the ramp 8 sloping flaps were fitted, which automatically extended when the ramp was opening. Each sloping flap worked independently of the others in order to compensate for heeling of the ship as long as the list did not exceed 2°.

The ramp was approximately 1.5 m longer than there was deck height available, thus was extending the forecastle deck in closed position by that distance. This extension was enclosed by the 'ramp house'.

The ramp was connected to the vessel's A-deck by means of 4 hinges of which the 2 outer ones were provided with spherical bearings and the 2 inner ones with bronze bushings. The bolts were of stainless steel.

The ramp was closed by the 2 hydraulic cylinders until the opening was only about 45 mm and the dead centre had been exceeded, thereafter 1 hook at each side of the vessel moved forward, engaged mating lugs at the upper end of the ramp and the ramp was hydraulically pulled tight against the rubber packings.

Then 4 conically shaped securing bolts moved from vessel's side into mating pockets at the ramp side, one after the other with audible noises. Once the bolts were fully extended contact was made with magnetic limit switches, switched in series which activated the green indicator light at the car deck control panel. This means that the green light was only activated if all 4 bolts had contacted the respective sensors. The 2 hooks and 4 locking bolts of the bow ramp were activated by means of one lever only and the system functioned in such a way that at first the hooks moved out and pulled the ramp tight against the rubber packings and thereafter the side bolts, one after the other, were activated.

The movements of the locking hooks of the bow ramp (ramp hooks) are shown on a drawing attached as [Enclosure 2.6.3.77](#). It reveals that the ramp has to be closed by the actuators until there is an opening at the top of no more than 45 mm whereafter the locking hooks engage the mating lugs of the ramp. The particular contour of the hooks was chosen to ensure that when a force was applied a bending moment in the hooks became imposed which pressed the hooks against the pins of the mating lugs, i.e. the hooks could never spring off the pins. Only by plastic deformation after respective load exposure could this locking mechanism fail. Calculations of the hook by means of a FEM-model with contact elements between hook and pin - see [Enclosure 2.6.3.78](#) (2) - revealed that plastic deformation commenced at a load of ca. 27 ts. and a so-called "plastic hinge" was built up. In summary it might be concluded that the failure-load of one ramp hook was in the range of ca. 30 ts., whilst the breakdowns of the ramp pockets for the securing bolts have been calculated with ca. 15 ts. each. Consequently the total load required to break open the intact and properly secured bow ramp would be in the range of 30 ts. x 2 = 60 ts. plus 15 ts. x 4 = 60 ts., thus in total = **about 120 ts.** The weight of the empty visor is 55 ts.

Around the ramp opening rubber packings housed in flat bars welded to the bulkheads were arranged which should have kept the closed ramp watertight (weathertight).

## 2.6.4 Technical description of the stern ramps

The **stern ramps** were designed as grillages with 4 longitudinal and 5 transverse webplated beams. The ramp platings were reinforced by rolled stiffeners. The ramp dimensions were:

Length = 6500 mm  
Breadth = 5500 mm  
Weight = 11.5 ts

At the upper part of each ramp 9 sloping flaps were fitted, which always remained extended, also when the ramps were in closed position. Each sloping flap was 1.5 m long and had an independent flexibility in order to compensate for heeling of the ship as long as the list did not exceed 2°.

The ramps were connected to the vessel's A-deck by means of 4 hinges of which the 2 outer ones were provided with spherical bearings and the 2 inner ones with bronze bushings. The bolts were of stainless steel.

The ramps were closed by two hydraulic actuators each until the opening was only about 45 mm and the dead centre had been exceeded, thereafter 1 hook at each side of the ramp moved forward, engaged mating lugs at the upper end of the ramps and the ramps were hydraulically pulled tight against the rubber packings. Then 3 steel cams, extending the bulkheads to both sides of the ramps, moved - hydraulically operated - underneath steel pads fitted at the sides of the ramp. Thereby the ramps were pressed tight against the rubber packings fitted in steel bars welded to the bulkheads around the ramp openings.

The movements of the locking hooks (ramp hooks) are shown on a drawing attached as [Enclosure 2.6.3.77](#). The particular contour of the hooks was chosen to ensure that when a force was applied a bending moment in the hooks became imposed which pressed the hooks against the pins of the mating lugs, i.e. the hooks could never spring off the pins. Only by plastic deformation after respective load exposure could this locking mechanism fail. Calculations of the hook by means of a FEM-model with contact elements between hook and pin - see [Enclosure 2.6.3.78](#) (2) - revealed that plastic deformation commenced at a load of ca. 27 ts. and a so-called "plastic hinge" was built up.

It might be thus concluded that the failure-load of one ramp hook was in the range of ca. 30 ts., whilst the breakloads of the steel pads for the securing cams have been calculated with ca. 15 ts. each. Consequently the total load required to break open an intact and properly secured stern ramp would be in the range of 30 ts. x 2 = 60 ts. plus 15 ts. x 6 = 90 ts., thus in total = about 150 ts.

## 2.6.5 Passenger and pilot doors

The vessel was also fitted with 4 **passenger doors**, one each at the port - and starboardsides of decks 4 and 5 in approximately midships position. The dimensions were 2.5 x 2 m. Each passenger door was operated by an hydraulic cylinder and a link system, so that the doors were opening parallel to the ship's side and then moved aft.

Furthermore 1 pilot door was installed each at the port - and starboard-side of the car deck slightly aft of midships. These doors opened 90° towards the center line of the ship.

The doors were locked to the ship by 4 wedges each, which were compressing the rubber packings in order to give a suitable sealing. The wedges were hydraulically operated.

For further details see [Enclosure 2.4.2.31](#).

## 2.6.6 Actuating, monitoring and control systems for the visor, the bow ramp and the stern ramps

**Hydraulic System and Hydraulic Cylinders (Actuators)** The hydraulic system of VIKING SALLY, serving the car deck installations including visor and ramps, consisted of 3 pump stations, 2 big ones and 1 small one. The working pressure for the big ones was about 250 bar and for the small one about 150 bar.

1 big pump station was placed in the stern part of the car deck on the starboard side and served the port side stern ramp, the port side drive-on ramps, the port side hanging decks.

1 big pump station in the fore part of the car deck on the port side served the bow visor, the bow ramp, the starboard stern ramp, the drive-on ramps on starboard, and the starboard hanging decks.

1 small pump station placed in the centre casing on B-deck level served 2 pilot doors, 4 passenger doors, and 2 passenger bridges.

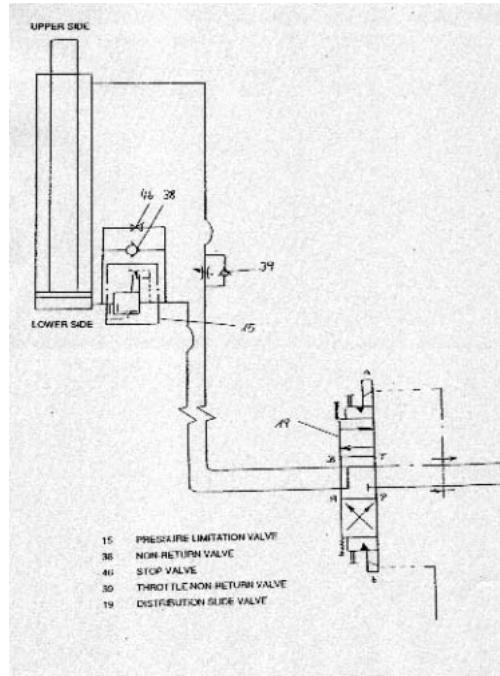
**The big pump stations** consisted of 1 oil tank each containing 900 litres and 3 pumps. When the system was in normal operation 2 pumps were running and the 3rd one was serving as a reserve unit.

**The small pump station** consisted of 2 pumps and 1 oil tank containing 150 litres. When the system was in normal operation 1 pump was working and the other served as a reserve unit.

The hydraulic system was connected in parallel and the pumps were pressure compensated axial piston pumps which delivered only the required quantity of oil. This quantity, required by each user, was adjusted by throttle valves. The max. working pressure of the pump station was regulated by a safety valve adjusted at newbuilding. It came only into effect if the pressure would exceed the max. working pressure to which the valve was adjusted and should never be changed.

Upon failure of one of the big pump stations the other one could be connected by switching off the two shut-off valves of the failing pump station and by opening the two valves located in the aft pump station, whereafter the "cross-over" between the two hydraulic systems was established. The operating time was slightly longer if the pump station aft was used to serve the forward system, i.e. the bow visor, the bow ramp and drive-on ramps on starboard side.

Since the hydraulic system of the actuators of the visor, bow and stern ramps do have some relevance for the casualty scenario, its functioning shall be explained in detail, whereby the figures refer to the sketch below:



- When the distributing slide valves were moved (19) from right to left, oil would flow from the pressure pipes (P) to the piston undersides, the piston rods moved upwards and the visor opened. The oil at the piston rod sides flowed undisturbed through valves 39 into the return pipes (T).

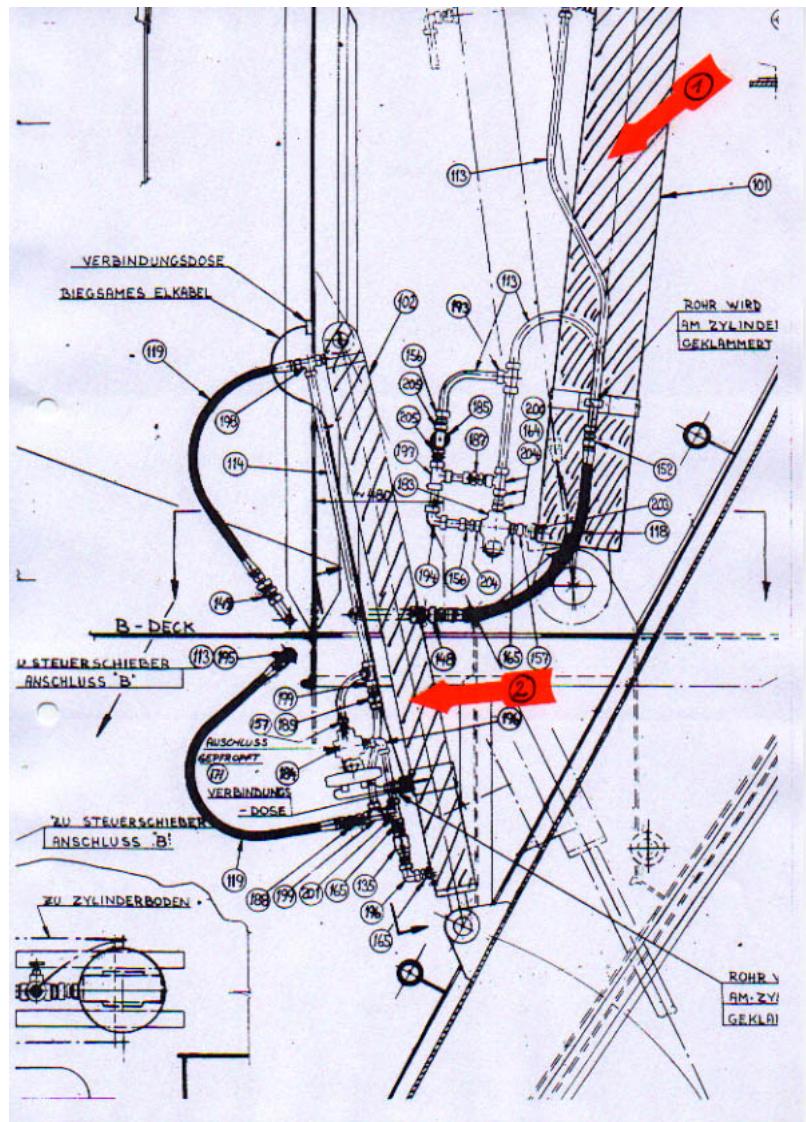
- When the distributing slide valves were moved from left to right the oil flow reached in throttled condition (39) the upper cylinder chambers (piston rod side). The pressure in the upper cylinder chambers pushed the pistons downwards. Also the weight of the visor acted on the pistons. At the underside of the pistons overpressure developed as the stop valves (46) closed, the non-return valve (38) prevented oil flow in this direction and the pressure limitation valves (15) were not yet open. Only if excessive pressure had built up at the lower sides of the pistons would the pressure limitation valves (15) open and the visor move downwards.

- There were two reasons for the installation of such valves (15). On the one hand such valves prevented the rapid falling down of the visor in case of pipe and/or hose failures, on the other hand the visor was unable to close by its own weight only. Consequently it was possible to keep the visor in a partly open respectively closed position.

- In the case of the bow and the stern ramps, which were connected to identical hydraulic systems, it was the other way round because the weight of the ramps acted in the opening direction.

- In case the visor and bow as well as the stern ramps should be closed or kept closed by hydraulic pressure, the piston rod sides had to be pressurized and the actuators would retract respectively remain retracted.

The following diagram shows part of the von Tell drawing 49111-387 with the visor actuator - arrow 1 - and the bow ramp actuator - arrow 2 - with the respective hydraulic systems, as explained on the previous pages, fitted to the cylinders.



As these installations were located in the void spaces above and below B-deck as it is visible from the drawing on the next page, they were accessible for the crew. This means that it has been possible to manipulate the valves at the visor and bow ramp actuators from inside the side-houses without having to touch the control panel on the car deck. By means of the above explained "cross-over" effected at the aft hydraulic station - see [Enclosure 2.4.2.31](#) - it has also been possible to put pressure on the cylinders of visor and bow ramp by means of the aft hydraulic station. In summary it can thus be concluded that it was possible to put pressure on the actuators of visor and bow ramp, i.e. to keep them closed by hydraulic pressure, without having to use the control panel on the car deck.

It can further be concluded that it was possible to keep visor, bow and stern ramps in a semi-open/-closed condition which, however, required the running of at least one hydraulic pump under continuous load changes (on/off). The visor actuators were connected to the vessel's B-deck by 2 lugs for each cylinder (see [Enclosure 2.6.4.79](#) - photo showing B-deck).

Below this deck there were respective stiffeners and brackets fitted, which transferred the forces into the vessel's structure. To lift the visor 118 ts. were required at each cylinder. The maximum lifting power of 1 cylinder at a design pressure of 250 bar was 153 ts. The test pressure of the cylinders was 350 bar.

#### Note:

According to the chief engineer Lars Karlsson the hydraulic pumps were changed in 1985/86 to more powerful ones which could produce a maximum operating pressure of 400 bar. Reportedly the other components of the system remained unchanged. - See [Enclosure 2.4.5.60](#) - and the class was not informed although this was a significant manipulation of the system.

#### Sensors/ indicator lights/ control panels

At the time of delivery the opening and closing procedures of bow visor and bow ramp were controlled by in total 25 sensors of which 18 were magnetic limit switches and 7 mechanical limit switches.

With reference to part of drawing 49111-871 - attached as [Enclosure 2.6.4.80](#) - these sensors shall be explained as follows:

G 1	: mechanical switch (only at starboard side) indicates: visor open, indicator light: green. Visor may be locked by parking devices on C-deck
G 2	: magnetic sensor (only at port side) indicates: visor closed, indicator light: green. Visor may be locked by Atlantic lock and hydraulic and manual side locks
G3/ G5	: mechanical switches (one at port, one at starboard side), indicate: visor not fully open and parking devices not engaged, indicator light: red. switched in series
G4/ G6	: mechanical switches (one each at port and starboard side) (counter pieces to G3/G5) indicate: parking device locked indicator light: green
G 7	: mechanical switch (Atlantic lock) indicates: bolt in open position, i.e. unlocked indicator light: red
G 8	: mechanical switch (Atlantic lock - counter piece to G 7) indicates: bolt in closed position, i.e. locked indicator light: green
G9/ G11	: magnetic sensors (one each at port side and starboard side for side locks) indicate: side locks in open position, i.e. unlocked, switched in series, indicator light: red
G10/G12	: magnetic sensors (one each at port and starboard for side locks - counter-pieces to G9/G11) indicate: side lock in closed position, i.e. locked, switched in series, indicator light: green

G 13	: magnetic sensor (only at port side) indicates: bow ramp in closed condition and may be locked, indicator light: green forced follow-up steering bow visor
G14/G16 G18/G20 G22/G24	: magnetic sensors for the locking devices of the bow ramp, each one pair at the upper, middle, and lower sides, switched in series indicate: all 3 pairs of locking devices are unlocked indicator light: red
G15/G17 G19/G21 G23/G25	: magnetic sensors for locking devices of the bow ramp (counter-pieces to above) each pair at the upper, middle, and lower sides, switched in series indicate: all 3 pairs of locking devices are locked indicator light: green

The stern ramps were fitted with identical magnetic sensors which activated control lights on the panels to both sides of the stern ramps. In case a bolt was not fully extended or retracted, i.e. had no contact with the respective sensor/ limit switch, there was no indication at all, i.e. neither green nor red.

#### Control Panels for Bow Visor and Bow Ramp

On the A-deck at port side, directly behind the bow ramp, there was a control panel with the control elements to operate the bow visor and the bow ramp as well as the hydraulic pumps, further, the panel of indicator lights for bow visor and bow ramp was also integrated into this panel. The panel was built into the bulkhead of the port side house and could be closed by 2 doors ([Enclosure 2.6.4.81](#)).

On the panel there were control levers for visor and ramp, each of which was connected to indicator lights, indicating to the operator during the opening/ closing procedure or locking/unlocking procedure in which position the respective part was at the time being. Also the start/stop buttons for the hydraulic pumps together with one control light each were integrated into the panel.

It is of importance for this investigation which indicator lights should be activated at the car deck panel if both visor and ramp were properly closed and locked.

In such condition there had to be 5 green and 1 red indicator lights. These are:

Visor :	green -	Atlantic lock closed
	green -	side locks closed
	green -	visor closed
	red -	parking device open
Ramp:	green -	ramp closed
	green -	all hooks and bolts were properly engaged and closed. (As they were connected "in series" there would be no indication at all if only one of them would have no contact with the sensor).

See also [Enclosure 2.6.4.81](#).

On the **bridge** - integrated into the control panels in front of the wheel house - there was a further panel with indicator lights controlling all hull openings, i.e. visor, bow ramp, stern ramps, pilot and passenger doors. For each opening there were just two indicator lights, one red and one green. The green light would only be shining if the respective opening was closed and locked, i.e. if one sensor had no contact there was no indication at all - neither red nor green.

According to the original electric drawings from the newbuilding phase the sensor system of the Atlantic lock was not connected to the bridge control panel. This was changed, however, in 1991 according to Captain Håkan Karlsson (†) having been master on VIKING SALLY from newbuilding until 1992.

## CHAPTER 3

### OWNERSHIP AND OPERATING HISTORY

#### 3.1 Owners

The vessel was delivered to Rederiaktiebolaget Sally on 29 June 1980 under the name VIKING SALLY and placed in daily operation between Turku and Mariehamn in Finland, and Stockholm.

Rederiaktiebolaget Sally, based in Mariehamn, was at that time one of the major Finnish shipping companies with engagement in tankers and passenger vessels. The company was one of three which together formed the marketing consortium 'Viking Line' for ferry operations between Finland and Sweden (see Subchapter 2.1).

In 1986, ownership of the vessel was taken over by the Finnish/Swedish group Effjohn, owners of the competing Silja Line. The vessel continued, however, to operate in the Viking fleet under the original name. The technical operation was subcontracted with the remaining part of the Sally company.

In April 1990 the Effjohn group took over full operation of the vessel and transferred her to Silja Line under the name SILJA STAR for continued operation between Turku and Stockholm.

In January 1991 the vessel was transferred to the Wasa Line, another subsidiary of the Effjohn group, and was placed in the Wasa Line operation in the Gulf of Bothnia between Vaasa in Finland and Umeå and Sundsvall in Sweden. The ship was then renamed WASA KING. She operated on this route until she was sold to the Estline Marine Company Limited, which is registered in Cyprus.

The ship was under Finnish supervision and flew the Finnish flag from delivery until 14 January 1993.



### 3.2 Operations

#### 3.2.1 Trade and crew

After commissioning, the vessel was placed into a rather tight schedule between Turku - Mariehamn - Stockholm, for example the vessel was operated for the first 10 years as follows:

arrival	Stockholm	07.00 hours	(stern ramps)
departure	Stockholm	08.15 hours	
arrival	Mariehamn	14.20 hours	(depending on car situation either bow or stern ramps)
departure	Mariehamn	14.30 hours	
arrival	Turku	18.30 hours	(bow ramp)
departure	Turku	21.30 hours	

This schedule was only interrupted by stays at the yard, maximum once a year, and during winter time when the vessel stayed one Monday at Turku and the following Monday at Stockholm. These were the only times for maintenance work to be carried out in port, otherwise workers of the Sally owned shipyard in Mariehamn travelled with the vessel and carried out the necessary repairs at sea.

The vessel had two experienced crews consisting mainly of Ålanders having spent their working life on board of car/passenger ferries in the Baltic. The crews relieved each other every 14 days.

The route of VIKING SALLY led through the archipelagos off the Finnish west coast via the Åland Islands crossing 28 nm of open sea to Stockholm, i.e. the vessel was never more than 14 nm from the nearest land.

The two masters basically employed on VIKING SALLY during the time before she was sold were Lars Mäkki (still with Viking Line) and Håkan Karlsson - member of this 'Group of Experts' until his death in March 1997 - whilst Stig Lindström was her chief officer for many years (who passed away in January 1996). Lars Karlsson, the co-ordinator of the owners' newbuilding supervision team at Papenburg, was her first chief engineer and stayed on board in that capacity until 30.03.92, i.e. 91/2 months before she was sold to Estline Marine Company Limited.

The technical superintendent from the time of newbuilding until 1988 was Yngve Röblom, thereafter it was his colleague Lars Janlöv until SILJA STAR became WASA KING, at which time Charles Richardson became responsible for technical matters until she was handed over to Estline Marine Company Limited in mid January 1993.

According to the statements of these three technical superintendents they never had any problems with the vessel.

In the course of this investigation a number of people who had spent a great deal of time on board of or with the vessel have been interviewed by this 'Group of Experts', among others:

Superintendent	Yngve Röblom
Superintendent	Lars Janlöv
Superintendent	Charles Richardson

Captain	Lars Mäkki
Chief officer	Stig Lindström
Chief engineer	Lars Karlsson
1st Engineer	Karl Mattson
Electrician	Dag Märtensson
Electrician	Per Erik Söderlund
Boatswain	Juhani Luttunen
Motorman	Göran Lindström
Repair manager of Turku Shipyard	Ari Puroya

The information obtained on the operation of the vessel is summarised as follows:

- Also at sea the vessel was run all the time on a very tight schedule, i.e. with all 4 main engines constantly at 90% output, unless weather conditions commanded reduction.
- In the engine control room (ECR) there were two output regulators for the main engines which were normally set at 90%. The output of the propulsion plant could be changed from the ECR. The propulsion plant could be run on "Combinator" or on "Constant Revolutions". Except during yard trials in 1980 the "Combinator" mode was always used. Up to 70% output pitch and revolutions were increasing simultaneously until the maximum revolutions were reached. Thereafter the output could be further increased by increasing the pitch while the revolutions remained unchanged.
- It has to be remembered that VIKING SALLY was originally built for traffic within the archipelago. When trading in the open Baltic in heavy seas a tendency of the visor to move sideways was observed which was created by the recess in the shell plating aft of the visor and caused the bow to set-in very heavily. When the vessel was, however, proceeding against head seas the pressure on the visor was in the aft direction. (Force direction is aft.)
- Reduction of speed in heavy head seas is not only a question of reduction of stress on vessel's and visor's structure and fixing points, but also the comfort of passengers has to be taken into account. Lars Karlsson made at least 1000 cruises and more than 100 times reduced the engine output himself in the engine room when he considered it necessary in heavy weather. He did so for the last times in July 1991 when the vessel was already sailing as WASA KING between Vaasa and Umeå/Sundsvall and consequently the vessel arrived once 11/2 hours late and another time 21/2 hours late.
- When the vessel was sailing between Turku and Stockholm there had to be two officers and one AB on the bridge. When she was shifted to the Vaasa/Umeå trade the owners wanted to spare one officer, which was accepted by F.B.N. under the condition that the control panel for the indicator lights for visor and bow ramp were moved to the large operation panel in front of the bridge where the lights could be seen from the seats of master and watch-officer. This was done some time in 1991.
- On the car deck 4 cameras were installed prior to delivery in 1980, i.e. one forward towards the forward ramp, two at the sides and one looking aft towards the stern ramp. The cameras could be moved and also had zoom ability. Monitors were on the bridge (located at port side of the entrance to the chart room) and in the ECR above the instrument panel. The camera picture shown on the monitor could be changed to any other camera, either manually or automatically. The monitors on bridge and in ECR were showing the same picture. The main monitor with operating sticks was in the ECR, i.e. the bridge could not change to another camera nor operate the zoom. Later a further camera was installed at port side of the car deck, but it is unknown where and by whom the pictures were recorded.
- Officers and engineers had their accommodation directly in front of the superstructure overlooking the forecastle deck including the visor.
- The forepeak was more or less always full in order to keep the vessel on even keel. By means of tank No. 1 the trim of the vessel was adjusted depending on the number of trucks. The trim was mostly 0.5 - 1 m by the stern.
- After closing of ramps and visor the hydraulic pumps were always switched off, whereafter a rest pressure remained between cylinders and control lever which slowly decreased within the following 3-4 hours.
- Visor and ramps were exclusively operated by the chief officer and the boatswain.
- Sea watches were maintained at sea and in port.
- Safety rounds were made every 30 minutes on the car deck and below.
- The inside of the visor was only accessible via the entrance hatch on the forecastle part of the visor. There were no lamps installed inside the visor.

### 3.2.2 Seakeeping behaviour

- The vessel was rolling softly in beam sea, but pitching hard in head sea and took over lots of spray water, the speed had to be reduced in time before green water was taken on the forecastle (visor).
- The vessel was reacting sensitively to beam wind, took up quickly permanent heel, e.g. Beaufort 6 - 7 from port side would create a starboard list of 2°- 3°.
- The anchors were sitting tight in the pockets. No banging was heard when the vessel was pitching in head seas.

### 3.2.3 Proceeding through ice

- On the route from Turku to Stockholm ice is usually met more frequently and longer compared to the route Tallinn-Stockholm, because the ice inside the archipelago grows faster and disappears later. If, however, the Gulf of Finland respectively the Baltic is covered by ice the route Tallinn-Stockholm is much more difficult and problematic in comparison to proceeding through ice in the archipelago, because the ice at sea is much heavier and thicker. The ice moves with wind and/or current, ice channels open and close quickly, wind and current press the ice floes together and on top of each other, thereby creating ice barriers of several meters thickness.
- The maximum speed when proceeding at sea through ice should not exceed 7-8 knots, whereby the ice pressure on the visor should always be the decisive factor.
- The risk of sustaining severe damage to the bow area and to the under-water hull, however, is most imminent if the Gulf of Finland and/or the Baltic Sea are jointly partly covered by ice and the bridge is manned by inexperienced navigators. The vessel then quickly picks up speed in free water and subsequently crashes with high speed into ice fields, thereby colliding with thick and solid ice floes.
- Also SOLAS requires the early and substantial reduction of speed near ice according to Chapter V, Regulation 7, a copy of which is attached as Enclosure 3.2.3.82.

### 3.2.4 Wave condition history

In the initial trading area of VIKING SALLY between Turku-Mariehamn-Stockholm the ferry never proceeded more than 14 nm from the nearest land, thus never left sheltered waters. Nevertheless according to Håkan Karlsson, one of the two long-term masters of the ferry, they experienced a couple of times hurricane force winds on the way to the Söderarm entrance when they had to hove-to for the safety of the ferry. Also in her subsequent trading areas in the Gulf of Bothnia between Vaasa and Sundsvall she met rough weather frequently according to her long-term chief engineer Lars Karlsson and the engine output was reduced repeatedly. Upon request of this 'Group of Experts' the Swedish Meteorological and the Hydrological Institute (SMHI) has studied the available weather and wave data to find out how often ESTONIA had met at least the same wind and wave

conditions as she did during the casualty night.

The result is that in the Gulf of Bothnia she has met similar conditions only once, viz. on 19 December 1992. (For details see Subchapter 12.2.)

### 3.3 Boatswain Juhani Luttunen

Juhanni Luttunen had been one of the two boatswains of the vessel from June 1980 to November 1992, while Christer Koivisto had been motorman and "ombudsman" at the same time.

Luttunen, who shot Koivisto on 12 June 1996, was interviewed in the prison of Vaasa by a member of this 'Group of Experts' and has stated the following:

- His function as boatswain in connection with operating the visor/bow ramp was to stand at the control panel.
- He explained the different handles and also the indicator lights. - He remembered clearly the 2 hooks and 4 bolts of the bow ramp as well as the hydraulic side locks, the Atlantic lock, and also explained that they had never engaged the manual side locks.
- At some time probably in 1982 it was realised that the visor was no more closing properly because it was in a misaligned condition athwartships. He thinks that the starboard corner was standing a bit up. It was for this reason that the Atlantic lock bolt could no longer move through the visor lug. The matter was discussed with the engine crew and it was considered what could be done.
- Engine repairman Koivisto considered himself to be the visor expert and offered to rectify the Atlantic lock to the effect that the bolt would fit again. Luttunen remembers that Koivisto was even called back from vacation to do the modification.
- In the presence of Luttunen and motorman Göran Lindström Koivisto cut off the upper part of the lugs of the Atlantic lock and took off the bushings. Thereafter he welded extended parts on the lug remains and the holes in the lugs now looked like an ellipse, the bushings did not fit any more and were left out as still the bolt would not go smoothly through the visor lug, which was extending apparently too much aft or too much forward. In any event Koivisto cut something off the inside of the visor lug, whereby Luttunen is of the opinion that it was from the forward part.

After the repairs were completed they realised at once that it was impossible and decided to contact the inspector ashore. The poor modification was inspected and about one week later Swedish speaking people came from the company von Tell AB, cut off completely all 3 lugs of the Atlantic lock and welded new ones to the A-deck with bushings inserted.

He believes also that it was then realised that there was something wrong with the hydraulic, which was adjusted. The visor lug remained - as far as he remembers - unchanged, i.e. should still be the original.

When the repairs were completed the von Tell people expressly prohibited Koivisto or anybody else on board to ever manipulate the Atlantic lock again.

The complete interview is attached as [Enclosure 3.3.83](#).

The statement of Juhani Luttunen that the Atlantic lock was replaced sometime in 1982/83 by Swedish speaking people, most probably from von Tell AB, was basically confirmed by Captain Håkan Karlsson having been Master of VIKING SALLY, SILJA STAR and WASA KING since commissioning of the vessel in 1980.

**Note:**

Before a respective statement could be drawn up and signed, Håkan Karlsson passed away on 14.03.97 due to cancer.

### 3.4 Surveys, Maintenance, Damage and Repairs

The vessel was maintained by the owners to class satisfaction in line with common practice and requirements. The surveys for maintenance of class were carried out by Bureau Veritas on a continuous five-year timetable for hull and machinery in combination with a schedule of annual surveys. On average, the surveying program involved five to six onboard-survey visits per year which were mainly carried out by the principal surveyor of the BV-Stockholm office, Lars-Olof Alander, who also carried out the Load Line Surveys on behalf of the F.B.N. - see [Enclosure 2.4.3.44.2](#). At this time the visor was kept weathertight and the rubber packings were renewed when required, at least once a year, either by MacGregor, Turku or by the crew - see [Enclosure 3.4.99](#).

The annual drydockings were mostly done at the Turku Repair Yard. Two were at the Valmet Helsinki Yard, one after grounding damage in 1984 and one in 1985 for repair of ice damage and for modification of the stern area of the hull by incorporation of the "duck tail" extension. Two drydockings were made in Stockholm, one in 1985 for repair of a leaking propeller shaft seal and one in 1988 for repair of grounding damage. The damage was surveyed and repaired in drydock following normal practice.

Besides the ice damage in 1985, two other occasions of ice damage were recorded, during the winters of 1982 and 1987.

The drydocking in conjunction with transfer to the Eiffel Group was done in 1990 at the Naantali branch of the Turku Repair Yard. Thereafter the vessel made some trips as SILJA STAR in her initial trade and was then laid-up at the Perno Shipyard outside Turku for some months until the beginning of 1991 when she was put in service on the Vaasa trade. The interior was upgraded and the sound-proofing in the cabin area was improved by building in ca. 85 tons of steel during this time. Thereafter an inclining experiment was performed by Veli-Matti Junilla of Ship Consulting Oy, Turku and a revised "Stability Booklet" issued, which was approved by the F.B.N. (Edelmann) on 20.01.91 and is attached as [Enclosure 3.4.86](#).

In detail:

**(1) Surveys/Inspections**

(a) By Bureau Veritas (B.V.)

- The B.V. organisation in Sweden/Finland: head office for Sweden was and is Gothenburg, manager: Hans Olsson, (until 9/98) Stock-holm and Trelleborg/Malmö report to Gothenburg, Gothenburg reports to Paris. B.V.'s office for Finland was and is in Helsinki. As of 1990 a head office for the northern countries was established in Copenhagen without any change in the reporting procedure.
- The vessel participated in the Continuous Survey program for hull and machinery incl. AUT, i.e. in total 1500 items had to be surveyed over a period of 5 years, i.e. 300 items every year.
- B.V. also carried out Load Line Surveys for F.B.N. which consisted of surveys respectively

- determining the condition of all closing appliances, e.g. those on car deck: doors, staircases, scuppers, valves, etc.
- visor/ bow ramp: rubber sealings.

The B.V. Report Form did not include the visor, but watertightness of the closed and locked visor was to be established by hose-testing as part of the Load Line Survey.

According to the opinion of the previous principal surveyor of the BV-Stockholm office, Lars-Olof Alander, it was clear to everyone in the field and in the offices that the bow ramp on all older ferries would not fulfil the SOLAS Regulation 10 requirement as upper extension of the collision bulkhead. However, it was not and is not the field surveyor's business to criticise this design characteristic - evidently approved by the head office - see [Enclosure 2.4.3.44.2](#).

**Note:** This is only correct as long as the surveyor is acting on behalf of the class but not if he is acting on behalf of the National Maritime Administration.

Attached as [Enclosure 3.4.87](#) is a summary of B.V. inspections while the ferry was flying the Finnish flag.

- B.V. surveyors experienced the following in the course of time that the vessel sailed under Finnish flag:

- on repeated occasions the visor was closed with locking devices already in closed position. This led to damages to lugs and bolts (also on DIANA II where the Atlantic lock bolt was changed to a high tensile steel bolt).
- Handling of the visor and ramp always belonged to the chief officer's duties on Swedish/Finnish ferries (on ESTONIA it was the boatwain's duty).
- When the vessel went to Finboda/Stockholm BV-Stockholm took care, if she went to Wärtsilä/Turku or Naantali it was the job of BV-Helsinki.

- According to Lars-Olof Ålander the locking devices and sensors of the bow visor and the bow ramp were always considered to be class items and not the responsibility of F.B.N.

**Note:** This is in direct contradiction to the explanations of BV-lawyer Bengt-Åke Johnson on page 61 where he stated that locking devices were not the responsibility of B.V.

- All electrical systems were subjected to annual megger testing, therefore also the sensors of the bow visor locking devices should have been megger tested once a year.
- The correct functioning of sensors/indicator lights are a pre-condition for the seaworthiness of the vessel. (This was confirmed by the B.V. head office Paris.)
- The manual locking devices of the bow visor were "heavy weather securities" which had to be applied when heavy weather was forecasted.

#### (b) Inspections by the Maritime Administration - F.B.N.

- The organisation of F.B.N. has already been explained in Subchapter 2.4.4. Reportedly it did not change very much during the following years. The role of the F.B.N. (and also Sjöfartsverket) Ship Safety Inspectors, whilst it was trading under Finnish flag, was basically to

- Examine all certificates
- Inspect social rooms/cabins/pasenger accommodations
- Inspect lifesaving and fire-fighting equipment
- Inspect navigation instruments
- Issue (PSSC) Passenger Ship Safety Certificate annually), and thereby confirming that the vessel meets SOLAS requirements.

As long as the vessel remained under Finnish flag and thus under the responsibility and supervision of the F.B.N. periodical inspections were apparently carried out every 3 months by F.B.N. inspectors, as can be seen from the attached extract of the control file together with inspection certificate and inspection report issued by F.B.N. ([Enclosure 3.4.88](#) together with translation). Every year a new PSSC was issued, sometimes just by changing the dates on the previous one.

In any event, the vessel never did create problems from the point of view of the F.B.N. They were not informed by the owners when she was sold. According to the F.B.N. there was no exchange of information/documentation with B.V. before, during or after take-over by the Estonians, because they became aware of the flag and name change only when WASA KING was deleted from the Finnish Register (information H. Valkonen).

#### (2) Maintenance

- In principle, the vessel was drydocked every second year, but during the intervals the bottom, the rudders and the propellers were inspected and, if necessary, cleaned by divers.
- The hull was at first painted red (VIKING SALLY), subsequently white (SILJA STAR and WASA KING), the underwater ship including the bootop area was coated with INERTA ice-resistant paint - blue. For details reference is made to [Enclosure 3.4.89](#).
- The moving parts of bow visor and bow ramp including the locking devices and hydraulic cylinders (actuators) were checked weekly and greased monthly. General maintenance and necessary repairs were carried out by MacGregor, Turku.
- Occasionally hydraulic pressure hoses and packings were renewed, cracks in the mountings of the lifting cylinders of the bow visor were re-welded by the crew (information: Yngve Röblom, Lars Karlsson), the pockets for the securing bolts of the bow ramp were strengthened by the crew (information: Lars Karlsson).
- According to the boatswain Juhani Luttunen already in 1982 it was noted that the visor was slightly misaligned, i.e. the starboard side stood up by about 1 cm. This resulted in a misalignment of the Atlantic lock arrangement and hence the bolt did not fit anymore. To rectify this, motorman Koivisto changed the position of the lugs on the forepeak deck and also modified the visor lug, but in such a miserable manner that the lugs on the forepeak deck had to be completely renewed. This was done by von Tell AB, Gothenburg. For details see Subchapter 3.3 and [Enclosure 3.3.83](#) - Interview Juhani Luttunen.
- As stated above the vessel was, in principle, drydocked every second year, but due to repeated problems with the Cedarvall stern tube seals she had to be drydocked during the intervals to repair these seals. From 1987 onwards the owners' specifications for all dockings, the quotations of the yard and the final repair invoices of the yard, which since that time was always Turku Shipyard, Turku, are available to this 'Group of Experts'. According to the records of International Paint, the suppliers of Inerta Ice Resistant Paint, the vessel was also drydocked in May 1985 at Valmet Shipyard/Helsinki, where the duck tail was fitted. These records are attached as [Enclosure 3.4.89](#).

#### Furthermore:

- Invoice Turku Shipyard dated 19.10.87 covering the yard time from 12.-23.01.87 - [Enclosure 3.4.90](#):

- Installation of 1 hydraulic valve between heeling tanks 13/14
- rubber packings of visor and both stern ramps renewed, in total 22 m.

- Invoice Turku Shipyard dated 07.10.87 covering the yard time from 06.-08.04.87 - [Enclosure 3.4.91](#):

- Repairs of Cedarvall stern tube seals
- renewal of the lower part of the bow ramp by two 18 mm thick plates, viz. 1280 x 4800 mm and 2900 x 3250 mm.

- Invoice Turku Shipyard dated 12.12.88 covering the yard time from 12.-16.09.88 - [Enclosure 3.4.92](#):

- Renewal of 6 m of walking platform on the car deck near the engine room entrance.

- Invoice Turku Shipyard dated 22.06.89 covering the yard time from 02.-03.05.88 - [Enclosure 3.4.93](#).

- Invoice Turku Repair Yard dated 02.10.90 covering the yard time from 30.04.-07.05.90 - [Enclosure 3.4.94](#):

- change of name to SILJA STAR
- cleaning of visor inside and painting white.

- Invoice Turku Repair Yard dated 01.02.91 covering the yard time from 20.-23.11.90 - [Enclosure 3.4.95](#):

- change of name to WASA KING and home port to Vaasa.

- After a strong ice-winter, probably in 1985/86, at sea water was noted in the visor up to the outside water level. As it turned out that this condition did not improve notably after renewal of the rubber packings and that the water caused a short-circuit in the mechanical sensors of the Atlantic lock, which also affected other installations on the car deck, the mechanical sensors were replaced by watertight magnetic limit switches.

Lars Karlsson - chief engineer of the vessel for 12 years - stated in respect of **rubber packings** and the exchange of the **mechanical sensors to magnetic limit switches** the following:

»The rubber packings of the visor were changed once a year. The packings were mainly damaged on A-deck and ca. 1 m upwards the front bulkheads because the final movement before closure is backwards - not downwards - which destroys the packings due to the rubbing effect. Therefore we did put grease (same as used for the hinges) on the packings and it became better.

At some time, probably after the strong ice winter 1986/87, we increasingly had problems with electrical failures, short circuits, etc. with the sensors for the indicator lights of the Atlantic lock. So I checked with other vessels, e.g. VIKING SONG and VIKING SAGA and also the market, and finally bought rather expensive magnetic limit switches, which were installed by electrician Sjögren and we never had problems again. I have been many times with B.V. surveyor Lars-Olof Ålander inside the closed visor when water or light test was made during Load Line survey. I believe that at the same time also the indicator lights were checked.«

The statement of Lars Karlsson is attached as Enclosure 2.4.5.60.

According to information obtained from Håkan Karlsson/Charles Richardson the rubber packings in way of visor and bow ramp were last renewed by the crew during the lay-up time end of 1990/beginning 1991 before SILJA STAR was renamed WASA KING and nothing was done thereafter until the sale in mid January 1993. Consequently at the time of the take-over the same rubber packings, respectively their remains, were in place which had been renewed at the end of 1990. Therefore the last Finnish crew, when preparing the next yard time scheduled for January 1993, had asked for renewal of 15 m of rubber packing in way of the visor and 10 m in way of the bow ramp.

- In winter it was frequently very difficult to open the frozen visor despite the two ice-cylinders assisting the opening procedure. Lars Karlsson reports in this respect:

*»In winter we had problems to open the visor.*

*It is easy to increase the pressure by just turning a wheel at the hydraulic pump (axial piston pump - make: Vickers). There was a lock nut to regulate the pressure. In case of difficulties to open the visor, e.g. due to it being frozen, it is the easiest thing to increase the hydraulic pressure.«* (Statement Lars Karlsson - Enclosure 2.4.5.60.)

- The lower parts of the visor were subject to considerable wear, i.e. from the outside due to ice contact and from the inside due to the continuous change between seawater/air as well as additionally to the "sloshing effect" caused by the water moving forward/aft and side to side, comparable to a partly filled tank. The outside was coated with ice-resistant paint (Enclosure 3.4.89) which could be renewed only during the annual overhaul at the yard. Therefore the ice damaged parts of the coating were painted over with normal blue paint at the end of the ice season. As the lower part of the visor was difficult to access the electrical blocking between visor and bow ramp was manipulated by the electrician in such a way that the visor could be lowered whilst the bow ramp was open. Thus the bottom and lower part of visor were accessible for maintenance work. According to Håkan Karlsson during the time as VIKING SALLY little or no maintenance work was carried out on the visor inside. Lars Karlsson:

*»Although it should be impossible due to the electrical system the visor can be closed if the ramp is open when the valves are operated manually. In case the rails of the ramp should be deformed this is due to the lowered down visor for working purposes.«*

**Note:** The rails of the bow ramp were indented.

- In respect of routine inspection Lars Karlsson reports:

*»After every stormy cruise I inspected all the parts in the bow area. Four times a year I inspected in detail all safety relevant parts. This included visual inspection of the visor hinges, its weldings, etc. and also the inside of the visor including locking devices and its welding seams.*

*During one such inspection I found cracks in way of the foundations of the hydraulic cylinders for the bow ramp bolts which were of fatigue nature and not due to overload. We welded strengthening plates to the foundations to stop the crack development.*

*Probably in 1990 we had to change the spherical bearing of the port lifting cylinder and after that experienced twice that the Nirosta bolt of the port visor hinges broke the outer securing plate screws and moved out by ca. 1 cm. This was noted by the deck officer being on forecastle deck for berthing because he found the broken off screws. The bolt was hammered back into position, the screw holes in the steel bushing drilled out and the securing plate refitted. If it would have happened again we would have investigated the cause, however, during my time, it did not occur again.*

*We never had greasing problems. Once per month grease was pressed into the bolts.*

*I have never seen the bolts out.«* (Statement Lars Karlsson - Enclosure 2.4.5.60.)

- All 3 hydraulic pumps broke down one after the other (normal pressure 185 bar, which was apparently not enough). Stronger pumps were built in and operated at 240 bar pressure. The 2 big pumps could produce 400 bar pressure, whilst the smaller one could produce 280 bar.

- There were valves directly at the lifting cylinders of the visor by means of which the speed of the oil flow could be regulated. This had to be absolutely identical on both sides, otherwise one side would open or close faster than the other side and the visor would get out of alignment. These regulating valves were fitted at the outside of the lifting cylinders at their lower side, i.e. at B-deck level (see Enclosure 2.6.4.79.)

- Before it was known on board that the vessel would be sold the mates and engineers drew up the repair specification, i.e. what they considered necessary to be repaired during the next scheduled yard time in January 1993. (The vessel had last been in the Yard in January 1991.) The copy received from Turku Repair Yard after the first Stockholm Exhibition in August 1997 was typed in Swedish with handwritten remarks and quoted prices in Finnish. The date "25.09.92" is handwritten on page 1 as well as the Finnish words "Telakointi Turussa" which means "Docking in Turku". The repair items start with 1. and ends with 65.26 whereafter 6 items are specified under the heading "Sundry", which read - office translated - as follows:

70.22 Stern ramps' locking devices to be serviced and strengthened; 71.22 Stern ramps hinges to be overhauled and new bushings;

72.22 Bow ramp and visor, locking devices to be serviced and strengthened;

73.22 Bow ramp, hinges to be overhauled and possibly new bushings;

74.22 Visor: 15 m rubber packings to be renewed and bow ramp: 10 m to be renewed;

75.22 12 wires on the car deck shelves to be renewed.

Prices are added in handwriting behind all items except for 72.22, where it is stated:

*"Price shall be quoted after inspections."*

The complete specification (15 pages) is attached as Enclosure 3.4.96. Subsequently probably the Yard typed the "M/S WASA KING - Docking Inspection 1993" - attached as Enclosure 3.4.97 - in Swedish - which contained under "Sundry" still the same wording and number of items. Since such work was not intended to be carried out by the yard but by the owners' contractor MacGregor, Turku, this company was requested to quote on items 70.22 to 75.22. A respective quotation was submitted by MacGregor, which is attached - with office translation - as Enclosure 3.4.98. The items on this quotation remain unchanged until item 72.22, which reads in "Ship Specification" - Enclosure 3.4.96 - and in the subsequent "Docking Specification" - Enclosure 3.4.97.

**72.22 Bow ramp and visor, locking devices to be serviced and strengthened, but in the MacGregor quotations**

**72.22 Bow ramp, exchange of end hinge bushings and axles (bolts); and the following items:**

**73.22 which initially referred to the hinges of the bow ramp now read "bow visor, exchange of 15 m and bow ramp of 10 m rubber sealing gasket", which was initially item 74.22, and item**

**74.22 became what had initially been item 75.22 - "the replacement of wires on car deck".**

The **"servicing and strengthening of the locking devices of the visor and bow ramp"** disappeared and is not mentioned in the MacGregor quotation at all.

The employee in charge of repair and maintenance work to the ferries in the area, Tarmo Mäkki, had been dealing among other things with VIKING SALLY, SILJA STAR, WASA KING since the guarantee period had expired sometime in 1982. He was questioned after the ESTONIA casualty by the criminal police, Turku in the presence of Dr. Tuomo Karppinen of the Finnish part of the JAIC and mentioned nothing whatsoever about the above repair specification and his own quotation - possibly because he was not asked. His office translated statement is attached as Enclosure 3.4.99.

There is another copy of the MacGregor quotation available which was found in the files of the Finnish part of the JAIC. The copy is identical to the above-mentioned one, however, item 72.22 has an asterix under which is handwritten in the bottom left corner in Swedish: "The bow ramp's end hinge bearings and hinge bolts have to be replaced." This copy is attached as Enclosure 3.4.100.

This means that the owners (Wasa Line) were then of the opinion that the port and starboard outer hinge bearings including bolts were in September 1992 in such a bad condition that replacement was necessary. Actually absolutely nothing was done to these hinges up to the sinking of the ESTONIA nor was evidently anything done to rectify the other items mentioned under "Sundry" in the initial repair specification. According to the Turku Repair Yard and the two attached invoices No. 31554 to Wasa Line - Enclosure 3.4.102 - and 31575 to Nordström & Thulin - Enclosure 3.4.103 - all the work carried out during the yard time in January 1993 and none of the items 70.22-75.22 stated under "Sundry" in the initial repair specification can indeed be found in these invoices.

**Note:**

According to the statement of chief officer Stig Lindström ((January 1996), the owners had to strengthen one of the locking devices of the visor already sometime before. This was therefore now the second time that the mates and the engineers having sailed on this vessel for many years were asking for the locking devices of visor and bow ramp to be strengthened. The complete statement of Stig Lindström is attached as Enclosure 3.4.101.

Also Lars Karlsson has reported in his statement (Enclosure 2.4.5.60.) that they had to strengthen the locking devices of the bow ramp.

### (3) Reported damage and repairs

- Groundings in Åland archipelago in May 1984 and near Stockholm in November 1988 (source: Lloyd's List) caused heavy bottom damage.
- In the course of the severe ice winter 1985/86 the lower part of the visor was damaged in way of the non ice-strengthened area. Repairs were carried out by the Wärtsilä yard at Turku when the vessel was in drydock with the visor closed (Enclosure 3.4.104 - photo showing bow area). Owners took the opportunity to have the renewed plating of the 1st strake above the ice-strengthened part increased to 20 mm. Survey reports, repair invoices, and damage photos are available at Ålandia Insurance Company, Mariehamn. According to B.V. these repairs respectively strengthenings are the only ones ever reported to them in respect of the visor and bow ramp with hinges and locking devices.
- Various damages ascertained at the pre-entry condition surveys performed on behalf of the new Hull and P&I underwriters by a surveyor of Trygg Hansa, Stockholm, on 15/16.01.93 and 21/22.03.93 and which are listed in the "Summary of the Pre-Entry Condition Survey" attached as Enclosure 3.4.105 were apparently never repaired.

## CHAPTER 4

### A SHIP EMANATING FROM THE BALTIC PHENOMENON

The attached report - made up by ADC Support AB, Stockholm on request of the JAIC - contains a historical overview of the ferry traffic between Finland and Sweden with the rapidly growing number of passengers as well as of cars/trucks and the rapidly growing ferries.

The VIKING SALLY, designed and constructed to cope with this fast development - called "The Baltic Phenomenon" - was considered the trend-setter when she took up service in the early 1980's with Viking Line. The effect of competition between the two main operators in these trades, i.e. Silja and Viking, on the design and construction of the ever growing ferries, and even on the safety philosophy of the two operators, is clearly outlined.

Also the development between 1959 and 1993 of the visor with ramp house construction - called "garage" in the report - in comparison to other visor constructions and bow doors on Silja and Viking Line ferries was examined in the report. The result is that Silja commissioned 25 ferries during these 34 years, of which 7 were fitted with a visor/ramp house construction, the last ones being the FINLANDIA and SILJA REGINA commissioned in 1981. Viking Line did bring 41 ferries into service, of which 27 had a visor/ramp house construction, the last ones being the OLYMPIA in 1986 (sailing in P&O charter as PRIDE OF BILBAO between Southampton and Bilbao/Spain since her sale) and ALANDFÄRJAN in 1987. This demonstrates that it was absolutely common in those years, and in conformity with the state-of-the-art, to apply this construction - bow ramp extending into a ramp house which was part of the visor.

The report further discusses the safety culture existing for decades within the Silja and Viking organisations and on the basis of which the "ships" navigation and operation at sea was not considered to be a main "risk factor" as the long-term experience had proved.

The collective record of Silja and Viking Lines from 1960 to 1995 is five killed passengers on 107 million passenger single trips, i.e. one casualty per almost 18 million single trips. Moreover, these 5 passengers were killed in one collision in a narrow fairway.

As to ESTONIA's crew recruited exclusively from ESCO staff, the author indicates by means of comparison between the power/breadth ratios of the Silja/Viking ferries in 1993, which was between 700-1000 kW/m and the ESCO vessels at the same time, which was between 100-300 kW/m except for GEORG OTTS being 600 kW/m, that the ESTONIA crew might not have had sufficient experience to handle the vessel competently.

The report has been prepared by the Naval Architect Hans Wermelin, thus from the point of view of a naval architect based on his knowledge at the end of 1995. Consequently it ends with the following remarks:

»This overview with the explanations of the work with safety is contrasting to the Estonia catastrophe. The reason is that until this happened the design philosophy was that big volumes of water should not enter into cargo deck when the ship was properly closed at sea. When the catastrophe showed this was a false philosophy an intensive work started to make these ships safe regardless of water on cargo deck. In fact this work was already started after the catastrophe with the Herald of Free Enterprise. Thus the latest purposely built ships in the trade manage to carry a lot of water on the cargo deck: M/S Silja Symphony and M/S Silja Serenade manage one meter and M/S Silja Europa has to sink before she capsizes.«

The Report is attached as Enclosure 4.106.

## II NORDSTRÖM & THULIN AND THE STOCKHOLM-TALLINN SERVICE

### CHAPTER 5

#### THE HISTORICAL DEVELOPMENT

Nordström & Thulin AB is a Stockholm-based public company, established in 1850, with extensive experience in the worldwide operation of large modern tankers and bulk carriers. Also passenger ferry operations between the Swedish mainland and the island of Gotland in the Baltic Sea belonged to the business and shipbroking is another important company activity.

In the light of the changes in the Soviet Union in 1988 the Board of Nordström & Thulin (N&T) decided to investigate the possibilities for a car/ passenger service between Stockholm and Tallinn and in early spring 1989 Hans Laidwa, a born Estonian, took up his work.

Laidwa's business was to investigate the possibilities of opening a ferry traffic between Stockholm and Tallinn. N&T's plans had a positive response in Stockholm and Tallinn, but the decisions - as far as Estonia was concerned - at that time were still being made in Moscow. The Soviet authorities would among other things have to tolerate that passengers on short cruises to Tallinn would not need visas, which was finally accepted.

N&T received the exclusive right for the passenger traffic between Tallinn and Stockholm from the Estonian side for a guaranteed period of 10 years. This was necessary for the long-term planning of investments, because N&T had to take care of all investments in vessels, in terminals and project preparations and also to conduct the ferry line with own personnel.

For the new activities N&T formed the company N&T Estline AB, and appointed Hans Laidwa its managing director. The Danish passenger ferry MV DANA REGINA, which for many years had been employed in the traffic between Copenhagen and Oslo, was purchased, renamed NORD ESTONIA and put under Swedish flag. The ferry left Stockholm on 16 June 1990 on her historical first tour and a very euphoric summer was commenced. The picture of the city of Tallinn was changing and many of the Soviet restrictions were breaking down through the influence of the numerous tourists visiting the city. The first song festival after 50 years took place without approval from Moscow and it was the first time in 50 years that people from all over Estonia could meet friends and relatives from other parts of the country.

After the summer of 1990 a difficult time began, and with the darkness and cold of winter came harder political signals which culminated in the bloody events in Vilnius and Riga in January 1991 and also the Estonians were prepared to build barricades and to fight for their independence.

To this dark picture also contributed the murder of two Swedish union leaders in Tallinn. MV NORD ESTONIA was more or less sailing empty during the winter and spring of 1991, a situation which only gradually changed in the less than 2 years that the NORD ESTONIA would remain in this service.

## 5.1 Company Structure and Activities

N&T is one of the oldest shipping companies in Sweden and is noted on the Stockholm Exchange. The office is located at Skeppsbron in the old City of Stockholm, where ca. 50 people were working.

The main activities in 1994 were

Shipping  
Sales & Purchase  
Broking and Chartering

with the main activities being concentrated on broking and sales & purchases.

The management in 1994 consisted of

Ronald Bergmann,	the senior manager and simultaneously majority shareholder
Anders Berg,	the number 2
Sten-Christer Forsberg,	the technician within the management and director of the Shipping Department
Lennart Ökvist,	Finance

Details can be taken from the company structure attached as [Enclosure 5.1.107](#).

## 5.2 The Relevant Staff and AB Hornet

The Director of the Shipping Department - Rederi Afdeling - was, and still is, Sten-Christer Forsberg, born in 1945. His CV is attached as [Enclosure 5.2.108](#). He was practically the Fleet Manager directly responsible to the Managing Director Ronald Bergmann. Forsberg had worked together with Börje Stenström († 2/1997), then the head of the Technical Group of the JAIC, and Kaj Janérus, then the General Director of Sjöfartsverket, some years ago for the Salén Group. In relation to the NORD ESTONIA and the ESTONIA the next one in the line of responsibility was Ulf Hobro, born in 1948 (CV see [Enclosure 5.2.109](#)), employed by N&T as marine superintendent since mid 1990, i.e. after the NORD ESTONIA had taken up her service to Tallinn. Hobro had been employed as safety inspector with Sjöfartsverket before he had joined this organisation after having sailed as 1st engineer and chief engineer with Rederi AB Gotland on the large car/passenger ferries

Gotland - 1973-1978  
Gute - 1978-1979  
Visby - 1980-1987

trading between Visby on Gotland and Nynäshamn south of Stockholm.

On 12 November 1973 - when Hobro was sailing as 1st engineer on the GOTLAND for the same owners and in the same trade - the VISBY suffered serious failure of the locking devices of her bow door on way from Nynäshamn to Visby and returned to Nynäshamn due to water on the car deck. Rederi AB Gotland was taken over by N&T in 1988 and Hans Laidwa, who later built up the Stockholm-Tallinn service, became managing director. Several years ago the VISBY was sold to the Larvik Line and has been sailing ever since between Larvik and Frederikshavn as the PETER WESSEL. When the name DANA REGINA was changed to NORD ESTONIA and the flag from Danish to Swedish, Ulf Hobro was still employed with Sjöfartsverket and was the responsible safety inspector controlling all the many new requirements following the change from Danish to Swedish flag.

**Note:**

Although also DANA REGINA respectively NORD ESTONIA had no upper extension of the collision bulkhead above bulkhead deck at the location required by SOLAS and, although, she proceeded more than 20 nm off the nearest land in the course of her route between Stockholm and Tallinn, Sjöfartsverket issued and annually renewed an unrestricted PSSC, thereby confirming that she did comply with SOLAS 1974, the same as B.V. had done for the ESTONIA on behalf of the Estonian National Maritime Board (E.N.M.B.).

S.-C.Forsberg explained his organisation in a letter to the criminal police Stockholm dated 01.11.1994 as follows:

»Internal Organisation  
The shipping department deals with the following functions:  
- operation  
- seagoing personnel  
- technical inspection  
- insurance.

In the shipping department we also deal with such external management contracts as the one which referred to the ESTONIA. We also have similar contracts with OK Petroleum and Neste Oy. Ulf Hobro, technical superintendent, and Lennart Klevberg, in charge of the purchase of spare parts, are employed with the shipping department Operation & Technique. The shipping department of N&T has also engaged personnel from the independent entity Rederi AB Hornet, e.g. for technical follow-up work on board. This situation is not unusual. In the shipping business it is more the rule than the exception that part of owners' employees are engaged from ship management companies. The idea is that certain entities become specialised with vast experience and knowledge and take over the activities which otherwise the shipping company employees themselves would have carried out.«

The full wording of the letter together with a translation is attached as [Enclosure 5.2.110](#).

This was the situation within N&T when in the early summer of 1992 the decision was made to replace the Swedish flag/Swedish crew NORD ESTONIA by a larger but cheaper ferry. Some time later the WASA KING was picked out to be the successor, however, under Estonian flag with Estonian crew.

### 5.3 The NORD ESTONIA - Captain Per Ringhagen

In January 1990 Captain Per Ringhagen joined Estline AB Stockholm together with his colleague Captain Sten Levander. Both were employed as masters for the Swedish flagged car/passenger ferry NORD ESTONIA ex DANA REGINA.

At that time Nordström & Thulin (N&T) owned 90% of Estline AB, Stockholm, whilst 10% were owned by the Estonian government owned transport company Tallinn Autobussi Kondis and by the Ministry of Transport. In Tallinn there was also a company registered by the name of Estline EESTI which, however, was owned 90% by the above-mentioned Estonian share-holders and only 10% by N&T.

During the first 4-5 months of their employment with Estline, Stockholm it was the primary task of the two captains to

- 1.) organise terminal and berthing facilities in Tallinn;
- 2.) select and employ two complete crews;
- 3.) develop safety and other manuals for the ship.

as to 1)

They had selected and assisted in the construction of the Ro-Ro berth in the port of Tallinn where at first NORD ESTONIA, subsequently ESTONIA were and now MARE BALICUM is berthing. At that time Estonia was still under Russian Regime, but they had an excellent co-operation with Estline and the Terminal employees.

as to 2)

They had some rooms in the N&T office in Stockholm where they were working with the senior staff employed first, i.e. officers, engineers, and catering. The chief officers also came from Silja. They were Karl Karel (stayed with N&T as nautical adviser on ESTONIA and subsequently MARE BALICUM, now probably superintendent) and Kjell Kereby (now sailing on Norwegian tankers). The 2nd officers were Nils Wigström, Karl Rosen, Juri Aavik, Christian Nordström. Juri Aavik succeeded Anders Andersson as nautical adviser on the ESTONIA was on board during the casualty voyage and did not survive. One of the engineers was Per Erik Kjellström. He sailed as chief engineer on NORD ESTONIA until she was finally sold as THOR HEYERDAHL. He is now probably technical inspector for MARE BALICUM.

as to 3)

They developed completely new safety plans and all other arrangements necessary to operate a car/passenger ferry of the NORD ESTONIA dimension between 2 countries, one of which then still being ruled by the USSR. They had absolutely no support from the owning company N&T.

The decision to buy DANA REGINA was made by N&T already in October 1989, i.e. long time before Per Ringhagen came into the picture.

After the take-over of the DANA REGINA, in March 1990, the vessel was shifted to Cityvarvet, Gothenburg, where she stayed for several weeks.

Substantial changes were effected, among other things, the bridge layout was changed to the effect that the vessel could be operated on the co-pilot system. The bridge had open wings.

From N&T Sten-Christer Forsberg was in Gothenburg more or less all the time together with Ulf Hobro, then safety inspector employed by Sjöfartsverket and subsequently responsible for the ESTONIA.

The most important changes were made in respect of fire-fighting and smoke detection (this was only couple of months after the SCANDINAVIAN STAR disaster and the maritime authorities were very sensitive). Both crews were on board at Gothenburg and trained in fire-fighting, escape, etc. The ship had to pass numerous safety inspections by Sjöfartsverket in order to get the new PSSC. At sea between Gothenburg and Stockholm lifeboat and fire-fighting drills and evacuation exercises were carried out.

In Stockholm the owners obtained the new PSSC confirming that the vessel complied with SOLAS 1974 without any exemption, although it was known to Sjöfartsverket that she would trade between Stockholm and Tallinn, i.e. more than 20 nm from the nearest land and she did not have the upper extension of the collision bulkhead in a position as required by SOLAS.

**Note:**

*According to Captain Ringhagen this had also been the case with one of his previous employments, the car/passenger ferry SVEA CORONA. This vessel was subsequently transferred to the US west coast and renamed SUNDANCER. After arrival in the first US port the vessel was at once inspected quite carefully by the US Coast Guard in accordance with Port State Control Regulations. It was immediately discovered that the ferry did not have a properly located upper extension of the collision bulkhead above bulkhead deck and have a "partial collision door" at the location required by SOLAS 1974, had to be installed before the ferry received permission to commence trading with US passengers.*

N&T went through the rather costly and lengthy procedure of fulfilling all requirements of Sjöfartsverket to obtain the new PSSC and to change to Swedish flag. As stated it was Ulf Hobro, who as responsible Sjöfartsverket inspector, confirmed that the vessel complied with SOLAS 1974, although she did not. DANA REGINA was renamed NORD ESTONIA, commenced trading on 16.06.1990 between Stockholm and Tallinn and stayed in this service until the beginning of February 1993 when she was replaced by the ESTONIA.

It was not possible for this 'Group of Experts' to obtain information from N&T and/or ESCO masters/officers about the practical aspects of berthing/unberthing in Tallinn and Stockholm as well as proceeding through the Stockholm archipelago/dealing with pilots, tugs, etc. Therefore the respective experience gained by the NORD ESTONIA as stated by Captain Per Ringhagen, shall be outlined as follows:

**(a) at Stockholm:**

- Frihamn Terminal, starboard side to berth,
- loading/discharging via stern ramps;
- anchor use only in emergency cases - no tugs;
- masters and officers had pilot licenses for all entrances to Stockholm, so they never used pilots; (this was different on ESTONIA);
- speed inside archipelago: max. 12 kn, in certain areas down to 6 or 8 kn;
- average time to Sandhamn 31/2 hours, average time to Söderarm 41/2 hours;
- in bad weather the Söderarm entrance was always used, because the vessel was one hour more in the shelter of the archipelago and also because the Sandhamn entrance is difficult in winds of more than 15 m/sec from W-ly directions;
- Silja had a restriction of 15 m/sec. for Sandhamn, if the wind exceeded the restriction the ferries had to go through Söderarm, the Sandhamn entrance is very difficult being in SW / W-ly winds (lee coast);
- in good weather they always went via Sandhamn because the sea distance is almost the same and the time inside the archipelago is one hour shorter;
- from time to time they went via Söderarm in order not to forget the fairway lights, etc.;
- after having entered the archipelago via Söderarm the ferries can remain on full speed the 1st hour.

**(b) at Sea:**

- The ferries were using the same track eastbound as well as westbound including the waypoint at approximately 59°20'N; 22°02'E.
- They met 25/28 m/sec. and more winds several times and the vessel arrived with several hours delay. Experience has shown that the Baltic is more aggressive, i.e. has shorter, steeper seas than the Kattegatt or North Sea.
- On such voyages, with respective wind and seas from ahead, the speed was generally reduced to 8-10 kn maximum.

**(c) Tallinn is a tricky port**

- they occasionally used tug boats in Tallinn, but always had to take pilots;

- because discharging/loading was exclusively done via the bow ramp the vessel always entered bow first, which was the easiest way, and berthed with the starboard side to shore;
  - the port is vulnerable to winds from directions between NNE - NNW, because the vessel then has to pass the breakwater with stern wind respectively wind on the port or starboard quarters, i.e. with relatively high speed to maintain steerageway, however, with a rather short stopping distance ahead;
- Note:** It was probably on such occasions that ESTONIA used the port anchor to reduce speed.
- the port authorities promised to keep the opposite berth empty to give the vessel more space to manoeuvre, which promise, however, was mostly not fulfilled;
  - the pilots had to be taken in and out - there were 6 licensed pilots to take NORD ESTONIA in/out, but only 2 had the experience to do it successfully;
  - upon departure there were two possibilities depending on wind direction/force:
    - if wind up to 15 m/sec. the vessel was turned inside the basin (which was always the wish of the pilots);
    - otherwise they proceeded stern first through the breakwater into the bay for some 3-4 ships length and then turned the vessel on westbound course.

- Whenever it was forecasted that on a voyage to Stockholm S or SW-ly winds would be met, i.e. from the port side, the heavier trucks were stowed at port side to have from the beginning a sort of counter weight to the wind pressure. Of course, this counter weight always had to be within controllable limits.
- Whenever the ship was alongside ca. 15 workers for the deck and another 15 for the engine department came on board. In the engine room they were basically working to keep it clean. On deck they did maintenance work like chiselling rust, painting, greasing, cleaning car deck, practically sailor's work. They had one foreman who worked under the instructions of chief officer and chief engineer.

Further details might be taken from the complete statement of Captain Per Ringhagen which is attached as [Enclosure 5.3.111](#).

### III UNDER ESTONIAN FLAG CHAPTER 6 THE NEW OWNERS / MANAGERS AND THE TAKE-OVER

#### 6.1 Owning and Managing Companies

Already in October 1992 the formalities to buy the WASA KING ex VIKING SALLY were finalised and the decision made, to operate the vessel under Estonian flag with Estonian crew. Since the Estonian Ships Register was not accepted by the mortgagee banks, the vessel had to be registered with one of the acknowledged Ships Registers and Cyprus was selected. To permit an additional entry in the Estonian Bareboat Register - condition to fly the Estonian flag and to employ Estonian crew - the structure of owning/operating/managing companies as below stated was created.

MV ESTONIA was owned by the Cyprus company Estline Marine Company Ltd. The shares of this company were owned 50% by Estonian Shipping Company (ESCO) and 50% by Nordthulin Luxembourg S.A., which is a wholly owned daughter company of Nordström & Thulin AB (N&T), Stockholm, whilst ESCO was owned by the Estonian Government. The vessel was registered in Cyprus with permission for parallel registry in Estonia on the basis of a bareboat charter party.

The reason for the vessel being registered in Cyprus was - as said before - the demand of the mortgagee, the European Bank for Reconstruction and Development (EBRD), that the vessel had to be entered in a register with mortgage security acceptable to the bank, which was not the case with the Estonian register.

The vessel was chartered by Estline Marine Company Ltd. to the Estonian company E-Line Ltd. (E-Line) on basis of a bareboat charter party. E-Line is owned 50% each by ESCO and Nordthulin Luxembourg.

MV ESTONIA was then registered in the Estonian bareboat register and therefore had the right and obligation to sail under Estonian flag and with Estonian crew.

The bareboat charter agreement provided - as is usual - that the vessel was let without crew and that the bareboat charterer was responsible for crewing and all other obligations of a ship-owning company.

The bareboat charterer E-Line contracted ESCO on the basis of a Ship Management Contract to provide the crews and to take care of technical maintenance/operations as well as insurance. The reason for this was that ESCO was a Tallinn based, state-owned stock company. Its history dates back to 1879, when the first shipping company Linda was established in Estonia. ESCO operated worldwide a variety of cargo vessels of up to 50,000 dwt. ESCO also operated passenger ferries in the Baltic Sea and in the Gulf of Finland. In the autumn of 1994 the company owned and operated 55 vessels and thus had considerable better possibilities than E-Line in dealing with crew matters, such as employment, quality control, education/training and follow-up.

ESCO for their part left the technical maintenance/operation on the basis of a respective subcontract to N&T, allegedly being more competent and experienced in respect of larger passenger ferries than ESCO and also having better connections to suppliers of equipment and spare parts, etc. Also insurance matters and administration were left to N&T having more experience than ESCO with the international insurance of vessels.

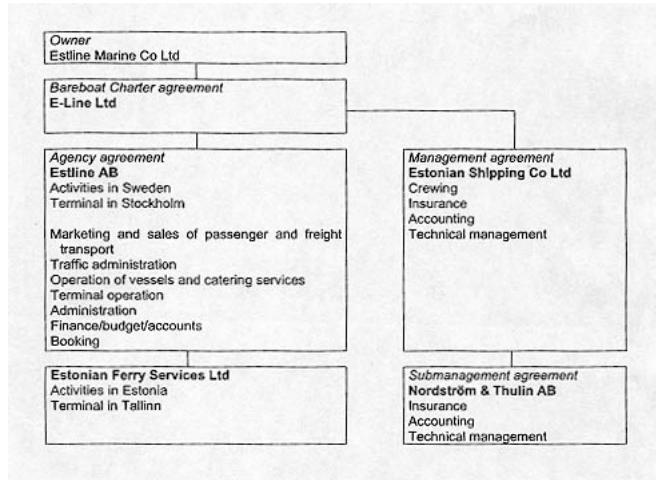
On basis of an agency agreement, E-Line also subcontracted the commercial activities (sale of tickets and freight, hotel - restaurant activities on board, terminal activities, etc.) to the Swedish company ESTLINE AB, which was owned 50/50 by ESCO and N&T.

One of Estline AB's Estonian sister companies, Estonian Ferry Services Ltd. (EFS), had the responsibility for the sale of tickets and freight in Estonia as well as the terminal activities in Tallinn, whilst Estline AB took care of the Swedish side.

Details of the structure of companies explained above can be taken from the next page and from [Enclosures 6.1.112 / 6.1.113](#).

As a matter of fact all the owning/operating/servicing/managing companies in relation to the ESTONIA were owned equally by N&T and ESCO.

Company	Nationality	Owner
Estline Marine Co. Ltd	Cyprus	50% Estonian Shipping Co Ltd 50% Nordthulin Luxembourg S.A.
E-Line Ltd	Estonia	50% Estonian Shipping Co. Ltd 50% Nordthulin Luxembourg S.A.
Estline AB	Sweden	50% Estonian Shipping Co. Ltd 50% Nordström & Thulin AB
Estonian Ferry Services Ltd	Estonia	100% Estline AB
Estonian Shipping Co. Ltd	Estonia	100% Estonian State
Nordström & Thulin AB	Sweden	Public Swedish joint-stock company
Nordthulin Luxembourg S.A.	Luxembourg	100% Nordström & Thulin AB



It is apparent from the structure of companies that

- (a) N&T was in charge of all technical matters including classification and ship safety, insurance and spare parts;
- (b) ESCO had to provide a sufficiently trained and qualified crew including the nautical officers and engineers, but also the hotel and restaurant staff including the management provided by Hornet;
- (c) ESTLINE AB was in charge of commercial matters and terminal operations at both sides.

It is obvious that N&T was the more powerful partner being in the driving seat as far as all operational matters were concerned.

## 6.2 The Estonian National Maritime Board

The Estonian National Maritime Board (E.N.M.B) was only established after Estonia's independence in 1991 and thus had no experienced inspectors to carry out the safety inspections on large and complicated vessels which were required from the flag state by SOLAS. It was apparently for this reason that B.V. was asked whether they would be prepared to perform, in addition to their obligations as Classification Society, the safety inspections. B.V. obviously agreed and a respective contract was signed already on 18 August 1992, a copy of which is attached as [Enclosure 6.2.114](#). Another contract was agreed and signed by B.V. and N&T which dealt apparently with activities in addition to the normal relationship between owner respectively technical manager and the Classification Society. This contract is in the files of the JAIC and remains classified even after the publication of the Final Report. It is only known that the parties to the contract have agreed to refer disputes to London Arbitration.

According to the then head of Sjöfartsverket's Stockholm inspection office, Ulf Beijner, however, also B.V. was uncertain about the requirements to be performed by the Maritime Administration of the new flag state in case of a large and almost 13 year old car/passenger ferry like ESTONIA. Therefore Sjöfartsverket was asked to render assistance during the take-over inspections at Turku and Tallinn, perform the "operative control" and whatever else might be required as a consequence of the flag change.

It will be explained in the subsequent subchapter that Sjöfartsverket complied with this request against respective payments and a rather close co-operation between the otherwise totally different organisations N&T, B.V./ E.N.M.B and Sjöfartsverket in connection with the take-over and flag change of the ESTONIA commenced.

## 6.3 The Swedish Maritime Administration Sjöfartsverket

The present Sjöfartsverket was established in 1956 through the merger of the Pilot Administration and the Sea Chart Administration. In addition, further responsibilities as regards waterways were transferred to the new administration. The name Sjöfartsverket was invented in 1969 and in 1988 it received a new structure. In 1975 the head office was moved from Stockholm to Norrköping where about 400 of the approximately 1400 employees are working headed by the general director, who at the time in question, viz. January 1993 to October 1994, was Kaj Janérus. The administration is part of the national defence organisation and is divided into six divisions, i.e.

- Sea Traffic
- Sea Charts
- Icebreakers Shipping Inspection (Sjöfartsinspektionen)
- Technical Department
- Financial Department - see [Enclosure 6.3.115](#).

The country is divided into thirteen sea traffic areas including the pilot stations, other installations and three shipping inspection districts, to one of which the Rotterdam office is attached. It is within the scope of Sjöfartsverket to supervise the performance of the rules and regulations relating to safety at sea, in particular in accordance with the Sea Safety Law, the subsequently issued Ship's Safety Regulation, further the Law Concerning the Investigation of Sea Accidents and other internal administrative regulations. Due to the international character of shipping Sjöfartsverket participates in the relevant international organisations.

### 6.3.1 The Shipping Inspection Sjöfartsinspektionen

The Shipping Inspection (Shipinspec) is one of the six divisions of Sjöfartsverket and is headed by the ship's safety director. Although directly responsible to the general director of Sjöfartsverket, this director has rather far-going own decision powers due to a number of laws and regulations. Therefore Shipinspec has a comparatively independent position compared to the other divisions, in particular in matters of sea safety.

The sea safety director (safety chief) is appointed by the government upon recommendation of the general director of Sjöfartsverket. The head office of Shipinspec is also in Norrköping where 60 of the about 120 employees work while the other 60 are distributed among the three regional offices in Stockholm, Gothenburg and Malmö and the Rotterdam branch office. The heads of the district offices carry the title "Oberinspektör" = chief inspector and are directly responsible to the safety chief - safety director - who during the relevant time frame from January 1993 to October 1994 was Bengt-Erik Stenmark while the chief inspector positions were occupied by

Ulf Beijner - Stockholm  
Ake Sjöblom - Malmö (also responsible for the Rotterdam office)  
Ralph Grundell - Gothenburg.

All three were naval architects by profession and well trained safety inspectors. The head office is divided into the following departments:

- a) planning : budget, personnel, organisation, legal, EDP, ships' movements.
- b) technical : safety relevant construction/design of vessels, equipment, stability, freeboard, maintenance, fire protection, crew accommodation, navigation equipment, dangerous goods, etc.
- c) operative : crew matters, certificates, sailor register, working environment.
- d) investigation : investigation of ship accidents, personal injury and death cases on board, accident statistics, violation of safety and environment protection regulations.

The safety chief is directly responsible for ensuring that the Swedish vessels and the foreign passenger vessels regularly calling at Swedish ports comply with the legally required safety standards. The same refers to the investigation of sea accidents reported to Shipinspec. According to the internal Sjöfartsverket Working Regulation, Shipinspec has among other things to provide

- 1) that respective regulations maintain compliance with the sea safety law;
- 2) that supervision and inspection of Swedish and foreign vessels regularly calling at Swedish ports ensure that they comply with the legally required safety standard;
- 3) the investigation of sea accidents and the evaluation/analysis of the results;
- 4) the keeping of accident statistics and the drawing of conclusions with the aim to prevent similar accidents in the future.

**as to 1) :**

This obligation of Shipinspec is based on the respective requirements of the Sea Safety Law of 1988 (in force at the relevant time) which refers to Swedish and foreign flag vessels regularly calling at Swedish ports according to which, among other things:

- The master is responsible for the vessel being in seaworthy condition upon commencement of the voyage.
- The owner is obliged to prevent the vessel from departing in case of a known unseaworthiness.
- The master is obliged to report all sea accidents to Shipinspec, and Shipinspec has to make sure by respective regulations that masters/ owners do comply.

**as to 2) :**

This item is separated into parts, viz.

- (a) newbuilding inspections for Swedish owners;
- (b) regular inspections of Swedish vessels;
- (c) inspection of foreign passenger vessels regularly calling at Swedish ports;
- (d) inspection of foreign vessels in Swedish ports on the basis of the international Port State Control agreements (PSC).

**(a) Newbuilding inspections for Swedish owners**

Shipinspec experts do the checking of all drawings relating to the design/ construction of safety relevant installations, do the approval and subsequently issue the respective certificates, however not in respect of hull & machinery matters. According to the respective conditions of the Sea Safety Law this obligation of Shipinspec was delegated to a number of approved Classification Societies, among them B.V., on the basis of particular agreements. These societies have at their disposal considerable technical resources and a worldwide net of inspectors which otherwise Shipinspec would have to create as well. Before this background of technical competence and well established control net the national maritime administrations, such as Sjöfartsverket and F.B.N., have since many years ago acknowledged the requirements and performance of these classification societies. In order to remain up-to-date with rule and/or other changes within the societies, the safety chief is for example a member of the supervisory boards of B.V., DnV and ABS. On the basis of respective agreements B.V. carries out on behalf of Sjöfartsverket, MARPOL, SOLAS and the Load Line inspections on board of Swedish vessels which are classed by B.V. In the light of these agreements and understandings both DIANA II and VIKING SALLY were built with B.V. being the Classification Society and as such also responsible for the approval of structural parts on behalf of Sjöfartsverket and F.B.N. This includes the location of "the upper extension of the collision bulkhead above bulkhead deck" as well as the locking devices and hinges of visor and bow ramp.

**(c) Inspection of foreign passenger vessels regularly calling at Swedish ports**

Based on the Sea Safety Law it is also required that passenger vessels, i.e. also car/passenger ferries, who are regularly calling at Swedish ports, have to be inspected as if they are Swedish vessels - see also Subchapter 6.4. In other words they have to pass the so-called "I/92 inspection" before taking up service and thereafter the vessel has to undergo continuous inspections in intervals determined by Shipinspec. This was the situation of the ESTONIA from January 1993 to 28 September 1994.

**as to 3)**

The investigation of sea accidents on the basis of the requirements of the "Law Concerning the Investigation of Accidents" from 1990. It is mandatory for a sea accident to be investigated if :

- several persons have been killed or severely injured;
- a vessel and/or its cargo has been damaged considerably or if substantial environmental damage has occurred;
- a vessel has disappeared.

In addition, nearby accidents also have to be investigated in the case that they were caused by substantial failures of the vessel and/or safety relevant installations.

The law clearly defines that - apart from establishing cause and development - the gained information is to be evaluated and proper measures have to be decided in order to prevent a repetition of the occurrence on this or similarly constructed vessels.

According to §2 of the "Law Concerning the Investigation of Sea Accidents" of 1990 the government has decided that all accidents and nearby accidents have to be investigated by the "Statens Havarie Kommission" (SHK) - the "Government's Casualty Commission". During the investigation carried out by SHK a representative of Shipinspec, generally the head of the Investigation Department, has to be present. Based on the same law SHK has the authority to delegate the investigation of smaller accidents, which have to be carried out under safety aspects only, to Shipinspec who report the result among others also to IMO.

**as to 4) :**

The keeping of accident statistics and the drawing of respective conclusions apparently failed completely within Shipinspec because the internal investigator Magnus Sjöberg concludes in his Report from March 1995 that there was a lack of procurement and transfer of the ship safety relevant information as well as the evaluation and analysis of the available material or the material which should be made available and, furthermore, of a follow-up of induced measures.

**Note:**

Magnus Sjöberg was instructed on the basis of a government decree of 3rd October 1994 which reads as follows:

»On the 28th September 1994 on voyage from Tallinn to Stockholm the passenger ferry "Estonia" sank southwest of the Finnish island Utö. The vessel sailed under Estonian flag.

On 29th September 1994 the Swedish government instructed SHK to participate in the casualty investigation. Thereupon a Joint Accident Investigation Commission was formed from representatives of the Estonian, Finnish and Swedish authorities. The main objective of the commission was to establish the cause of the casualty.

Survivors of the shipping catastrophe had reported that the visor had been torn open, which could be one cause of the casualty.

Subsequently obtained information revealed, that already earlier there had been accidents and problems with bow doors of ferries of the same type as the

*"Estonia". Proper safety at sea requires that conclusions are continuously drawn from casualty and incidents. In addition to the investigation by the Joint Accident Investigation Commission (JAIC) therefore, also the reporting routines and other procedures adopted by Shipinspec should be closely examined.«*

In compliance with the above-mentioned instructions Magnus Sjöberg has listed a number of incidents on board Swedish Ro-Ro vessels whereby problems with bow doors, their hinges and/or locking devices were involved. These were:

- car/passenger ferry VISBY on 12.11.1973 on way from Nynäshamn to Visby - bow door broke open and water on car deck - class L.R.;
- Ro-Ro freighter STENA SAILOR on 16.01.1974 on way from Zeebrugge to Dover - locking devices of bow door broken - class B.V. In the course of the investigation it turned out that the same had occurred before on this and also on board a sister-vessel.
- car/passenger ferry SVEA STAR on 05.05.1974 on voyage from Travemünde to Helsingborg - locking devices and additional securing of bow door broken - class L.R.
- car/passenger ferry SAGA STAR on 16.05.1982 - visor hinges broken and visor fell down whilst vessel was in port - class L.R.
- car/passenger ferry STENA JUTLANDICA on 12.10.1984 bow door hinges broken in port - class Dnv.

Although the respective causes for the above-mentioned incidents, viz. too weak design, were realised by Shipinspec and counter-measures were required from the respective class of the vessel - which were promised in all cases - there was no follow-up from Shipinspec to control whether the promises were actually fulfilled by the classification societies and whether the relevant construction was changed respectively strengthened.

Since the damage statistics kept by Shipinspec were also made up according to the names rather than according to types of vessel, it was also not easily recognisable whether particular types of vessels, e.g. Ro-Ro's, had repeated damage to particular components such as the safety-relevant locking devices and hinges of bow doors/visors. This was the situation within Sjöfartsinspektionen at the end of 1994 and many years before. The English translation of the complete report of Magnus Sjöberg is attached as Enclosure 6.3.116, the Swedish original as Enclosure 6.3.116.1.

#### 6.4 The New Role of Bureau Veritas and the Co-operation with Sjöfartsinspektionen (Shipinspec)

The B.V. head office for the Nordic countries was located in Copenhagen since 1990. The head office for Sweden was in Gothenburg, the manager was Hans Olsson. Further, there were B.V. offices in Trelleborg, Malmö and Stockholm whose senior and staff surveyors reported to the Gothenburg office. Hans Olsson reported directly to the head office in Paris.

**Note:** Hans Olsson left the B.V. organisation in August 1998.

There was also a B.V. office in Helsinki which inspected the vessel in Finland as long as she was flying the Finnish flag. The office was no more involved after the flag and name change to ESTONIA.

According to the previous principal surveyor of the BV-Stockholm office, Lars Olof Ålander, N&T had made it a condition for the ESTONIA to remain under classification of B.V. that only one surveyor, namely his junior colleague, Anders Wirstam, should carry out all the required surveys both in respect of class items and the safety items to be inspected on behalf of the E.N.M.B. This was accepted by B.V. and Anders Wirstam from the Stockholm office became the exclusive surveyor for the ESTONIA in all respects. Upon instructions from the head office in Paris he reported directly to the manager of the B.V. head office for Sweden in Gothenburg, Hans Olsson, thereby bypassing the principal surveyor Lars Olof Ålander - see also Enclosure 2.4.3.44.2.

As mentioned before, a contract was agreed also between B.V. and E.N.M.B. and signed already on the 18.08.92 (see Enclosure 6.2.114), which provided that B.V. would act as agent for the Estonian Administration for the purpose of surveying Estonian flag ships with classification certificates issued by B.V. in order to determine the compliance of such vessels with the mandatory requirements of certain International Conventions referred to in Annex 1 - which includes SOLAS 1974. As the contract had already been running since August 1992 it has to be assumed that B.V. had already carried out some inspections of Estonian flag cargo vessels, but was uncertain about the requirements in respect of car/passenger ferries like the ESTONIA. Therefore B.V. sought the assistance of Shipinspec. The approach, however, was not made by B.V. but by S.-C. Forsberg and Ulf Hobro from N&T, although both Hans Olsson and Anders Wirstam are ex Shipinspec employees and Wirstam had actually been working under the head of the Stockholm office of Shipinspec, Ulf Beijner, who was now contacted by Forsberg/Hobro.

**Note:**

Hans Olsson - born in 1944 - studied marine engineering at Chalmers University, Gothenburg from 1973-1977. Thereafter he joined Sjöfartsverket and stayed for 13 years until 1990 when he became head of BV-Sweden. Anders Wirstam - born 1942 - testified to having had 28 years of experience when being interrogated in November 1994 and has been with Shipinspec Stockholm from 1966-1969 under Ulf Beijner.

Forsberg and Hobro contacted Ulf Beijner, then still the head of Shipinspec's inspection office Stockholm, on 24.11.92. According to a memo made by Ulf Beijner after the meeting they outlined their plans to replace the NORD ESTONIA by the ESTONIA, including the new companies structures, flag of vessel, Estonian crew and time schedule. They also asked whether Shipinspec could assist B.V. in the take-over procedure which was promised. The respective memo by Ulf Beijner is attached - together with an office translation - as Enclosure 6.4.117.

Accordingly N&T did not just request assistance for B.V. in general, but also requested that Shipinspec should carry out the so-called "2/90 inspection" after the take-over in Tallinn, which was also accepted. This "2/90 inspection" had then already been replaced by official "Regulation 1/92" which came into force on 15 April 1992 by order of the then head of Shipinspec, Safety Chief, Bengt-Erik Stenmark. Regulation 1/92 together with an office translation is attached as Enclosure 6.4.118. It reveals that the main issue of this regulation is fire-fighting and lifeboat drills respectively the training of crews and passengers in respect of the above and it is quite obvious that this regulation had been drafted under the influence of the SCANDINAVIAN STAR catastrophe. It further reveals that the stated controls and exercises had and have to be carried out on all Swedish flag vessels and all other vessels calling at Swedish ports. In addition, it is required that passenger vessels regularly calling at Swedish ports have to undergo a "1/92 inspection" with acceptable results before the vessel takes up service. Whilst in service the vessel has to undergo continued inspections in intervals determined by Shipinspec, however, at least once a year.

Part of the Regulation 1/92 are the attachments 1 and 2, i.e. the "Report", and the "Guidance to Surveyors on Procedures for Operational Control of Ships". Both are attached as Enclosures 6.4.119 and 6.4.120.

In particular the "Guidance to Surveyors on Procedures for Operational Control of Ships", which draws attention to the negative role the human element has played in shipping disasters in the past, had been developed to avoid what did take place only 20 months later on board of MV ESTONIA, a vessel which had been "carefully" checked by inspectors of Shipinspec before taking up her trade and which thereafter had called at Stockholm every second day.

In any event, in addition to those "inspections" the vessel had to be visited frequently by the Classification surveyor Anders Wirstam since ESTONIA participated in the "Continuous Survey System" of B.V., i.e. 1500 items had to be checked during 5 years, viz. 300 per year. For details see Subchapter 9.1.

Further on behalf of E.N.M.B. the same B.V. surveyor had to

- carry out the Load Line Surveys
- examine all certificates
- inspect social rooms / cabins / passenger accommodations
- inspect lifesaving and fire-fighting equipment
- inspect navigation instruments
- issue Passenger Ship Safety Certificate (annually), thereby confirming that the vessel met SOLAS requirements.

Obviously quite a substantial job for one man on a vessel like the ESTONIA. Further details can be found in Subchapter 9.2.

After the companies' structure had been established and the basic agreements were made quite some activities developed between N&T and B.V. in connection with ESTONIA's documentation/certification, and it became very obvious that N&T behaved and was treated as if they were the owners. Nowhere in the relevant correspondence do E-Line, Estline or ESCO appear.

**Note:**

The respective files of B.V. head office, Paris could only be sighted very briefly and only until 16 June 1994.

Due to the change of flag and also because Estonia is signatory to the SOLAS Convention the vessel had to comply with a number of amendments to SOLAS 1974, which she apparently did not or, at least, B.V. and N&T were uncertain whether she did.

They found out, for example, that in 1985 the duck tail had been fitted and that at the end of 1990/beginning of 1991 ca. 85 ts. of steel plates had been built-in in way of the accommodation and that subsequently an inclining experiment was carried out by Ship Consulting Oy, Turku, because according to SOLAS - Chapter II-1, Regulation 22, paragraph 2, the following is required:

*»2 Where any alterations are made to a ship so as to materially affect the stability information supplied to the master, amended stability information shall be provided. If necessary the ship shall be re-inclined.«*

In addition, since 1991 SOLAS requires in paragraph 3 of the same regulation:

*»3 At periodical intervals not exceeding five years, a lightweight survey shall be carried out on all passenger ships to verify any changes in lightship displacement and longitudinal centre of gravity. The ship shall be re-inclined whenever, in comparison with the approved stability information, a deviation from the lightship displacement exceeding 2% or a deviation of the longitudinal centre of gravity exceeding 1% of L is found or anticipated.«*

The full wording of SOLAS - Chapter II-1, Regulation 22, is attached as Enclosure 6.4.121.

Based on the results of the inclining experiment carried out in January 1991 Ship Consulting Oy drew up a revised "Trim and Stability Booklet" dated 20.01.91, which was stamped "Approved" by the F.B.N. on 23.01.91 and which is attached as Enclosure 3.4.86. It is based on the initial one provided by Meyer Werft for the newbuilding VIKING SALLY. Ship Consulting Oy, however, found that the centre of gravity (CG) - in their opinion - was too far astern which had the following consequences:

- (a) the vessel had a permanent stern trim which was compensated by filling up ballast tank 2;
- (b) the A/Amox value was more than 95% if calculated on a stern trim of 0.40 m; if the calculation was made on even keel the Amox value was below 95%, but the margin line was submerged.

**Note:**

The A/Amox value is obtained by summarising the damage stability calculations with 1 and 2 compartments flooded, based on IMO Resolution 265 by means of a probabilistic method.

All this was not mentioned in the "Trim and Stability Booklet" made by Ship Consulting Oy, dated 20.01.91.

This "Trim and Stability Booklet" as well as another calculation by Ship Consulting Oy without date concerning the influence of the duck tail was received by N&T from the previous owners and sent to B.V. by letter of 07.12.92.

Upon request of N&T Meyer Werft sent to B.V. by letter of 23.12.92 various drawings and a Meierform, Bremen calculation dated 17.10.92 concerning the "Floodable length criteria numeral factor of subdivision".

By letter of 19.01.93 (i.e. after take-over of the vessel) BV-Paris (DuPont) confirmed to BV-Gothenburg:

- receipt of stability files;
- the willingness of BV-Paris to check the intact and damage stability and the subdivision of the ship according to SOLAS 1974;
- that they have all drawings except longitudinal and transverse sections allowing them to define the duck tail fitted in 1985.

BV-Paris continued by stating:

*"We assume that owners are aware of SOLAS 1974 and amendments."*

**Note:**

B.V. could correctly assume that the owners, i.e. N&T, whom B.V. considered to be the owners, were aware of SOLAS 1974 and amendments as the chief inspector Ulf Hobro, responsible for the ESTONIA, was an educated/trained ship safety inspector from Sjöfartsverket (see [Enclosure 5.2.109](#) and Subchapter 5.2 above).

Attached to this letter was the circular letter 1080 SMS dated 09.09.1987 concerning

- First Issue of PSSC
- Issue of PSSC after modification.

According to Ship Consulting Oy, Turku, BV-Paris discovered the deficiencies stated above under (a) - (c) after having reviewed the stability documentation submitted by N&T and others and consequently declared the "Trim and Stability Booklet" dated 20.01.91 "temporary", instructed N&T to order a new "Trim and Stability Booklet" including all criteria plus Amox calculation (which they did with Ship Consulting Oy) and instructed BV-Sweden just to issue "temporary" PSSC's and Load Line Certificates as long as the "Trim and Stability Booklet" would be "temporary". This required inter alia Anders Wirstam to carry out Load Line Surveys every 3 months, or at least, issue new "temporary" L.L. Certificates every 3 months.

Based on the present level of information of this 'Group of Experts' there is no indication of any involvement of Sjöfartsverket in this particular part, although it can be expected that the vessel's stability documentation had been checked, because according to the "Guidance to Surveyors on Procedures for Operational Control of Ships" ([Enclosure 6.4.120](#)) item 2.4., the surveyor had the following rights:

*»Damage Control Plan*

*The surveyor may determine if a damage control plan is provided on a passenger ship and whether the crew are familiar with their duties and the proper use of the ship's installations and equipment for damage control purposes.*

*The officers may also be asked to explain about the boundaries of the watertight compartments, the openings therein with the means of closure and position of any controls thereof and the arrangements for the correction of any list due to flooding.*

*The officers should have a sound knowledge of the effect on trim and stability of their ship in the event of damage to and consequent flooding of a compartment and counter measures to be taken.«*

The B.V. head office files also reveal the following:

- Fax Ship Consulting Oy dated 28.03.94:

*»MSC/Cir.1574*

*Damage stability calculation for "Estonia"*  
mean draught: 5.55 m, trim: 0.57 m; GM 1.55 m  
cross-flooding assumed on empty tanks 16A + 15A  
freshwater tanks 4A + 4B, heeling tanks 13 + 14  
(heeling tanks about 50% filled).

*The side casings on A-deck forward and aft are assumed to be weathertight.«*

**Note:** Here was a handwritten remark on the fax: "to be dealt with".

The "side casings" on A-deck = car deck are the "side houses" which were not weathertight because of the openings in both front bulkheads for the lugs and hooks of the hydraulic and manual side locks of the visor. This was acceptable from the point of view of the Load Line Convention because the "side casings" were considered to be closed structures above the bulkhead deck. Also SOLAS 1974 - II-1, Rule 71 (margin line condition) excluded the theoretical flooding of the deck and therefore such openings remained without closures in those years. Moreover, as long as the visor remained weathertight no water could penetrate these openings anyway, because they were located inside the rubber packings of the visor at both front bulkheads. As soon as the visor started to "leak" and became filled with water, these openings became a problem because they extended from about 300 mm above the 3rd stringer level to the 2nd stringer level which is within the area of watermarks visible inside the visor. Behind the openings there was a void space located between A-deck and B-deck, which was accessible only through an opening in B-deck with a sill of 200 mm height, but without cover. It is unknown to this 'Group of Experts' whether the handwritten remark "to be dealt with" on the fax dated 28.03.94, i.e. 6 months before the casualty, had been followed up and, if so, to what effect.

- In a further fax dated 30.03.94 from BV-Paris to BV-Gothenburg it is stated:

- »re: Compartment 10
- the 500 mm butterfly valve operated from bridge between tanks 13 and 14 is not large enough. Valve has to be calculated according to A.266;
- Note: Tanks 13 and 14 are the heeling tanks.
- down flooding ducts mentioned;
- trim always to be 0.6-0.75 m by stern;
- as noted in original stability booklet down flooding ducts are arranged in tweendeck (deck below A-deck, i.e. 1st deck);
- File ends 16.06.94.

In addition, the following information could be taken from the files of BV-Paris:

- Letter BV-Paris to BV-Gothenburg:

»re: cross-flooding between heeling tanks. For this purpose we need to know type and section of this connection, i.e. dissymmetric flooding in compartment 10 (85-98) 1 m<sup>2</sup> hole to be made.«

- The damage stability calculation by Ship Consulting Oy proved that there was some difficulty to pass the criteria.

Although these information relating to the time after the take-over are not strictly in line with the structuring of this report they have to be mentioned here already to demonstrate:

- (a) the deep involvement of the B.V. head office, Paris and
- (b) the obvious fact that B.V. and N&T had some problems with the fulfilment of SOLAS requirements concerning stability criteria which were not solved at the time when the vessel sank.

In summary it can be concluded that B.V. and N&T obviously still had serious problems after the vessel had been in her new service for more than 1 year. At a meeting with Capt. Hummel in July 1996 Veli Matti Junnila of Ship Consulting Oy, who had made the calculations for the old Trim & Stability Manual dated 20.01.91 and who was working on the new one upon instructions of N&T at the time of casualty, gave the following comments:

- When rechecking the intact and damage stability in the light of the new requirements B.V. found out that the Centre of Gravity (CG) was too much astern. For this reason she had always stern trim.
- To correct this and to reduce the swell in the archipelago, the duck tail was fitted, which indeed allowed a reduced stern trim and increased the GM because the waterline area was increased. Also the damage stability was improved because the duck tail created more buoyancy in damaged condition.
- The problem, however, was the margin line which is a theoretical line 3 inches or 76 mm below bulkhead deck = car deck. This line must not be submerged in the final stage of the flooding of two compartments - a requirement since SOLAS 1965 - a condition which the ferry did fulfil only with stern trim.
- As the first *Stability Booklet* as well as the second one issued 20.01.91, did not indicate the stern trim requirement and further, did not take into account the duck tail, the built-in 85 tons of steel and, finally, also the stabilisers, B.V. demanded a new "*Trim and Stability Booklet*" and declared the old one "preliminary".
- He was still working on this booklet when the casualty occurred.
- The Stability Booklet of 20.01.91 is based on the actual inclining experiment of 11.01.91 when the duck tail was fitted and the 85 ts steel were built-in already.

**Note:** According to the amended SOLAS 1974 - Chapter II-1, Regulation 22, since 1991 passenger vessels have to perform inclining experiments at least every 5 years (see [Enclosure 6.4.121](#)).

- That the cross-flooding valve between the heeling tanks 13 and 14 - a 500 mm butterfly valve operated from the bridge - was not large enough to comply with the requirements of IMO Resolution A.266 ([Enclosure 6.4.122](#)).

**Note:** This valve had previously been connected to the WT-doors, i.e. when the WT-doors were closed this valve opened automatically. Reportedly this connection had been removed whilst the vessel was owned by Silja, however, there were rumours that the Estonians had re-established the connection.

## 6.5.2 In Tallinn

The vessel was moored alongside Baltic Shipyard and considerable inspections were carried out by the representatives of B.V.:

- Hans Olsson
- Anders Wirstam
- somebody from the head office, Paris - probably J.-F. Segretain - Manager of the Marine Department

and by the inspectors of Sjöfartsverket, Stockholm:

- Tom Evers
- Johann Bäth
- Stellan Johansson
- Ari Niemenen

and by various representatives of the E.N.M.B. as well as ESCO and N&T.

The findings of B.V. are summarised in the "Survey Report for Issue (1) for Passenger Ship Safety Certificate" dated 07.02.93, which is attached as [Enclosure 6.5.2.125](#). The report mentions for example under 'General Information' on page 1:

«Does the vessel proceed more than 20 miles from the nearest land, in the course of her voyage? (Reg. 1 (c), Chapter II)? Yes.»

In the SOLAS edition in force in January 1993, which included the SOLAS 1974 edition plus subsequent addenda, no Regulation 1 (c) in Chapter II can be found anymore, i.e. the B.V. form is based on an older edition of SOLAS 1974 when Reg. 1 (c) - which is now Regulation 1.4. - contained the following:

«Chapter II-1  
Construction - Subdivision and Stability,  
Machinery and Electrical Installations  
Part A General  
Regulation 1

(c) The Administration may, if it considers that the sheltered nature and conditions of the voyage are such as to render the application of any specific requirements of this chapter unreasonable or unnecessary, exempt from those requirements individual ships or classes of ships belonging to its country which, in the course of their voyage, do not proceed more than 20 miles from the nearest land.»

Consequently it should have been obvious for B.V. that it was not possible to grant any exemption whatsoever as "the vessel proceeded more than 20 nm from the nearest land in the course of her voyage." As the wording of Regulation 1 (c) is more or less identical to Regulation 1.4. of the 1992 edition of SOLAS 1974 the application of the older form did not make a difference.

The report continues with item 2 - Survey of Hull and Machinery

»2.1. Has an inspection of the structure been carried out? Yes, 1-93.«

This item is the only one, where the B.V. form does not quote any SOLAS Regulation.

»3. Stability Chapter II-1, Reg. 7 - 19-20  
Is the master supplied with the necessary documents concerning stability? Yes.  
(Approved by the Finnish Authorities, pending B.V. approval).«

Here B.V. correctly did not accept the "Stability Booklet" approved by the F.B.N., because there were indications that it could not comply with all requirements (see Subchapter 6.4).

On the other hand B.V. accepted the structure of the vessel approved by F.B.N. including the location of the bow ramp as upper extension of the collision bulkhead, although this was obviously not in accordance with the requirements of SOLAS because the ramp was visibly located too much forward. It did not require a detailed structural examination to find that out but just the knowledge of the structure of the vessel which a Classification Society should have after 12 years of attendance to a vessel built under its supervision! Knowledge of the relevant SOLAS requirements Mr. Olsson and the man from Paris definitely should have had, as the SOLAS rules had then already been part of the B.V. rules for about 10 years. B.V. now argues in defence that the vessel in her previous trade had also proceeded more than 20 nm from the nearest land - which is true for the leg Vaasa-Sundsvall - and thus they could assume that the structure had been approved by F.B.N. to be in conformity with SOLAS 1974 requirements.

SOLAS Regulation 12, however, requires:

»A certificate called a Passenger Ship Safety Certificate shall be issued after inspection and survey to a passenger ship which complies with the requirements of Chapters II-1, II-2, III and IV and any other relevant requirements of the present Regulation.«

and Chapter II-1, Regulation 9 (ii) requires:

»If the ship has a long forward superstructure, the forepeak bulkhead shall be extended watertight to the deck next above bulkhead deck. The extension need not be fitted directly over the bulkhead below, provided it is at least 5 per cent of the length of the ship from the forward perpendicular, and the part of the bulkhead deck which forms the step is made effectively watertight.«

Nevertheless B.V. issued an (Interim) PSSC confirming that the vessel did comply with SOLAS in every respect.

After the casualty, B.V. has explained this in their letter to the JAIC dated 10.01.95 - see Enclosure 2.4.3.37 - as follows:

»D-change of flag in February 1993 D1 Bureau Veritas authorisations for Estonian flag vessels Bureau Veritas received as of 18 August 1992 authorisation from the Government of Estonia to issue certificates pursuant to the following conventions:

Load Line 1966

SOLAS 1974

MARPOL 1973

Tonnage 1969

The following documents were issued to the vessel:

International Load Line Certificate

Passenger Ship Safety Certificate

International Oil Pollution Prevention Certificate

International Tonnage Certificate 1969

Attestation Pursuant to the Helsinki Convention 1974 (Prevention of Pollution by Sewage).

D2 Surveys carried out by Bureau Veritas

The vessel had valid International Certificates and kept the Bureau Veritas Class when applying to fly the Estonian flag.

A periodical survey pursuant to SOLAS 1974, consolidated edition 1992, Chapter I, Part B, Regulation 7 (b) (ii) was carried out by Bureau Veritas on behalf of the Estonian Government according to the transfer of flag clauses of the Agreement signed 18 August 1992 between the Estonian Maritime Administration and Bureau Veritas.

The Exemption Certificate granted by the Finnish Authorities for radiotelegraphy (hours of listening by operator) was not re-issued under Estonian flag.

In the course of the periodical survey carried out by Bureau Veritas, a few anomalies were detected and notified to the Finnish Authorities.

E Renewal of certificates as from 1993.

The ship was surveyed and certificates renewed during the period 1993 - 1994.

The Passenger Ship Safety Certificate was kept interim pending completion of the vessel's new loading cases.«

This means that a representative from the B.V. head office Paris together with the B.V. manager for Sweden, Hans Olsson, have carried out a "Periodical Survey pursuant to SOLAS 1974, consolidated edition 1992, Chapter I, Part B, Regulation 7 (b) (ii)", where it is stated:

#### »7. Survey of Passenger Ships

(b) The surveys referred to above shall be carried out as follows:

(ii) The periodical survey shall include an inspection of the structure .... The survey shall be such as to ensure that the ship, as regards the structure .... is in satisfactory condition ... and that it complies with the requirements of the present regulations, ...«

It is obvious that a survey in compliance with this regulation cannot have been conducted. Insofar the statement of B.V. must be untrue.

It is furthermore questionable whether B.V. was entitled to carry out just a periodical survey, because Regulation 14 - Duration and Validity of Certificates states under

»(g) A certificate shall cease to be valid:

(ii) upon transfer of the ship to the flag of another Government. A new certificate shall only be issued when the Government issuing the new certificate is fully satisfied that the ship is in compliance with the requirements of Regulation 11 (a) and (b) of this chapter.«

Regulation 11 (a) Maintenance of condition after survey - requires:

»The condition of the ship and its equipment shall be maintained to conform with the provisions of the present regulations to ensure that the ship in all respects will remain fit to proceed to sea without danger to the ship or persons on board.«

This 'Group of Experts' consequently concludes from the above that Bureau Veritas in its capacity as mandatory of E.N.M.B. has on 07.02.1993 issued an - Interim - Passengership Safety Certificate for M.V. ESTONIA in obvious violation of the relevant regulations of SOLAS.

Note:

When the co-operation between B.V. and Sjöfartsverket in connection with the flag change procedure was discussed with Ulf Beijner - the head of the Sjöfartsverket Inspection office Stockholm at that time and in this capacity in charge of the ESTONIA matter - he fully agreed to the developments and sequence-of-events explained on the previous pages, but when it came to the causative connection between the missing "partial collision door" and the catastrophe, he strongly rejected this connection with reference to the explosion hole in the starboard side in way of the 0-deck, which in his opinion was the cause of the sinking.

The findings of the Sjöfartsverket inspectors - as far as available here - can be taken from the handwritten remarks made on pages A - J between 04.01.93 at Turku and 21.01.93 in Tallinn and on 21.03.93, when the vessel was again in Turku. These remarks - 9 pages - are attached as Enclosure 6.5.2.126 and indicate that at least part of the relevant safety installations had not been in proper condition. It has to be assumed that the deficiencies were rectified prior to Sjöfartsverket approving the vessel, although some of the items either still existed or had reappeared when Ake Sjöblom and his colleague inspected the vessel with their trainees shortly before the last departure. See Chapter 15.

In addition to a large number of safety checks the Sjöfartsverket inspectors also had an "Operational Control" performed by the new crew of the ESTONIA which consisted of a fire drill and an abandon ship drill. Details can be taken from Enclosure 6.5.2.127 - Operational Control ESTONIA.

On 2 February 1993 ESTONIA finally departed from Tallinn with representatives from authorities, B.V. and Sjöfartsverket on board. At sea a function test of ship and crew was successfully carried out and after 2 hours the voyage to Stockholm was resumed. ESTONIA looked perfect as can be seen from the following three photos.



## 6.5 Take-over and Change of Flag

N&T had arranged for some officers, engineers and ratings to be trained on WASA KING already since November/December 1992. Thus at least some of the Estonian crew members had some basic knowledge about the new vessel. Also some of the Swedish advisers spent some time on WASA KING, inter alia, the first nautical adviser to the Estonian captains, Anders Andersson, who had been sacked after repeated clashes with Captain Arvo Andresson already in June 1993, while his wife Marlene stayed in her capacity as hotel and restaurant manager until July 1994. Their testimonies to the public prosecutor shall be discussed in Subchapter 7.1.3.

### 6.5.1 In Turku

The vessel was drydocked between 4-8 January 1993 and the necessary inspections were carried out. As has already been explained in Subchapter 3.4 above at this time also some maintenance work was performed which was partly ordered by the old owners, Wasa Line, and partly by the technical managers of the new owners, N&T. The executed

repair work, however, constituted only less than a fraction of what had been intended to be carried out by Wasa Line at the scheduled docking time in January 1993 had the ferry remained with them. This must be concluded from the following comparison between

- the tender specification and quotation dated 25.09.92 - [Enclosure 3.4.96](#)
- the docking specification - [Enclosure 3.4.97](#)

and

- the repair invoice for Wasa Line - [Enclosure 3.4.102](#)
- the repair invoice for N&T - [Enclosure 3.4.103](#)
- Accordingly only the following works were performed:
- renewal of Cedarvall stern tube seals
- measuring of rudder deflection
- repairs of 1 electric motor
- repair welding of both rudders, propeller shafts, bottom valve, leakage in way of bilge keel, fender bars at port and starboard
- repair welding of bow thruster nozzle
- grinding of 2 propeller blades

as far as the Wasa Line invoice - [Enclosure 3.4.102](#) - is concerned and

- generals, i.e. docking, electric connection, freshwater, fire-watch, garbage removal, etc.
- change of zinc anodes, anchor with chains checked, bottom- and side-valves, etc.
- work in connection with change of name /home port
- some sandblasting.

In addition, the N&T invoice - [Enclosure 3.4.103](#) - contains the following item:

- "pipe work according to offer yard 25.09.92"

56.26.1		12.500,-
56.26.2		24.000,-
56.26.3	no text	7.700,-
56.26.5		4.300,-
56.26.19		17.000,-
55.26.20		8.000,-

Accordingly the "offer yard", i.e. the tender specification dated 25.09.92 - [Enclosure 3.4.96](#) - must have been handed over to N&T since otherwise they would have been unable to understand (and accept) the meaning of the item nos. 56.26.1 to 55.26.20 on their invoice.

This means, on the other hand, that N&T in their capacity as technical managers of the ESTONIA had been aware of the intention of the previous owners of the ferry to have, among other things

- the locking devices of the bow ramp and the visor serviced and strengthened;
- the hinges of the bow ramp overhauled and possibly the bushings renewed;
- 15 m of the visor rubber packing and 10 m of the bow ramp rubber packing renewed.

It has to be assumed that these requirements of the experienced Finnish crew of WASA KING came to the knowledge of N&T during or before the time of take-over of the ferry, however, nothing at all was done by N&T to rectify the deficiencies of the locking devices, hinges and rubber packings of the visor and the bow ramp which were obviously due to wear and tear after 12 years in service.

Nevertheless, the responsible Technical Director of N&T and Board-member of Estline, Sten-Christer Forsberg, replied to the question of the reporter Erik Ridderstolpe on the Swedish Radio on 11.12.97:

**Forsberg:** «I admit the responsibility of N&T for the condition of the visor and the too weak locking devices had we known it, however, I saw the repair specification of the last Finnish crew for the first time in the report of the Commission.»

**Ridderstolpe:** «And you did not receive any type of information in this respect?»

**Forsberg:** «No, this was not available to us.»

It is, of course, possible that Forsberg himself was unaware of this tender specification at the time of the take-over, however, this certainly cannot be accepted for the superintendent Ulf Hobro, the technical no. 2 after Forsberg, who was representing N&T and the owners at Turku during the take-over as well as during all previous inspections of the vessel. See further in Subchapter 12.5 below.

On 15 January 1993 the vessel was formally handed over to the new owners and her name was changed to ESTONIA, the home port to Tallinn and the flag to Estonian.

The first crew list ([Enclosure 6.5.1.123](#)) contains quite a number of names of crew members who were also on board on the last voyage, only very few of whom survived. The first Estonian master was Arvo Andresson and his nautical adviser was Anders Andersson, whilst the first chief engineer was Harli Moosaar and his technical adviser was Tomas Rasmusson. These two as well as all the other "advisers" were employed by Hornet AB on behalf of N&T (see CV Tomas Rasmusson attached as [Enclosure 6.5.1.124](#)).

The handing-over procedure was attended by

Ulf Hobro - technical inspector of N&T on behalf of the buyers,

Charles Richardson - technical inspector of Wasa Line on behalf of the sellers,

Anders Wirstam - on behalf of B.V. and the Estonian Board of Navigation,

1 inspector from Sjöfartsverket to assist B.V.

1 technical surveyor of Trygg Hansa, Stockholm, the new Hull Underwriters of the vessel, who performed a condition survey also on behalf of the new P&I Club, Skuld-Stockholm.

A summary of his condition survey report is attached as [Enclosure 3.4.105](#) and refers also to findings made subsequently during a further drydocking in March 1993. The surveyor approved the vessel for entry into the new Hull and P&I covers without any condition whatsoever. According to a statement of Ulf Hobro made before the JAIC in February 1995 visor and bow ramp as well as locking devices and indicator lights were function tested at Turku and everything was found to be in order. It is obvious that Hobro and/or Wirstam paid no attention to the items in the repair specification/quotation dated 25.09.92, which they had received from the previous owners as explained on the previous pages.

The vessel departed with problems from Turku on the evening of 15 January 1993 and sailed to Tallinn.



## CHAPTER 7

### OPERATIONS ON BOARD

#### 7.1 The Crew and the Advisers

##### 7.1.1 The selection

All members of the actual crew were employed by the Estonian Shipping Company (ESCO). When senior officers were to be employed, Nordström & Thulin was consulted in compliance with the contract on technical management. In practical terms the crew matters were dealt with as explained in the testimony on the adequacy and qualifications of the crew of the ESTONIA submitted by the **Estonian Shipping Company** - the ship-management company - to the JAIC on the 15.12.94:

*»The crew of the passenger ferry was staffed and prepared by the Staff Department of the Estonian Shipping Company. The recommendations for the crew, including mates and engineers, were given by the Technical Department and the Senior Captain Department. Previous service on ships was taken into account when choosing the crew.*

*The existence of all certificates, and those required by Estonian and International legislation, was checked.*

*All officers (captain and mates) and engineers have the respective certificates. They have gone through the respective preparation units. The preparation units have been tested by the Estonian National Maritime Board. Captain Arvo Andersson has taken a piloting exam in Sweden in order to sail in the Stockholm archipelago. The ship's officers knew one or two foreign languages besides their native language and English.*

*Alarm exercises were regularly carried out on board the ship in order to train the crew for actions to be taken in extreme situations. The action plans (alarm plans) were drawn up according to the International and Estonian regulations.«*

#### Note:

In this connection attention has to be drawn to the Safety Manual of ESTONIA published as "Supplement No. 226" to the JAIC Report. Under item 6 "Fire Group 1" and under item 7 "Fire Group 2" are explained.

In 6.4 (referring to Fire Group 1) it is stated among other things: "The Group, that is led by the second engineer, shall ....." and in 7.4 (referring to Fire Group 2) it is stated among other things: "The Group, that is led by the second engineer, shall .....". How can one man lead two fire groups simultaneously?

**Sten-Christer Forsberg** - the responsible Director of the technical-management company, Nordström & Thulin, and boardmember of Estline AB wrote in his explanatory letter of 01.11.94 to the criminal police (the complete letter together with office translation is attached as Enclosure 5.2.110):

*»Selection and Education of Crew*

*The selection and employment of officers and ratings was performed by ESCO, who had to supply vessel's crew according to the management contract with E-Line. ESCO was responsible for competence control and for vessel-specific education. The N&T organisation took an active part through Sten-Christer Forsberg and Ulf Hobro in selecting the masters, chief officers and chief engineers. In addition to requiring formal and practical competence and qualification, N&T also required that the top people should also be able to communicate in English, and in particular, that the respective masters and chief officers had experience with passenger ferries / Ro-Ro traffic.*

*M.V. ESTONIA was taken over from her previous owners at the shipyard in Turku, there the Estonian crew took possession of the vessel, the on board organisation was established and the necessary work to adjust the vessel to Estline's traffic was carried out. Finnish speaking personnel from the previous owners Wasa Line (chief officer, 1st engineer, electrician, and 2 repairmen) were hired from the start of the new traffic for between 2 1/2 and 5 months to assist their Estonian successors with practical advice in dealing with the vessel's specific systems. This principle was always followed by the Operations Organisation of N&T when taking over vessels, independently of flag or nationality of crew.*

*One of N&T's ferry-experienced masters, Anders Andersson, assisted N&T's organisation in preparation work for about 2 months before the vessel was taken over and stayed on board the vessel for the first 5 1/2 months. His main task was to give practical advice to the Estonian master in respect of navigation in the Stockholm archipelago and manoeuvring in port, but also in respect of cargo and stowage planning, and other traffic related questions.«*

The responsible superintendent from Nordström & Thulin, Ulf Hobro, was interviewed by the criminal police Stockholm on 22.11.94 when he testified as quoted below:

»Mr. Hobro participated in the selection of master and chief engineer for the ESTONIA. He considered that the Master was qualified. He had many years of experience in passenger traffic between Tallinn and Helsinki. Also the chief engineer had worked on board vessels routed between Tallinn and Helsinki. The crew was, according to Mr. Hobro, as good as a Swedish crew.«

Naturally those responsible for the education, selection and training of the crew must have - at least externally - a good opinion of those whom they have selected, which, however, is by no means shared by all the insiders. Actually Captain Andresson had been master onboard GEORG OTTS for 8 months, chief officer for 10 months and 2nd officer for 10 months, i.e. in total 28 months. Bearing in mind that two crews relieved each other every 2 weeks, the time onboard is only 50%, i.e. 14 months and certainly not many years, as Hobro told the police.

### 7.1.2 The first crew

The work schedule for the crew of the ESTONIA was in general two weeks' service on board, followed by two weeks ashore. Consequently two full crews were employed alternately and all positions on board were held by two persons. In the deck department there were, besides the master, five deck officers, one radio officer and eight ratings. Organisationwise the ship's doctor was also a member of the deck crew. The engine department consisted of eight engineers and eight ratings. In the catering department there were eight positions with officer's status and 113 ratings.

The first crew (see crew list - Enclosure 6.5.1.123) was to a large extent identical to the last one.

Of those crew members

Captain Arvo Andresson  
2nd officer Peeter Kannussaar  
2nd officer Tormi Ainsalu  
4th officer Andres Tammes (later 3rd officer)  
AB Kaimar Kikas (later 4th officer)  
boatswain Vello Ruben  
2nd engineer Arvo Tulvik (later 1st engineer)

did not survive,

whilst 2nd engineer Peeter Tüür  
4th engineer Margus Treu (later 3rd engineer)  
reefer engineer Andres Verro  
motorman Ivan Ziljajev  
electrician Arvi Rohumaa  
motorman Elmar Siegel

have survived and are important witnesses.

### 7.1.3 The first - and last - master and his adviser

The first master of the ESTONIA was selected by ESCO, and apparently also by N&T, to be Arvo Andresson, the second captain for the first two months was the elderly Captain Rain Erlach, of whom nothing is known. He was replaced by Avo Piht who relieved Arvo Andresson in two-week intervals until the last voyage, when he was on board, but not in command, and who has been considered "missing" ever since. The first - and at the beginning only - "nautical adviser" was Anders Andersson, a well qualified and experienced Swedish ferry master. The reason for his employment was:

- N&T wanted to know what was going on onboard;
- at first, none of the Estonian masters, Andresson and Piht, had pilot licenses, thus they had to take a state pilot in the Stockholm archipelago, but in addition one holder of a pilot license had to be on board and that was the nautical adviser;
- the Estonians were inexperienced in almost every respect, i.e. loading and securing of trucks, ballasting the tanks accordingly, safety matters, nautical matters, etc.

After several months increasing tension developed between Andersson and the Estonian officers, in particular, Arvo Andresson, who became known for knowing everything better. Andersson was consequently replaced by Juri Aavik (did not survive) and Karl Karel (now nautical superintendent of N&T).

The situation and the atmosphere on board during the first months in service can probably best be demonstrated by an extract from the book "**Katastrofen Kurs**" by Anders Jörle and Anders Hellberg. Anders Hellberg, who spoke in length with Anders Andersson, reports as a result of this discussion in Chapter 11 of the book:

»Arrogant, nonchalant and not very competent  
Arvo Andresson, Master of "Estonia", was in many respects an extraordinary master. He took care that discipline and order on board were properly upheld. However, he had a little problem: He mixed up port and starboard. He, as well as his relief Avo Piht, were described as little Gods on board. Under the old Russian system, of which practically the entire crew was a product, the master's word or orders were never questioned. In particular during his absence this could become quite serious. On board a vessel certain things have to be carried out immediately in order not to endanger the safety. But if the master was not present and could not be asked, the result could be that nothing at all was done. It was better to do nothing instead of doing something which could cause the master to see red. Such a system certainly has its advantages, if the master is fully competent. But was Captain Arvo Andresson fully competent? This is questioned by someone who has worked with Andresson.

When the Estonian Shipping Company ESCO took over "Estonia" the Swedish part owner of Estline, N&T, employed a number of advisers, actually assistant masters and crew members working in other functions, who were to train and control the Estonian crew members to make sure that they really knew what they were doing.

Initially N&T wanted to have a Swedish master, chief officer and chief engineer for the vessel, although sailing under Estonian flag, however, ESCO refused to accept that. Instead, the Swedish "advisers" were employed.

One of the Swedish assistant masters, Anders Andersson, worked for quite some time with Arvo Andresson. He has described the Estonian master to the Joint Accident Investigation Commission as having been arrogant and nonchalant, and having strictly upheld discipline and the hierarchy on board. He pursued this so rigorously that he even changed the crew in the hotel and restaurant sections, even if the results were catastrophic. The Swedish and Finnish advisers were professionals from Viking, Silja, and Estline's previous vessel "Nord Estonia" in respective positions on board, such as hotel, restaurants, tax free and business shops. This worked very well and effectively until Arvo Andresson changed everything and put incompetent Estonian personnel into management positions, no matter what effect that had on the business results.

All this was reported to Sten-Christer Forsberg, Technical Manager of N&T, who spoke to Arvo Andresson requesting him not to interfere with matters which he did not understand. To discuss these things with ESCO "was totally useless as they under all circumstances strengthened the position of Arvo Andresson. He had an unbreakable position within ESCO".

When "Estonia" was taken over and Andersson and Andresson met for the first time, Andersson asked Arvo Andresson how he managed the change from "Georg Ott" to "Estonia" and Arvo Andresson just replied "vessel is vessel". This explains a lot about Arvo Andresson because 9 months on the "Georg Ott", a small ferry without much windage sailing between Helsinki and Tallinn, can naturally in no way be a proper preparation for taking over the command of a ferry like "Estonia" with a substantially larger windage and other relevant differences. As a confirmation, the vessel grounded near Sandhamn soon after the service had been opened, because Arvo Andresson had totally underestimated the drifting speed.

All vessels which regularly call at Stockholm have a wind restriction for the passing of Farfarsgrundet (Sandhamn). The large Silja and Viking ferries do not enter here if the wind speed is in excess of 15 m/sec. from S/SW, then they use the northern entrance (Söderarm). For the considerably smaller "Estonia" the senior pilot of Stockholm had set the limit to 10 m/sec.

The experience of Arvo Andresson in ferry traffic was restricted to the Helsinki-Tallinn service. There are 3 smaller ferries: "Georg Ott", "Vaana Tallinn" and "Tallink" which go daily both ways. Reportedly these relatively small vessels always used tugs.

"Estonia" had the highest ice class and 24000 hp, whilst "Georg Ott" was so low powered that they always had to run the engines at full speed against heavy seas

or ice in order to make some headway at all. To proceed with "Estonia" against heavy head seas, however, required a lot of experience as otherwise quite some damage could be done to the foreship with such powerful engines. This experience Arvo Andresson did not have. This became obvious rather quickly after the take-over at Turku, when "Estonia" departed and he misjudged the wind completely and used the propellers the wrong way so that the vessel almost hit the quay. Subsequently he admitted to Andersson that he had difficulties with manoeuvring the engines and also mixed up port and starboard. Similar incidents happened frequently during the following months.

According to the Swedish captain the Estonians also never did learn how to properly load the "Estonia". It is important to load a Ro-Ro vessel correctly, both in order to obtain the correct trim in the ballast tanks considering the wind and in order to prevent the vessel from heeling.

The mates were sitting all afternoon with their cargo plan, only to discover that it did not function when the cars were rolling on board. There were always significant changes in the bookings at the last minute. Then emergency solutions had to be found in order to take all cars on board. Simultaneously, there was an aversion within ESCO against the Swedish interfering on board.

As master, Arvo Andresson was dominant and authoritarian. The mates never dared even to come close to the sticks (Note: pitch controls), not even the chief officer who normally has to be able to manoeuvre the vessel. Andresson was a product of the Soviet system. Once when he damaged the quay at Frihamn in Stockholm with the aft of the vessel, he did not accept to write a report to the ship owners. "I will be able to persuade my mates to testify that the damages to the quay were already existing when we arrived", he said.

The Swedish captain describes the difference between an Estonian and a Swedish or Finnish vessel as follows: "On a Swedish ferry the mate first reduces the speed and does thereafter inform the master about what he has done. As regards "Estonia", it was the other way round."

Generally, there was a poor ability to take initiatives within the crew, probably as a result of the old system. Nobody dared to take his own initiative.«

The files of the public prosecutor in Stockholm, Tomas Lindstrand, who performed his own investigation, contain the following, additional information in relation to Captain Anders Andersson and his wife Marlene:

- Andersson had been on the WASA KING since October 1992 to become acquainted with the vessel.
- N&T took over the complete safety organisation from NORD ESTONIA and transferred it without changes to ESTONIA, although this vessel was much larger, had more crew members, for example a radio operator which the NORD ESTONIA did not have. Therefore the ESTONIA radio operator was not mentioned in the safety role and thus had no function in case of emergency.
- His wife Marlene was the restaurant and hotel manager and remained on board until July 1994.
- There had been plenty of occurrences with drunken Estonian crew members; in the crew's dayroom it was almost always party time on the last trip to Stockholm before the relief crew would take over on the following day (also on the last voyage).
- There were lots of problems with Arvo Andresson who was absolutely unsuitable for passenger vessels; everything was much easier with Avo Piht, who already had experience with Baltic ferries.
- Andresson also had a problem taking decisions by himself since he was always used to having somebody above him. This became drastically obvious in stress situations when quick decisions had to be made. Typical were two occurrences, viz:
  - (a) A passenger sustained a heart attack at sea and Andresson was totally helpless, did not know what to do and asked Marlene Andersson what he should do.
  - (b) When 60 Iraqis were discovered in a container on the car deck he did not know what to do either or how to behave, phoned his principals in Tallinn and asked what he should do.
- Very often relatives of the crew members simply stayed on board in Tallinn for the whole round-trip without being registered and without Arvo Andresson doing anything against it although he knew of it. It was easy for non-crew members to get on board.
- Marlene Andersson as well as Arvo Andresson respectively Avo Piht attended the Estline board meetings when they took place on the ESTONIA. Frequently there was an irritated, stressed atmosphere. There were also language problems. The Swedes and Estonians were sometimes shouting at each other. Also Peter Barasinski, an ex restaurant chef on the ESTONIA, has reported that he had been told by his wife Carita, who was a conference hostess on ESTONIA (did not survive), that during the meetings of the Estline Board of Directors, which were held on board the ESTONIA, there had always been clashes and that the N&T and ESCO representatives had shouted at each other in loud voices and with red faces, and that this had been so up to the end.

So much for Arvo Andresson seen with the eyes of Anders Andersson and his wife. Some of this is confirmed by the Finnish advisers who have told this 'Group of Experts' that it always took unusually long for Andresson to get the vessel alongside and that the berthing manoeuvres were quite often accompanied by impacts. They also recounted that during the first real heavy weather voyage from Tallinn to Stockholm Anders Andersson decided to enter the archipelago at Utö and proceed inside up to Söderarm for the safety and comfort of passengers and crew and, last but not least, the vessel. Reportedly this also led to a major clash with Andresson and ESCO although no time was lost, and, because there was absolutely no support from N&T, was never repeated by Andresson. The Finnish advisers have also stated that at the beginning when the vessel was proceeding too fast against head seas passengers complained to the Information desk, whereafter the girls phoned the bridge and passed on the complaints, but were harshly brushed off and never dared to do it again. (For more details about Captain Arvo Andresson see also Chapter 13.)

## 7.2 Working Routines and Organisation

As this 'Group of Experts' to a large extent agrees with the findings of the JAIC regarding the Working Routines and Organisation their findings are repeated here:

### 7.2.1 Deck department

The master was responsible for all activities on board the vessel. He reported to ESCO on all matters regarding navigation, day-to-day operation, personnel and related issues. In technical matters, he reported to Nordström & Thulin.

The master in command on the accident night was the Number 1 master of the ESTONIA, Arvo Andresson, "and it was he who, together with his superiors at the office, laid down rules and routines for work on board".

**Note:** This is the view of the JAIC, whilst actually they just copied everything from the predecessor vessel NORD ESTONIA which is proven, inter alia, by the fact that the radio officer did not exist on the safety plan of the ESTONIA, because on the NORD ESTONIA there was no radio officer. Also the advisers were not shown on the safety plan because on NORD ESTONIA there were no advisers. (See also Subchapters 5.3 and 7.1.3.)

According to standing orders laid down by him, the various responsibilities and duties, in addition to normal watch duties, were divided between the deck officers as described below.

The chief officer had the responsibility for cargo operations and the planning of these. He was also responsible for the daily work of the deck crew. The second officer A was responsible for the navigation equipment, and also assisted the chief officer with cargo operations. He led the port lifeboat group and was responsible for associated lifesaving equipment.

The second officer B was responsible for stability calculations prior to departure, and assisted the chief officer with the cargo operations. He also led the starboard lifeboat group and was responsible for associated lifesaving equipment.

The third officer was in charge of nautical charts and literature, and was also responsible for the calibration of all clocks on board. The fourth officer was responsible for keeping the log of the working hours of the deck crew, and for keeping lists of certificates of competence and passports for the deck crew. He was also responsible for cargo declarations to the harbour authorities, and for the documentation of cargo operations.

The radio officer was responsible for the radio, including the emergency beacons (EPIRBs) and communication equipment, and in co-operation with the second officer A for the maintenance of the electronic navigation equipment. He was also responsible for making and updating crew lists. The ESTONIA was certified for pre-GMDSS operation and consequently the radio officer had to keep watch on 500 kHz and 2182 kHz. The watch hours at sea were from 19.00 to 01.00 hours.

When the vessel was at sea, there were always two officers and one AB seaman on duty.

On westbound voyages, the second officer B was on duty between 20.00 and 01.00 hours assisted by the third officer, and the second officer A was on duty between 01.00 and 06.00 hours, assisted by the fourth officer. For the periods between departure and 20.00 and between 06.00 hours and arrival, the bridge watch was taken by the master and the chief officer.

During the sea voyage, the AB seamen changed watches at 22.00, 02.00 and 06.00 hours. Their duties at sea were to be additional lookouts and to make watch rounds on a defined route throughout the vessel (Supplement). These rounds were made once every hour, starting at 20.30 hours and lasted for about 25 minutes.

Watch rounds were also made by the security guards. They had no other duties than to ascertain the safety and security of the vessel and the passengers, and they patrolled continuously.

### **7.2.2 Engine department**

The chief engineer was responsible for the organisation and all work in the engine department, for the purchase and storage of spare parts and consumables, and for the technical maintenance of the entire vessel. He reported to the technical superintendent of Nordström & Thulin, Ulf Hobro and certain parts of these reports were copied to ESCO. His day-to-day contact within the N&T organisation was Tomas Rasmussen, the assistant to Ulf Hobro. The second engineer was in charge of the separators, the steering gear and all other hydraulic and pneumatic systems, including the systems for manoeuvring and locking the visor, the ramps and the hull doors as well as the stabilisers.

The systems engineer was in charge of the fresh water distribution systems, the sewage system and the galley equipment.

The work schedule in the engine department was a traditional three-watch system. On each watch there were one engineer and one motorman.

The watches 12.00-16.00 hrs and 24.00-04.00 hrs were held by the third engineer, the watches 04.00-08.00 hrs and 16.00-20.00 hrs by the second engineer and the watches 08.00-12.00 hrs and 20.00-24.00 hrs by the fourth engineer.

### **7.2.3 Catering department**

The total number of persons employed in the catering department was 121. The catering department was managed by the chief purser, who was responsible for the organisation and conduct of the work. He was also responsible for the commercial results of the department. Regarding personnel, maintenance and other operational matters he reported to ESCO via the master. His economic reporting was to Estline in Stockholm. There was a Swedish or Finnish adviser for the Estonian chief purser, who from the time of the take-over until July 1994 was Marlene Andersson, the wife of the nautical adviser until July 1993, Captain Anders Andersson. On the last voyage it was the Finn Jan Bergendahl from Mariehamn who did not survive.

## **7.3 Safety Organisation**

In as much as this 'Group of Experts' agrees with the findings of the JAIC under this heading they are cited here.

### **7.3.1 The development of the safety organisation**

When the operation of the ESTONIA was taken over by ESCO in 1993, the new safety organisation was based on the safety plan of their previous vessel on the same route, the NORD ESTONIA.

All documents, plans and manuals included in the safety system were in both Estonian and English, and the safety organisation was implemented at all crew levels prior to commencement of traffic. The safety organisation was tested during the operational control in Tallinn before the ferry commenced trading, see Subchapter 6.2.

The safety organisation and the training and implementation thereof were described in the emergency plan, the safety manual and the training manual.

**Note:** Reportedly due to the fact that the NORD ESTONIA had no radio operator and consequently was not included in the safety plan, the radio operator of the ESTONIA - as well as all the Swedish/Finnish advisers - had no functions in the safety list of the ESTONIA.

### **7.3.2 Alarm signals**

Various types of alarm were used on board the ESTONIA. The lifeboat alarm and fire alarm were general alarms, addressed to passengers and crew. Besides these there was a coded alarm "Mr. Skylight" addressed only to the crew and intended to alert relevant parts of the safety organisation. The alarms were described in the emergency plan and in the safety manual available at various locations in the crew accommodations such as mess rooms, day rooms and all major workplaces. The different alarms are explained as follows:

#### **Lifeboat alarm**

The lifeboat alarm - seven short sound signals, followed by one long one - was given repetitively with the alarm bells and/or the vessel's horn. When the alarm was given, the command group, the port and starboard boat groups, the engine control group and the eleven evacuation groups were alerted.

#### **Fire alarm**

The fire alarm - continuous repetitive short sound signals - was also given with the alarm bells and/or the vessel's horn. When the alarm was given, the command group, the two fire groups, the engine control group, the control group, the port and starboard boat groups and the first aid groups were activated.

#### **"Mr. Skylight"**

Without alarming the passengers, the crew could be alerted over the public address system with the coded message "Mr. Skylight". This message could also be used with a suffix. Depending on which suffix, viz.

**in case of fire:**

"Mr. Skylight to No. 1", means for the fire groups to proceed immediately to "Fire Station No. 1".  
 "Mr. Skylight to No. 2", means for the fire groups to proceed immediately to "Fire Station No. 2".

Fire Station 1 is forward on deck 8.  
 Fire Station 2 is aft on the car deck.

**Note:** According to other sources "Number One" meant "Deck 1" and "Number Two" meant "Deck 2", etc. which, however, is not in accordance with the "Safety Plan" attached as Supplement No. 226 to the Report of the JAIC. "Mr. Skylight to number one and two" according to this plan means that Fire Group 1 should proceed to Fire Station 1 (underneath the bridge) and Fire Group 2 should proceed to Fire Station 2 on the aft part of the car deck.

**in case of collision or grounding:**

"Mr. Skylight Damage Control" means for the fire groups to proceed to their fire station and prepare themselves for access and damage control. Alarm no. 121 sounds all tanks, nos. 130 and 132 close all scuppers and covers on car deck. The first aid group is called together.

**Note:** Several crew members have testified to having heard "Mr. Skylight to No. 1 and 2" over the loud speaker after the excessive heel at 01.02 hours and thus assumed that there was a fire and tried to reach their respective fire stations at the beginning (e.g. see statement of 2nd engineer Peeter Tüür - Enclosure 7.3.2.128).

### 7.3.3 Alarm

The safety organisation was led by a command group mustering on the bridge. The command group consisted of the master, the chief engineer, the chief officer, the chief purser and the third officer.

The master was the overall commander of the operations. The chief engineer was the fire chief, commanding the two fire groups and the engine control group. The chief officer was responsible for stability calculations and was also the deputy fire chief. He commanded the port and starboard lifeboat groups, the first aid group and the helicopter groups. The chief purser was responsible for evacuation, the evacuation group reported to him through forward and aft zone leaders. The third officer's main responsibility was to record times of events and to take notes.

According to the emergency plan and the safety manual, the chief officer - not the radio officer - was responsible for external radio traffic. The reason for this is that the safety organisation for the ESTONIA was copied from organisation of the NORD ESTONIA. This ferry had no radio officer.

### 7.3.4 Training and drills

The various groups in the safety organisation drilled according to the vessel's exercise schedule. The drills were led by the group leaders, who also made a report of the content of the drill and of any group members absence. This report was submitted to the responsible officer in the command group.

The fire groups, the engine control group and the boat groups were scheduled for training every two weeks, and the first aid group and the evacuation groups were scheduled to exercise once a month.

When the ESTONIA commenced her traffic between Tallinn and Stockholm, an operative control was carried out on board by the Swedish Sjöfartsverket, which has been described in Subchapter 6.5.2.

On 2 February 1994 the ESTONIA also participated in a major bomb exercise, the RITS Övning. The report is attached in Swedish as Enclosure 7.3.4.129.1 and a summary of the report in English is attached as Enclosure 7.3.4.129. The threat that a bomb might explode in the sauna and swimming pool compartments half way between the Estonian and the Swedish coasts, i.e. approximately in the actual casualty position, was simulated. The purpose of this exercise was to train the co-operation between the shore-based, helicopter landed anti-terrorists experts with bomb dogs, etc. and the vessel's safety organisation.

Reportedly the exercise was a great success and ESTONIA's crew was said to have performed well.

## CHAPTER 8

### EMERGENCY AND LIFESAVING ARRANGEMENTS AND EQUIPMENT

#### 8.1 General

The requirements for emergency and lifesaving equipment are governed in detail by the SOLAS Convention. The vessel was built to SOLAS 1974, but the first PSSC was issued on a form which referred to SOLAS 1960 (see 2.4.4.). The F.B.N. surveyed the vessel for compliance with the requirements while she flew the Finnish flag, and B.V. surveyed on behalf of the E.N.M.B. during the following period assisted by the Swedish Shipinspec as far as the take-over was concerned. The surveys were annual and the surveys in connection with the change of flag were performed by senior staff members of B.V. and Shipinspec at Turku and in Tallinn. For details reference is made to Subchapters 6.4 - 6.5.

#### 8.2 Lifeboats and Rafts

The vessel was equipped with ten motor-driven lifeboats of open type and of fibre-glass construction. The first boat on the starboard side - lifeboat no. 1 - was a man overboard (MOB) rescue boat, i.e. the emergency boat. Two boats were equipped with searchlights. The boats were suspended under davits on deck 8. Embarkation was from deck 7. The vessel also carried 63 inflatable rafts, which were packed in containers stowed on decks 7 and 8 and were equipped with hydrostatic release mechanisms. Twelve rafts were equipped to be launched by davits, four of which were installed on deck 7. The remaining rafts were intended to be dropped into the sea. With one exception, the rafts were manufactured in 1980 and delivered to the VIKING SALLY during construction.

According to the JAIC lifeboats and rafts provided on board satisfied the SOLAS 1974 requirements as to number and standard.

The lifeboats and rafts were surveyed every year in conjunction with the issuance of the Passenger Ship Safety Certificate. The last survey was in June 1994.

### **8.3 Lifebuoys and Lifejackets**

The vessel was equipped with 18 lifebuoys, nine of them with self-activating lights. One lifebuoy on each side of the ship was equipped with a lifeline and with self-activating light and smoke signals.

There were 2298 lifejackets for adults and 200 lifejackets for children on board. All the jackets were equipped with whistles. There were no lights on the lifejackets.

On the open passage on deck 7, rescue stations and bins containing lifejackets were located on both sides of the ship.

The Final Report of the Joint Accident Investigation Commission does not mention whether there were survival suits and/or immersion suits on board and/or in the lifeboats/rafts. When being interviewed by Erik Ridderstolpe on 17.12.97 the technical director of N&T and boardmember of Estline, Sten-Christer Forsberg, stated: *"The poor, overaged safety equipment was accepted by Sjöfartsverket. Otherwise we would have renewed it."*

### **8.4 Emergency Beacons (EPIRB)**

The ESTONIA carried two emergency beacons (EPIRBs) of type Kannad 406F. The last check of the radio beacons was reported to have been made about one week prior to the accident by the radio operator. This check confirmed that the EPIRBs were in full working order.

### **8.5 Emergency Alarm Systems**

The ship had an alarm system incorporating 197 alarm bells and 11 alarm sirens.

The alarm system was function tested once a week. The audibility of the system against the background noise in the accommodation areas had been judged to be adequate, although no documented measurements had been made.

Alarms were installed in the passageways and public spaces as well as in non-passenger areas.

The alarm system operated on the 220 V system and was connected to the main- and emergency generator systems. The alarm system was not powered by the emergency batteries.

Alarm buttons were installed on every deck, including the sections and work rooms of the crew. By pressing an alarm button an audible signal was triggered off on the navigation bridge and an indicator showed which section the alarm was coming from. In case of no reaction within 30 seconds, the alarm in the entire vessel was automatically activated. The receipt of one signal on the bridge did not prevent the receipt of additional signals from other alarm buttons.

The public address system was operated from the navigation bridge and also from the Information desk. The microphone on the bridge had priority over the one at the Information desk.

A separate personal paging system for crew members was installed.

### **8.6 Escape Routes and Instructions**

The escape routes led to 18 rescue stations located on deck 7. The routes were marked with signs on the walls and fluorescent tape along the corridors.

### **8.7 Passenger Information**

According to the JAIC each passenger cabin was supplied with an instruction pamphlet in Estonian, Swedish and English on safety measures describing how to react in the event of an emergency. It is said that there also was an evacuation scheme posted in each cabin indicating the escape routes and the particular rescue station for the passengers accommodated in that cabin and that the exits and emergency exits were marked by arrows in passageways, on staircase landings and in recreation areas as well as by signsboards on exit doors.

In any distress situation, besides alarms given only to the crew, the passengers **should** be given general information and instructions through the public address system.

**CHAPTER 9****CLASSIFICATION INSPECTIONS, STATUTORY  
INSPECTIONS AND PORT STATE CONTROL INSPECTIONS**

### 9.1 Classification Society Inspections

Bureau Veritas inspected the vessel for compliance with the class requirements in accordance with their rules and standards. The main inspection period was five years and the 1500 items to be inspected were divided into approximately 300 items to be inspected each year according to the Continuous Survey Programme of Bureau Veritas. The bow area under this programme was inspected in 1983, 1988 and in 1993. No discrepancies were recorded during any of these inspections. The question remains why the severe deficiencies of the visor and the bow ramp which clearly existed already in 1993 were not recorded.

Based on the available documentation it has to be assumed that the two B.V. people responsible for the ESTONIA, both from a classification and statutory point of view, Hans Olsson, manager of BV-Sweden, and Anders Wirstam, staff surveyor of the BV-Stockholm office and exclusively involved with ESTONIA, were not interrogated by Joint Accident Investigation Commission and there is no recorded evidence in the files of the Swedish part of this Commission about their interrogations by the police and the prosecutor.

In a memo found in the files of the prosecutor the following is, however, stated:

*»On 12.10.1994 at 12.10 hours I had contact with the manager of B.V. in Gothenburg, Hans Olsson, Tel. (031) 17 14 15. The subject was which surveys they had done on the "Estonia". All the relevant documentation was with them; Olsson stated that he could not submit any documents without the respective authority. In case he should have to do so, he would need the approval partly from N&T, partly from the Estonian Government. Olsson even wishes to inform the lawyer Bengt-Ake Johnson by telephone (08) 665 90 70. This lawyer protects them legally. Olsson also advised that Olof Forssberg from the Commission had already given the same explanation as the police now give. Forssberg raised the same questions which the police are now asking. Olsson knew that Forssberg had been in contact with the owners in this matter, N&T had been in contact with Olsson and they will send a letter with what Forssberg wants to know. The documentation concerning "Estonia" consists of a large number of A4 folders. Olsson requires a written statement from the police with the documents they are demanding. Before this the police have to contact N&T - S.M. (Sven Malmroos). In the course of the further development I managed to contact sometimes the prosecutor and sometimes Forssberg. Some co-ordination has to be found. / S.M. (Sven Malmroos).«*

This indicates that B.V. apparently enjoyed some special treatment as did N&T and ESCO, which continued throughout the investigation up-to-date. Reportedly Hans Olsson left B.V. in the summer of 1998 and might thus be willing to give some explanations now.

The files of the prosecutor reveal that Hans Olsson and Anders Wirstam were interrogated together for the first time on 21.11.1994 by the criminal inspectors L.E. Andersson and S.A. Wränding. On 02.06.1997 Hans Olsson was questioned alone by the criminal inspector Bo Wide and thereafter Anders Wirstam was questioned again and alone on 22.01.1998 also by Bo Wide and Tomas Lindstrand.

In summary both made the following statements:

**a) On 21.11.1994 - see Enclosure 9.1.130:**

- the B.V. organisation worldwide and in Sweden was explained;
- education and experience of the B.V. inspectors
- the contract with E.N.M.B.;
- Load Line, SOLAS, etc.;
- they had nothing to do with the crew;
- summary of surveys was handed over;
- the last detailed inspection on 23.-25.08.1994, hull & machinery, automatic controls - no remarks, also the visor and bow ramp were inspected without remarks. During the inspection of visor and bow ramp the weatherlightness, signal system and strength were also controlled. Also the cylinders which activate the visor and bow ramp were checked. On the bridge and car deck it was indicated whether the lock bolts were closed or open. Actually the control of the indicator lights is part of the statutory inspection according to SOLAS which was done in January 1994. Since the visor had to be inspected in August anyway, they did the check of the signal system again.

According to Wirstam the bow area including the visor was inspected in accordance with three different rules resp. regulation requirements, viz. on behalf of

- the Classification Society B.V. according to their rules once a year.
- the E.N.M.B. according to the Load Line Convention four times a year (the Load Line Certificate was kept interim).
- the E.N.M.B. according to the SOLAS Convention once a year.

- Hull and Load Line Surveys were due in August 1994 and the statutory inspections according to SOLAS in January 1994.

- the inspection in August 1994 took three days without any remarks.
- because of the interim nature of the certificates, the surveys had to be carried out four times per annum.
- the Continuous Survey Class System was explained - 20% of the items per annum.
- in addition to this were the Maritime Administration controls: MARPOL, etc.
- the "Stability Booklet" was explained and the reason why it had not been accepted - the list of changes to be made was handed over to N&T:

- within 6 months
- within 12 months.

**Note:** Nowhere is it stated whether all the requirements were rectified on 27 September 1994.

- all certificates and inspections had to be renewed after the flag change.
- cargo lashings and securities are not subject to inspections, there are allegedly no rules for lashing points, lashings, etc.

**Note:**

According to the JAIC the overall guidance for the lashing of cargo, given in the IMO Resolution A 581 (14) "Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships" and in the IMO Resolution A 714 (17), had been applied. The vessel also carried a **Cargo Securing Manual** issued by Estline which, however, had not been available during the inspection by the two Swedish Sjöfartsverket inspectors and their trainees some hours before the last departure - see Chapter 15. The Cargo Securing Manual has to be approved by the National Maritime Administration, i.e. to be approved by B.V. on behalf of E.N.M.B., and Wirstam - according to his own statement - knew nothing about it, although it was part of his "statutory inspection job".

- the cargo had to be distributed according to the load cases in the Stability Booklet.
- proceeding in heavy weather was discussed in the light of SOLAS.
- no items affecting the seaworthiness was found and reported to B.V.
- visor and bow ramp have to be weatherlight, i.e. they have to be tight against splashing water
- weathertight- watertight explained.

- ice cylinder explained.
- between 15.01.93 and 27.09.94 ESTONIA passed all the hull and machinery and statutory inspections without any remark whatsoever.

**b) Hans Olsson on 02.06.1997 (born 16.12.44)**

- See Enclosure 9.1.131:
- has been with Sjöfartsverket for 13 years.
- explained SOLAS / IMO / certificates, etc
- they did not check the bow ramp location because there was no Exemption Certificate.
- explained the DIANA II incident from the B.V. point of view.
- was confronted with the German findings but pretended to know nothing about it.

**c) Anders Wirstam on 22.01.1998 (born 08.08.42) - Enclosure 9.1.132:**

interrogated by public prosecutor Tomas Lindstrand and the police inspector Bo Wide in the presence of lawyer Olof Rågmark of Johnsson & Johnson:

- 28 years experience as marine engineer.
- first contact when vessel was still WASA KING.
- had also known DIANA II very well for a long time. - he did not know that the ramp was in wrong place according to SOLAS
- no measurements in this respect had been made, neither at time of flag change nor newbuilding.
- regarding the "*short international voyage*" he is of the opinion that the vessel must not be more than **100 nm** from land, which was not the case with ESTONIA.
- discussion of the **100 nm** limit - the lawyer stated that nowhere in the Baltic could you be more than 100 nm from land.
- upon being questioned about the **20 nm** limit Wirstam stated that he could not answer the question. - What checks did he perform before signing the PSSC? Safety equipment/radio equipment, etc. The inspection took three weeks including visor, bow ramp, locking devices.

- T. Lindstrand asked, whether he wanted to say anything in this respect?

Wirstam: "No, I did not concentrate on visor and bow ramp very much."

Lindstrand asked again, whether there was anything in respect of visor and bow ramp that was noteworthy or strange?

Wirstam: "No."

- Lindstrand: Did you see the Finnish PSSC?

Wirstam: "Yes."

- Lindstrand: What did you do in 3 weeks? Did you look at drawings, did you check whether anything was changed?

Wirstam: "One sees how the vessel is built. One asks the crew. If nobody says that the vessel had been modified, one takes it that it has not been."

- Lindstrand concludes that the check is just made by looking at the vessel and asking questions to people who are believed to have knowledge about the vessel.

- Lindstrand: Did DIANA II sail in sheltered waters between Rostock/ Trelleborg?

Wirstam: "Well within 100 nm, I don't know whether within 20 nm."

- Lindstrand: What importance did the ramp position have for the cause of the casualty?

Wirstam: "No importance. This is difficult to answer. It is outside my scope of evaluation. Do you mean that it should be further aft?"

- Lindstrand: Yes, and also if it had been constructed differently without the ramp extending into the ramp house?

Wirstam: "This has now fortunately been forbidden and therefore the conclusion has to be drawn that it cannot have been that good. But there are still many ferries which have the ramp built into the visor."

- Lindstrand: Do you consider the ramp to be the upper extension of the collision bulkhead in accordance with SOLAS?

Wirstam: "Yes, this was the case."

- Lindstrand: B.V. carried out the Flag State Control?

Wirstam: "Yes."

- Lindstrand: Refers again in detail to the distance between ramp / f.p.p. What did you do? Why didn't you know?

Wirstam: "No."

- Lindstrand: Was it normal not to care about this?

Wirstam: "Yes, we trusted the previous administration."

- Lindstrand: Did you assume that the vessel had been correctly built at the beginning?

Wirstam: "This is part of my job. On the other hand, I was not alone. There was also Hans Olsson."

Wirstam: "I was from 1966-1969 with Sjöfartsverket, Stockholm."

- Lindstrand draws attention to the German findings of the visor's misalignment. Was this checked?

Wirstam: "When an inspection is carried out it is expected that the vessel is in a certain condition. If this would have been the case, it should have been visible. During inspection you look at the opening and closing of the visor. If nothing is visible, it is o.k."

**Note:** Åke Sjöblom and Gunnar Zahlée noted upon their inspection with open visor that there was a misalignment of the visor.

- Lindstrand: What about the rubber packings?

Wirstam: "Nobody during my time told me that any were missing."

- Lindstrand: You should have controlled this.

Wirstam: "Such inspection normally starts with the certificates. To check whether all certificates are there. That's where it starts."

- Lindstrand: When did you inspect what, and if you found a deviation, did you go into detail?

Wirstam: "That is correct."

A list with all surveys carried out by B.V. is attached as Enclosure 9.1.133 and the statement of the previous chief surveyor of the B.V. Stockholm office, Lars-Olof Ålander taken on 03.02.98 by Bo Wide and Tomas Lindstrand is attached as Enclosure 9.1.134.

The "Marine Surveyor Certificate" issued by B.V. for Anders Wirstam is attached as Enclosure 9.1.135.

Finally attention has to be drawn to the remark made by Olsson during the first interrogation on 21.11.94 (Enclosure 9.1.130), viz. that B.V. had handed over to N&T a list of items to be prepared for inspection after 6 months respectively 12 months which is not mentioned anymore anywhere. Olsson also gave a substantial memo to the police, the pages of which are referred to in this statement. He also stated that this memo had been given to the JAIC. It could neither be found in the files of the public prosecutor nor in the files of the Swedish and Finnish Commissions.

## 9.2 Statutory Inspections

As mentioned before, B.V. also carried out statutory inspections to fulfil the obligations of the National Maritime Administration of the flag state Estonia in accordance with the

- SOLAS, MARPOL, Load Line and Tonnage Conventions. The respective certificates were also issued. According to Hans Olsson - Enclosure 9.1.131 - B.V. had nothing to do with crew matters. This was handled exclusively by the E.N.M.B.

As far as the visor and bow ramp, their locking devices and indicator lights were concerned the watertightness had to be checked according to the Load Line Convention, while the functioning of the indicator lights of the locking devices had to be checked according to SOLAS. The last SOLAS inspections had been carried out in January 1994 and the last Load Line Inspection only on 9 September, only 18 days before commencement of the last voyage and, of course, without remarks.

Also the control of the substantial lifesaving and fire-fighting equipment had been carried out according to SOLAS, always without remarks. For further details reference is made to the protocol of the joint statement of Hans Olsson and Anders Wirstam taken on 21.11.94 - see Enclosure 9.1.130 - and also to the statement of Sten-Christer Forsberg made during the interview with Erik Ridderstolpe on 17.12.97: "The poor, overaged safety equipment was accepted by Sjöfartsverket (Note: and by B.V. on behalf of E.N.M.B.). Otherwise we would have renewed it."

### 9.3 Port State Control Inspections

The situation as to the allegedly performed Port State Control (PSC) inspection is confusing:

(a) According to a memo by Sven Malmroos, investigating police inspector during the early days, he was advised on 12.10.1994 by Eva Lindström from the Sjöfartsverket head office that two operative controls had been carried out by them, one at the beginning of 1993 (during take-over) and another one at the beginning of 1994, which is unknown unless they mean the RITS exercise on 01.02.1994, which was actually a bomb exercise and not an operative control. The memo of Sven Malmroos is attached as Enclosure 9.3.137.

(b) According to the JAIC there had been four inspections: the take-over inspection, which had to be considered a Port State Control (PSC) inspection, - see Subchapter 6.5.2 - and three further PSC inspections during the following 20 months. One was supposed to have been carried out in connection with an oil spill caused by leaking stern-tube seals already in April 1993, another one was supposed to have been in December 1993 and the final one was said to have been in March 1994 which allegedly did not give rise to any remark. See the JAIC Report - Subchapter 3.2.10. The JAIC reports further in Subchapter 5.3: "During the last day in Tallinn the vessel was used in a training programme for Estonian Maritime Administration surveyors in the conducting of a Port State Control in compliance with the Paris Memorandum of Understanding on Port State Control (see about Paris MOU in 9.1). The trainees made a thorough Port State Control inspection of the ESTONIA and were supervised and instructed by two senior inspectors from the Swedish Maritime Administration. The exercise was documented in protocol, set up in a form according to the Paris MOU. A copy of this protocol is included in the Supplement.

The Swedish inspectors leading the exercise have been interrogated by the Commission and have stated that the vessel was in good condition and very well maintained. They found no deficiencies that would have caused detention or other serious remark, if the inspection had been a regular Port State Control."

(c) The Independent Fact Group (IFG), Stockholm searched the archives of the Shipinspec Stockholm office in autumn 1998 and found protocols about PSC inspections performed on the following days:

01.02.1993  
02.04.1993  
06.04.1993  
16.12.1993  
02.03.1994

These dates include the take-over in Tallinn on 01.02.93, followed by two oil spills on 02.04.93 and 06.04.93, and another two in December 1993 and in March 1994 which are unknown. The RITS Exercise is not included. Actually Ulf Beijner, then the head of the Sjöfartsverket's Shipinspec office in Stockholm, confirmed to a member of this 'Group of Experts' and the safety inspector, Peter Hoffsten, confirmed to Tommy Lindström, who investigated the matter on behalf of the relatives organisation SEA, that they had never carried out a real PSC inspection. The report of Tommy Lindström is attached in English as Enclosure 9.3.136 and in Swedish as Enclosure 9.3.136.1.

## CHAPTER 10

### OPERATIONAL CHARACTERISTICS OF THE VESSEL

#### 10.1 General Observations

The vessel was equipped with two controllable-pitch propellers, two rudders and two bow thrusters. It was designed for berthing and unberthing without external assistance. Senior officers who had served on board the vessel when she was under Finnish flag have generally expressed satisfaction with the handling characteristics of the vessel. The fact that the navigation bridge was located aft of the front bulkhead of the superstructure in such a way that the bow of the ship was less visible than normal has not been considered as a disadvantage. As a matter of fact, the flag mast on top of the foremost part of the visor was visible from all positions aft of the control panel whilst the visor itself could only be seen through the lower windows at both sides of the centre part of the bridge. This, as well as the blue steering light on top of the above-mentioned flag mast just shining aft are not mentioned by the JAIC at all. The drawing on page 34 of the Final Report is thus incomplete and the view sector shown is wrong. The correct facts are shown on page 110 above.

#### 10.2 Speed Resources

The ship had a contractual speed of 21 knots at 90 per cent of maximum continuous rating. The practical maximum operating speed of the ship in later years was considered to be 19 knots. This was adequate for the service in which the ship was engaged. To meet the timetable, the average speed in open sea was required to be about 17.0 knots on eastbound voyages and about 16.5 knots on westbound voyages.

## CHAPTER 11

### CARGO HANDLING SYSTEM

#### 11. Lashing Equipment

The vessel was equipped with standard lashing belts for securing heavy vehicles and containers. Chocks were available on board for additional securing of heavy vehicles and for securing passenger cars on the hoistable car decks and on sloping deck surfaces. The equipment was stored in the service areas at the forward and aft ends of the car deck.

## 11.2 Operating Practice and Instructions

The chief officer had the responsibility for cargo handling and planning loading operations. Both second officers were engaged in the actual loading and unloading on the car deck and all lashing of cargo was performed under their supervision. Besides the second officers, the boatswain was directly engaged in lashing operations together with the deck hands.

No standard cargo loading plan was followed on board - but there was a general scheme - and a sketch of the cargo allocation was made before loading started. According to the JAIC the overall guidance for the lashing of the cargo, given in IMO Resolution A 581 (14) "Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships" and in IMO Resolution A 714 (17), was applied. The vessel also carried a cargo securing manual, issued by Estline, which however, was not available during the inspection by the two Swedish Sjöfartsverket inspectors and their trainees some hours before the last departure - see Chapter 15. According to frequent travellers personal cars and vans were never secured, trucks and trailers sometimes and trailers without trucks mostly.

During the voyage the cargo was checked by the seaman of the watch on his watch-round who had to activate control clocks at particular check points. On the car deck there were said to be one in the forward, one in the middle and one in the aft part. The car deck could also be checked on monitors on the bridge and in the engine control room by means of 4 cameras located forward, aft and at both sides of the centre casing.

## CHAPTER 12

### OPERATING HISTORY

#### 12.1 Route / Schedule

The vessel was operated in a ferry service between Stockholm and Tallinn.

##### **Tallinn**

The vessel berthed at Terminal 2 in Basin No. 2 (see map attached as [Enclosure 12.1.138](#)), starboard side to shore, loading/discharging via bow ramp, i.e. the vessel was alongside all day with open visor. Berthing was not always easy which is demonstrated by the frequent use of the port anchor. The vessel had to pass the narrow entrance between the two breakwaters with some speed, in particular when side winds were prevailing, but the stopping distance ahead was only about 3 ship lengths. The scheduled arrival was 09.00 hours and the departure was 19.00 hours (Estonian time = Swedish time + 1 hour). At wind speeds in excess of 15 m/sec the ferry proceeded stern first all the way out through the breakwater and turned round outside, at lower wind speeds the turning took place already inside the breakwater.

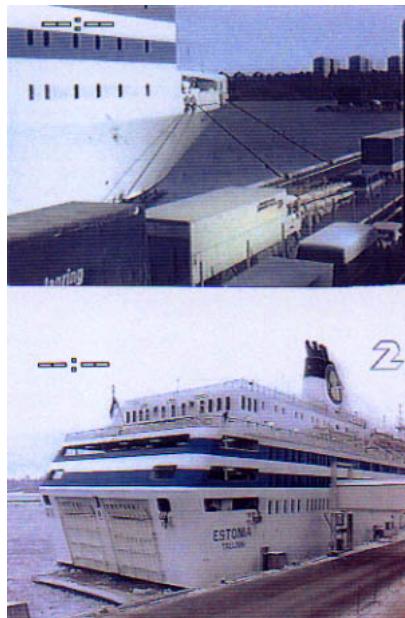
The three pictures following this show ESTONIA at her berth in Tallinn.

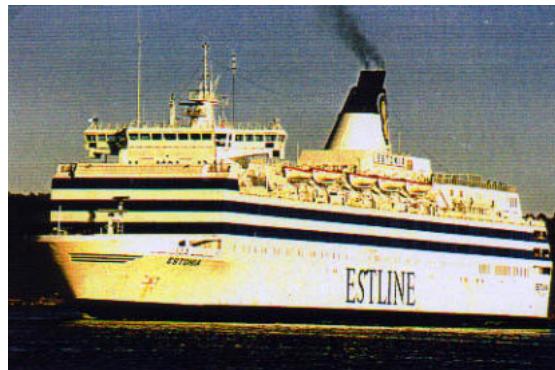


**Stockholm**

The scheduled arrival was at the beginning of the service 09.30 hours and since 24.01.94 at 09.00 hours local time. The ferry berthed at the Frihamn Terminal opposite the Silja Terminal also starboard side to the shore, but discharging/ loading took place via the 2 stern ramps. Departure was at 17.30 hours (Swedish time).

The pictures below show ESTONIA at her berth in Stockholm.





#### **At Sea:**

The route from Tallinn to Stockholm was leading between mainland and the island Nayssaar to the west and followed the Estonian coast with a course of ca. 262° to a waypoint on approximately 59°20' N, 22°00' E. The waypoint was changed according to requirements. Up to the waypoint the vessel was normally running on full speed, i.e. in calm sea = about 19 kn, and depending on the time when the waypoint was reached, the speed was then adjusted to be at the Sandhamn pilot at ca. 05.00 hours respectively at the Söderarm pilot at about 04.00 hours. The course from the waypoint to Sandhamn was ca. 266° and to the Söderarm entrance 287°.



## 12.2 Weather and Wave History

The Swedish Meteorological and Hydrological Institute (SMHI) has investigated the weather conditions met by WASA KING in the Gulf of Bothnia and by ESTONIA in comparison to the wind and wave conditions met by ESTONIA on her last voyage. The result is quoted as follows:

»SMHI have earlier studied and found that m/s ESTONIA the last 1-2 hours during the accident night 27-28 Sept 1994 was exposed of:

- \* winds: direction S-SW, mean speed of 14-20 m/s
- \* significant wave height 3.5-4.5 m, with some possible maximum waves of 6.5-7.0 m.

For m/s ESTONIA earlier voyages we have found the similar conditions as follows:

### **1. Tallinn-Stockholm/Stockholm-Tallinn 02.02.93 - 27.09.94**

\* Westbound voyages 3 occasions;

- 4/5 Feb. 1993
- 22/22 Jan. 1994
- 5/6 March 1994

\* Eastbound voyages 3 occasions (means that winds must be from E-SE-S)

- 15/16 Sept. 1993
- 2/3 Dec. 1993
- 19/20 Aug. 1994

## **2. Vaasa-Umeå/Sundsvall 01.01.91 - 31.01.93**

**Only one occasion with the similar conditions**

- 19/20 Dec. 1992 «

Consequently ESTONIA had encountered similar or worse wind and wave conditions at least 6 times before the casualty in her last trading area, whereby the last time had been only about 5 weeks before the casualty, i.e. at a time when the visor and bow ramp had been in a very bad condition for several months already, as will be explained later on.

The complete SMHI opinion is attached as [Enclosure 12.2.139](#).

The wind table below has been drawn up for easy reference of the reader who might not be well acquainted with the measuring of the winds in m/sec.

BEAUFORT	KNOT	KM/H	M/SEC
1	1- 3 KN	1.9- 6.4 KM/H	0.5- 1.8 M/SEC
2	4- 6KN	6.5- 12.0 KM/H	1.9- 3.3 M/SEC
3	7-10KN	12.1- 19.4 KM/H	3.4- 5.4 M/SEC
4	11-15KN	19.5- 28.7 KM/H	5.5- 7.9 M/SEC
5	16-21KN	28.8- 39.8 KM/H	8.0-11.0 M/SEC
6	22-27KN	39.9- 50.9 KM/H	11.1-14.1 M/SEC
7	28-33KN	51.0- 62.0 KM/H	14.2-17.2 M/SEC
8	34-40KN	62.1- 75.0 KM/H	17.3- 20.8 M/SEC
9	41-47KN	75.1- 87.9 KM/H	20.9- 24.4 M/SEC
10	48-55KN	88.0- 102.8 KM/H	24.5- 28.5 M/SEC
11	56-63KN	102.9- 117.6 KM/H	28.6- 32.6 M/SEC
12	> 63KN	> 117.6 KM/H	> 32.6 M/SEC

## **12.3 Always on Time**

The distance from Tallinn to Söderarm is 173 nm, to Sandhamn 177 nm. The distance from Söderarm to Frihamn, however, is 54 nm corresponding to 41/2 hours steaming time (in most parts of the archipelago the speed is restricted to 12 kn), whilst the distance from Sandhamn is only 42 nm corresponding to 3.5 hours steaming time. Therefore the Sandhamn route was preferred.

Assuming that ESTONIA departed from Tallinn on time (which was seldom the case) she was turned on outbound course at the earliest 15 minutes later, whereafter it needed some minutes to reach full speed (which is not taken into account). The ferry consequently had **14.75 hours** to reach Stockholm.

In case the Söderarm entrance had to be used she had available for the 173 nm long sea voyage 14.75 hours less 4.5 hours through the archipelago = **10.25 hours**, i.e. she had to make an average speed of **16.87 kn** to be at the pilot station on time.

In case the Sandhamn entrance would be used, there was some more time because she had available 14.75 hours less 3.5 hours through the archipelago = **11.25 hours**, thus had to make an average speed of only **15.73 kn** to be on time at the pilot station.

An evaluation of the logbooks of the Stockholm pilots for the time between ESTONIA's first call on 03.02.93 and her last call on 26.09.94 revealed the following:

- During 20 months of service the ferry was only once delayed for 1 hour and that was on 1 January 1994 at the Sandhamn pilot station.
- At Frihamn Terminal ESTONIA during the same period of time the ferry arrived late only 8 times with max. delay of 24 minutes (also on 01.01.94).
- None of these delays could apparently be attributed to weather influence.
- Delays occurred, however, generally upon departure from Stockholm, although only seldom of more than 20 minutes.
- In total, the vessel departed from Stockholm 12 times with more than a 30-minute delay. It has to be assumed that it was worse in Tallinn, according to the reports of previous passengers. Pilot or harbour master logbooks from Tallinn, however, are not available to this 'Group of Experts'.

An examination of the logbook entries of the Stockholm Pilots Association for the three days, when according to the SMHI ESTONIA had met wind and sea state conditions comparable to those encountered during the night of the casualty, has revealed the following:

On 5 February 1993 ESTONIA arrived at 05.59 hours at the Sandhamn Pilot, on 23 January 1994 at 05.43 hours at Söderarm Pilot and on 6 March 1994 at 05.25 hours at Sandhamn Pilot. Consequently she was always on time. The respective logbook pages are attached as [Enclosures 12.3.140, 12.3.141](#).

Since no detailed information is available from the Estonian side and previous passengers frequently experienced considerable delays on arrival in Tallinn, the eastbound voyages cannot be evaluated.

In any event, it is a fact that ESTONIA met at least 6 times similar or worse wind and wave conditions compared to those she met on the night of the accident, however, without delayed arrival (on the westbound voyages) and it is unknown whether damage to the visor and its locking devices were sustained. The last time she met similar conditions was only on 19 August 1994, i.e. 5 weeks before the casualty, and at this time all the disastrous deficiencies - as will be explained later on - were already existing.

The evaluation of the arrival times at the Stockholm Pilot stations outlined above also reveals that ESTONIA obviously always maintained her schedule, regardless of the prevailing weather and/or ice conditions.

The explanation for this adherence to schedule by all means and under all circumstances can probably be found in

- (a) the pride of the newcomer wanting to be at least as good as the competitors Silja and Viking.
- (b) the pressure of competition from the large and more comfortable Stockholm-Helsinki ferries which - according to Ulf Hobro - was also the reason for the installation of stabilisers at high costs after less than 1 year in service. As a matter of fact Ulf Hobro had asked Turku Repair Yard already in the beginning of April 1993, i.e. after ESTONIA had been in service for just 2 months, but mainly in bad weather, to quote for the installation of stabilisers. The offer was submitted on 5 April 1993 and is attached as [Enclosure 12.3.143](#).

The pressure on the masters of ESTONIA from the Board members of Estline AB is confirmed by the statement of Captain Per Ringhagen - [Enclosure 5.3.111](#) - who has stated that during board meetings of Estline AB it had been repeatedly stressed that ESTONIA had to maintain her arrival at Stockholm by all means and that this had been made quite clear to the masters, who sometimes attended the board meetings. This is said to be written in the protocols of these board meetings which must be still available. The apparent fact that the masters of ESTONIA did their utmost to maintain the schedule was obviously not unknown to the crew as it is demonstrated by the questioning of motorman Ziljajev, who testified in this connection as follows:

**Q: Was it a must or was it a requirement from the management that ESTONIA or any other vessel may not miss her schedule, i.e. be delayed?**

**A: With ESTONIA we were always on time. The master had a time schedule received from the owners and we were always on time. The masters always followed the schedule received from the company. According to contract he had to follow this schedule.**

**Q: You have now told us about the obligations of the master to follow the schedule. There are rumours that masters who are unable to keep the schedule will be sacked.**

**A: Yes, that is principally so. This is the requirement of the company that the master has to maintain the schedule. Some of the passengers have to reach other connections and if they miss them, because the vessel is delayed, the company has to pay compensation.**

**Q:** Which company has worked out the schedule?

**A:** Estline AB. But I don't blame Estline for anything. Each company has its own schedule, where it is described up to the minute. If a company buys a ship, then it is not completely known how the vessel reacts during operation, how much power is needed, among other things, during a storm.

The complete interview of Ivan Ziljajev is attached as [Enclosure 13.193](#) and is also available on video cassette.

## 12.4 Observations on Board

Since no information about the operating history of the vessel was made available by owners/managers and also the Final Report of the JAIC contains very little in this respect, members of this 'Group of Experts' have spoken to previous passengers, advisers and crew members in order to find out how ESTONIA and her crew did perform during the 20 months in service under Estonian flag. Further information has come from viewers of the Swedish TV program 'EFTERLYS' after the ESTONIA casualty had been presented and viewers were requested to report about their own experiences on board the ESTONIA, which about 40 viewers did. The reports submitted during or immediately after the program - attached as [Enclosure 12.4.145](#) - were analysed and the witnesses assumed to have made relevant observations were contacted by a Swedish speaking expert of this 'Group of Experts' either personally or by phone. The results are summarised in two faxes from Oy Mariner's Assistance Ltd. Ab, Helsinki to Marine Claims Partner (Germany) GmbH, Hamburg dated 30.07.97 - [Enclosure 12.4.146](#) and dated 12.08.97 - [Enclosure 12.4.147](#). The results of all observations made on ESTONIA and which are available to this 'Group of Experts' are summarised below.

One of the viewers of the 'EFTERLYS' program reported that he saw the ESTONIA in July 1994 at her berth in Stockholm with open visor and open bow ramp, which was categorically denied by N&T, ESCO and the JAIC members.

The following picture proves it. It was made by a German tourist in July 1994.



### 12.4.1 Heavy weather, excessive speed and banging noises

- **Martin Jakobsson** - ESTONIA always maintained high speed, irrespective of the weather circumstances. MARIELLA could always be seen at a relatively short distance, but not on the last voyage.
- **Li Iker** - travelled on board ESTONIA three weeks before the casualty. The ferry proceeded at rather high speed. The weather had deteriorated and the wind was blowing quite hard, the vessel was rolling violently and smashed into the seas to the effect that there were bangs in the hull. The witness felt uneasy and was unable to sleep, the rolling of the ferry made it almost impossible to lie in bed.
- **Jan-du-Rietz** - retired captain, ca. 70 years old. He made 4 trips on the ESTONIA, the last one was in May 1994. When he saw on board the ESTONIA how the ship was being run he realised that the crew still had to learn a lot. No doubt the master was under pressure but this is no reason to push the vessel so hard against heavy head seas. The interview is attached as [Enclosure 12.4.1.148](#).
- Next a letter shall be quoted which the retired Captain Joel Haukka wrote on 2 February 1996 to his old mate Captain Hans Rosengren, lecturer at the Nautical Academy Kalmar and a member of the Swedish part of the JAIC:

»I have made, at least, 20-25 voyages on the ESTONIA and was, at least, 3 times on the bridge.

I am sending you the Swedish translation of an interview with Andi Meister published in the Estonian newspaper 'Postimees' on 16 January 1996.

Read the article and draw your own conclusions.

For me, having read his statement, it is a further confirmation that the guy doesn't know what he is talking about.

He made it quite clear that the causes of the catastrophe are exclusively technical.

Why is the excessive speed not taken into account?

In interviews and statement by the Estonian members of the JAIC it is said that the speed is of no relevance and had no effect on the catastrophe.

The chairman of the Commission has furthermore given wrong information in the interview when he stated that during the voyage there would be nobody on the car deck. The crew went safety rounds on the car deck.

At the same time I am asking the question, after having read in the interview about all the deficiencies that had been on the vessel, why were these obvious deficiencies not rectified when the vessel changed flags to Estonia?

The vessel was for a longer time sailing under Estonian flag and it should very well have been noted that the ramp was at the wrong place.

Or didn't they have competent masters and superintendents who were able to find that out?

According to the Estonian newspapers one of the conclusions in the Final Report shall be that the speed had no relevance for the catastrophe, which is totally wrong and not understandable because the vessel was proceeding with full engine power against a full storm. Many people, who do not even have own experience with good seamanship, will laugh about it. Already in the autumn (1995) the public has pointed to the fact that the Estonian Commission is biased. This is true, but the required consequences have not been taken.

The Commission itself does everything to make the Final Report, which is of substantial international interest, a farce, which is absolutely impossible.

Forsberg did indeed state in yesterday's 'Svenska Dagbladet' that the survivors had been questioned by the police. I am asking you, Hans: Is it possible for an external, who has never had to do with shipping or with how to handle a vessel, to ask the proper questions to establish a correct picture (scenario) of what had happened?«

Hans Rosengren never replied to this letter and the friendship between the two came to an end.

- **Captain Joel Haukka** has in addition stated the following:

He heard from Estonian truck drivers before and after the casualty that cargo had shifted inside the trucks to forward, which they attributed to the excessive speed of the vessel trying to keep to the schedule. When they complained to crew members about the damage caused, the answer had always been that Estline was proud of beating Silja and Viking in bad weather. The complete letter from Joel Haukka to Hans Rosengren together with an office translation is attached as [Enclosure 12.4.1.149](#).

- **Ingrid Asp** - made a heavy weather voyage from Tallinn to Stockholm in April 1993, probably 21/22 April 1993. She wrote to Sjöfartsverket already on the 28 September 1994 as follows:

»My cabin was on the 4th deck, port side, forward and was overlooking the forecastle deck. I went to bed at 11.30 hours Estonian time. The waves were coming over the bow visor and were smashing with remarkable force against my cabin window. Each time the vessel was diving into a wave-trough there was banging - metal on metal - and I had the feeling that the visor was loose. It was impossible to sleep, so I got dressed and walked all around the vessel and subsequently I went as deep as I could inside the vessel. Down there I could also hear the banging, but it did not sound as dangerous. I went back to my cabin where the banging noises were much louder and frightening. I went back to the aft part of the vessel and found an empty sofa, where I slept until the next morning.«

The complete letter with office translation is attached as [Enclosure 12.4.1.150](#).

- **Eva Andersson:** This witness travelled on the ESTONIA in April 1993 and had a cabin either on the 4th or 5th deck, which was the 4th one from forward, heard all the time rhythmical bangs which were frightening and made it impossible, or at least difficult, to sleep. The crew understood neither Swedish nor English.
- **Roger Nyström:** Made a trip on the ESTONIA in May 1993 and noted water on the car deck, although the sea was calm, heard strange noises in his cabin, like rhythmic bangs from forward. \* Maude Lisborg: Travelled on the ESTONIA 17/18 September 1994 from Tallinn to Stockholm and had a cabin on the 1st deck. The weather was stormy and she heard and felt hard bangs from forward, which she had never heard or felt before.
- **Eva-Lotte Nilsson:** Made a trip on the ESTONIA on 14/15 September 1994 which was rather unpleasant/uncomfortable, she had a cabin from where she looked on to the visor, on the voyage to Stockholm the weather was bad and she heard and felt rhythmical bangs from forward.
- Ivan Petrov - a Russian businessman living in Stockholm, travelled frequently on ESTONIA. His last voyage was on 22 September 1994 from Stockholm to Tallinn. He was in cabin 1064, i.e. below car deck (1st cabin at port side in the 4th compartment), and could not sleep due to the continuous banging noises from forward. The weather was not bad - WSW, ca. Bft. 3 - and the vessel was slightly pitching and rolling. He heard the noises for several hours. The vessel passed Söderarm at about 22.00 hours, whereafter the banging started and went on to about 02.00 hours. Petrov informed the JAIC accordingly on 15.03.95 and spoke to this 'Group of Experts' on 03.04.95.

## 12.4.2 Proceeding through ice

The picture below shows ESTONIA at her berth in Tallinn with open visor and bow ramp on 30.03.94, i.e. more or less at the end of the ice winter which had left visible traces to the visor's structure - see arrow.



**Carl Övberg:**

"I also made trips with ESTONIA in February/March 1994 when ESTONIA was acting like an icebreaker proceeding at full speed through heavy ice all the time until shortly before arrival. Once she almost stopped due to the very thick ice and then proceeded slowly ahead. The vessel was shaking and vibrating which was felt and heard all over the ship.

ESTONIA was always late arriving in Tallinn and also always delayed departing from Tallinn, but she was always on time in Stockholm no matter what the ice or wind conditions were like."

The complete statement of Carl Övberg is attached as [Enclosure 12.4.2.151](#).

**Henning Frederiksson on 24.03.1994:**

»It was stormy weather and ESTONIA was proceeding in open water at full speed with a following sea when she met pack ice, which she crashed into without any speed reduction. ESTONIA came fast into the pack ice with an enormous crash and had to go backwards and try again. There was 16 m/sec. storm, nevertheless, ESTONIA kept her high speed.«

The ice situation is demonstrated on the ice chart of 28.03.94 which is attached as [Enclosure 12.4.2.152](#) and two photos showing the cruise vessel SALLY ALBATROSS sitting aground outside Porkkala (opposite Tallinn) in heavy ice during February/March 1994. The photos attached as [Enclosure 12.4.2.153](#) clearly demonstrate the ice conditions which were prevailing at this time in the Gulf of Finland. The effect these ice conditions had on the visor and foreship of the ESTONIA can be seen on the photo below which was made on 24.03.94.



### 12.4.3 Difficulties with visor and bow ramp

- **Manfred Salzberg** - travelled together with his wife on 01.02.94 to Tallinn on board ESTONIA by car. Upon arrival in Tallinn the crew was unable to open the bow ramp. It took one hour before they were able to open it by means of heavy hammers. (Why didn't they warm it up?) It was frozen fast. He has a number of pictures showing the forepart.
- **Henning Frederiksson**: Out of 6 trips, the last one on 12/13 June 1994, he and his wife saw 5 incidents when crew members were banging on the locking bolts of the bow ramp with sledge hammers. He recalls the upper starboard and lower port bolt. It took the crew 10 minutes and more to open or close one bolt. They always drove on board among the first cars at Stockholm, thus were close to the bow ramp and could observe the activities of the crew rather closely.
- **Ake Eriksson** - travelled on the ESTONIA in September 1994: The car deck was wet. Upon departure from Stockholm the crew was unable to close the visor. Quite a number of crew members were jumping around on the forecastle deck. Upon departure from Tallinn, one week later, the departure was delayed by 2 hours because the visor could not be closed.
- **Veronica** (ex crew member): Draws attention to the not locked watertight ramp as entrance to the car deck and the smuggling of strategic material in 1994.
- **Anton B. Paulomo**: In July 1994 two of his friends were travelling by bus from a place in Lithuania together with a couple of others via Tallinn on the ESTONIA to Stockholm for shopping. On the way back they had to wait for 3 hours in Tallinn before the crew was able to open the visor, which was only possible after some burning/cutting had taken place. They left the bus and went up to the 8th deck overlooking the forecastle deck from where they observed what the crew and subsequently also workers from ashore were doing. The statements of Anton Paulomo and his two friends will be available.
- **Gerhard Stenhammer** - a Stockholm pilot and now retired, had observed shortly before the casualty that after departure from Frihamn Terminal the crew tried to close the visor for 15 minutes by opening/closing with loud bangs until it became silent. The master explained that the crew again had problems with closing the visor. The pilot asked the master whether the locking devices would still fit and the answer was 'no problem'. In the opinion of pilot Stenhammer the visor was 'out of geometry'.
- **Lars Lindström** - was on board as a passenger with car the last week in July 1994. Their car was the last one to roll on board in Tallinn, the bow ramp was closed behind them and they were leaving the car when he realised that 2 crew members were trying to lock the starboard lower bolt of the bow ramp, which did not work. A third one came with an iron bar in his hand, was hammering a couple of times on the pocket, without the bolt moving at all, whereafter they turned round and walked away by saying: "It can remain as it is", although the bolt was not locked. (He speaks and understands Estonian.) He has subsequently written a letter to Estline AB and complained about the above, whereafter he received a letter stating that the securing bolts and locking devices were the responsibility of a Finnish engineer company, the name of whom he also received. He wrote to them as well as to Det norske Veritas, but never received a reply. (The respective memo is attached as Enclosure 12.4.3.154.)
- **Kari Holmsten** (trained as a shipyard welder) made more than 50 trips on the ESTONIA, lost his wife and children during the casualty. It was on 3 March 1994 when they arrived in Tallinn and when for the first time he noted that something was wrong with the ferry. His car was the second one from forward and he watched how the crew tried in vain to open the visor, he was nervous because he had to reach the Belorussian Embassy before they closed to obtain a visa. He speaks and understands the Estonian language, thus picked up from crew members talk that they were unable to unlock the side locks of the visor, he left his car and told the crew members to lift / lower / lift / lower, etc. the visor in short intervals and, when lowering, try to open the side locks simultaneously, they followed the advice and after about 30 minutes they finally managed to open the visor and subsequently also the bow ramp, which did not create problems. There was no ice in the port of Tallinn at the time, however, he seems to remember that there had been ice at sea. Later, probably on 27 March 1994 he was again on his way to Tallinn when the same happened, but this time it took the crew only 15-20 minutes to open the visor. He had the definite impression that the visor was totally misaligned and did not fit anymore into the locking devices. The interview is attached as Enclosure 12.4.3.155.
- **Captain Joel Haukka** (retired, 68 years)

*»I have made at least 20-25 trips between Tallinn-Stockholm on the ESTONIA.*

*I knew Captain Arvo Andresson personally, have been on the bridge at least 3 times. He made a sympathetic, open and experienced impression on me, however, I don't know anything about his behaviour in unusual situations.*

*Concerning the bow ramp I would like to state that in January 1994 in Tallinn I, together with many others, had to wait for ca. 45 minutes because they were unable to unlock the ramp. It could not be opened. My car was the first one to leave the car deck which I had arranged respectively with the chief officer. The car was the first in line at port side, directly next to the hydraulic pump controls which were at port side.*

*They had a problem with the system and alleged that the ramp was frozen fast.*

*The Estonian crew members tried to open the bow ramp in vain for about 20 minutes by operating the hydraulic different ways, then started to hammer against the what he believed were the securing bolts, also in vain, then they asked the Swedish adviser to come down and he believes it was Karl Karell. He stepped out of the car, shook hands with him and said: 'Why do the Estonians switch off the hydraulic system at sea?' He shrugged and said something like "one year with Estonians is more than enough", but he did something whereafter it was possible for the crew to open the bow ramp and they left the ferry.«*

The complete interview is attached as Enclosure 12.4.3.156.

- **Tommy Hernertz** - a truck driver - was on board ESTONIA on the voyage before the casualty when they had to wait in Tallinn for 4 hours before the crew was able to open the bow ramp, which was only possible after they had cut off something by burning at the right side of the ramp. He could not see from his truck what it was.
- **Torbjörn Cederqvist** - a truck driver - with more than 50 voyages on ESTONIA.

»I have very often waited on the car deck for 1-2 hours, once in May 1994 even 4 hours before the crew was able to open the visor and/or bow ramp. In May 1994 the crew was unable to open the visor in spite of all sorts of attempts. Finally crew members brought 2 gas bottles plus burning gear to the door in the starboard side house. The 2 gas bottles were on wheels and were left in front of the door whilst the crew members pulled the hoses into the side house together with the burning gear. I was curious what they would now do and tried to enter the door, however, I was blocked off by crew members. I saw sparks falling down further forward and after some time visor and bow ramp opened. The bow ramp could only be opened or closed after 3-4 ups and downs, i.e. the crew was unable to open or close the ramp in one go. My friend Jonny, who is also a truck driver in the same trade, once told me that he had observed from the car deck side that the crew was unable to close the ramp, because only the starboard side came up whilst the port side remained down. Only after several ups and downs of the ramp and something else he could not identify, the crew managed to close the ramp. I do clearly remember that the ramp was visibly bent.«

The complete statement is attached as [Enclosure 12.4.3.157](#).

- **Carl Övberg** - a truck driver and businessman.

»I have actually seen crew members working at the bow ramp many times by hammering, welding or cutting (burning). I have seen the gas bottles and considered it to be very dangerous. As I am quite familiar with the way the crews from ex Eastern Block countries work, I was, however, not too surprised. It was clearly visible that the bow ramp was severely misaligned respectively bent. In open condition the port side was much lower compared to the starboard side. The bow ramp could not be opened in one go, but had to be raised/lowered several times before it was finally down.

Before the ramp was lowered down completely to the quay two crew members jumped on the quay and rolled one or two rope coils underneath the starboard side of the ramp, which was still 30-40 cm above the quay when the port side was already resting on it. I remember also to have seen that wooden pallets were placed underneath the starboard side of the bow ramp instead of the rope coils.

I am also of the opinion that, at least during the last months before the catastrophe, the bow ramp could not be closed completely anymore, because several times I observed from my position at the fore part of the car deck that light was falling on to the car deck as soon as the visor began to open, i.e. before the bow ramp itself was even moved. This, in my opinion, is only possible if the bow ramp was already open to a certain extent when the visor opened. The light came in at the upper port side. The whole ramp was badly misaligned, in particular the port side looked very bad, whilst the starboard side looked quite in order. Once I saw a crew member standing on a wooden pallet which was lifted up by a forklift standing behind the closed bow ramp at port side. The man was lifted up to a position just underneath what I believe was the upper bolt. After some hammering to the area where the bolt was located the man was lowered down to the car deck again.

I also remember more or less always having seen a large number of wooden pallets on the car deck, which were stowed behind the side houses at both sides.

On my last trip to Tallinn before the casualty (I missed one sailing) my car was on the hanging deck at starboard side. Thus I could not see what was going on at the ramp and the visor when being opened. I saw, however, crew members working at the bow ramp before it was lowered down. When I drove down the ramp I saw the equipment for either welding or burning (gas bottles) laying at port side near ramp. We had to wait longer than normal, maybe half an hour or more before the bow ramp opened. I remember this clearly, because I had people waiting for me at the quay who had left before I was from board because it took so long. It could be the time when I saw the visor moving up and down several times before the bow ramp opened combined with banging noises and also hammering.«

The complete statement is attached as [Enclosure 12.4.2.151](#).



- **Bo Pettersson** - manager of a non-marine company and passenger together with his wife for one trip Stockholm-Tallinn-Stockholm at the end of May 1994.

»We boarded the ferry in Stockholm and were the last people to come onboard, because we had first gone to the wrong terminal. As we were late the ship left straight away. After we had settled down in the cabin, I believe on the 6th deck, which was overlooking the foreship, I went to the window and looked down onto the foreship while the vessel was proceeding through the archipelago. I immediately had the impression that it was a very old vessel in a bad condition. I saw a couple of empty foundations where the parts belonging on top, e.g. mooring winches and the like, had been taken away. I had a rather negative impression from the beginning, also that apparently a lot of paint layers were used without taking care for what was underneath. I also noted that the mooring ropes were substantially worn and in a bad condition. They looked simply worn and over-stretched.

I also saw two crew members on the port side of the forecastle deck. The bigger man was standing on the visor facing me and was hammering with a big sledge hammer on the port edge of the visor which was extending the forepeak deck by some 10 cm. The gap was in any event big enough so that I showed it to my wife. We could see the water through the gap. The other man was standing on the forecastle deck opposite to the one with the sledge hammer and I could only see his back side. The visor was obviously not properly closed because its port side was standing upwards above the level of the forecastle deck, worse at the port outer corner on which the crew member was hammering, apparently without success, as far as I remember.

The window could only be opened by force. I also checked the nearest way to the rescue station. I think we stayed in the cabin for about 1 hour, after some time the hammering stopped but the visor edge was still standing up.«

The complete statement is attached as [Enclosure 12.4.3.157.1](#).

#### 12.4.4 Water in the visor and on the car deck

The picture below shows ESTONIA at her berth in Tallinn with open visor and closed bow ramp. The arrow no. 1 points to the oil covered lower part of bow ramp which demonstrates the height of the water level with hydraulic oil floating on top inside of the visor when the vessel was at sea in calm weather. Arrow no. 2 points to the bow ramp hinges which are on car deck level.



- **Charley K. Dahlberg**, engineer, ca. 40 years old, made about 30 trips on the ESTONIA, clearly remembers frequently having heard the splashing of water inside the visor at sea; realised the bad condition of the visor and of the bow ramp as well as the many cracked and re-welded welding seams in way, decided not to use the ESTONIA anymore when going from Stockholm to Tallinn, but to go via Helsinki instead. The complete interview is attached as [Enclosure 12.4.4.158](#).
- **Torsten Sundberg**, skipper of the Sandhamn pilot boat, wrote to the Swedish Commission on 14.02.95 as follows (office translation):

*"Reference is made to our earlier telephone conversation in December 1994 about observations concerning the lower bow part/bow visor of "Estonia". There is a little uncertainty about the exact date which could have been the 02.09.94, but what can be of importance is my observation from the pilot boat. On the way out to a vessel we met "Estonia", sea state was moderate, wind came from ESE. "Estonia's" lower bow part was submerged in the waves and when the vessel rose out of the wave-trough masses of water were streaming out of the whole lower part of the bow visor, even out of the sides. This was repeated many times during this meeting with "Estonia". The distance to "Estonia" was ca. 75 m during the observation and the visibility was good."*

Attached to the letter is a drawing which shows water streaming out of the visor from a level above the 3rd stringer, which was the normal filling stage in good weather. Letter and drawing are attached as [Enclosure 12.4.4.159](#).

**Note:** According to the logbook of the Stockholm Pilot Association ESTONIA arrived at Sandhamn on the 2 September 1994 at 05.15 hours.

- **Torsten Söder**, ex Master of DIANA II and since 1993 Stockholm pilot, as well as a number of other pilots have frequently seen what Torsten Sundberg has explained in his letter of 14.02.95. When ESTONIA was approaching the pilot station and had reduced speed from ca. 20 kn to 7-8 kn water was pouring out of the visor, also in calm sea. (See [Enclosure 12.4.4.160](#).)
- **Pilot Bo Söderman**

*»On the 24 December 1993 I piloted "Estonia" to Stockholm at about 05.50 hrs I went alongside the ferry's starboard side on board the Sandhamn pilot boat inside Svängens Light, wind and sea state according to the attached copy. Water covered the whole starboard side of the car deck ca. 3-5 cm high.  
On 26 December 1993 I piloted "Estonia" again, this time from Söderarm. The weather was now worse, according to my own notes ca. 22 m/s from East, with rough seas. I boarded the ferry about 1,5 nm outside Remmargrund Light. Upon my recommendation the master turned to starboard to make leeway for the pilot boat. I jumped on board from the upper platform of the pilot boat, the port pilot door was open. Under such conditions one has to expect water splashing up from below between ferry and pilot boat. This time, however, surprisingly the water came from above out of the pilot door when the "Estonia" rolled to port. When I came on board the mate warned me that there was "plenty of water on deck!" On the way to the lift I walked through water high up the legs of my boots, ca. 20 cm.  
In my opinion there was 5-10 cm of water over the whole area of the vessel's car deck. The water was splashing about 1 m high against the bulkhead of the stairways (centre casing).«*

The complete report is attached as [Enclosure 12.4.4.161](#).

- **Kari Holmsten** - Shipyard welder, 44 years old.  
As far as he remembers, it must have been already back in October 1993 when they came down to the car deck and there was still water on the deck inside the indentations and in the corners at the sides. (See [Enclosure 12.4.4.155](#).)

The following 6 statements were taken during telephone interviews after EFTERLYST TV - see [Enclosures 12.4.145 - 12.4.147](#).

- **Roger Nyström** - made a trip on the ESTONIA in May 1993 and noted water on the car deck although the sea was calm, heard strange noises in his cabin, like rhythmic bangs from forward.
- **Åke Eriksson** - travelled on the ESTONIA in September 1994. The car deck was wet as if there had been water rushing around.
- **Li Iker** - This witness travelled to Tallinn on board the ESTONIA on 2 September 1994 and returned on the following day. The vessel left Stockholm on schedule, but then returned after about 30 minutes, stayed re-moored to jetty for about 30 minutes and then left again. This was said to be due to trying out a new jetty, which everyone on board knew to be only an excuse because it was the same jetty which ESTONIA was always using. Upon return to Stockholm somebody from the crew (she cannot say who) said it was "because of visor problems, but we did not want to make the passengers nervous". Li sat in the reception and did not see the visor during this incident.  
The witness had a cabin all the way down in the vessel (i.e. on the 1st deck). Whilst waiting for her friend she was walking around a bit. As there had been a peculiar smell on the car deck she went there to have a look. She changed her mind, however, because before stepping over the sill she saw that the car deck was full with water - more than there would be just from deck washing. It is difficult to estimate the exact height of the water, but it was in any event remarkably high, so high that she could not step into it without becoming quite wet. The witness considered this to be strange, because the weather was fine and there was no storm.  
The witness and her friend had booked the offered sightseeing tour through the engine room which, however, was cancelled without explanation.
- **Tomas Jannupe** - His parents made a trip on the ESTONIA two weeks before the casualty. It was quite stormy at night. They heard noises from the car deck as if water was moving from side to side. It took a long time in Tallinn before they were able to leave the car deck as there was something wrong with the hydraulic cylinders.
- **Thomas** - This witness has already spoken to the police a couple of times. Travelled on ESTONIA the voyage before she sank together with his father, mother and girl friend. They had a cabin below the car deck and heard large water quantities moving above them from side to side. "It sounded as if a 25-m pool was in movement." The family tried to report to the crew what they heard, but could not find anybody able to speak Swedish.
- **Osten Lönneström and Barbro Hellström** - They met two ex crew members of the ESTONIA in October/November 1994, then probably on VIRONIA (subsequently renamed MARE BALISTICUM) who told them the following:

- there was a continuous leak in the hydraulic system of the visor which was frequently reported to the officer, but not changed;
- the watertight doors could not be closed properly which was widely known on board;
- the Atlantic lock did not function properly;
- the visor could not be closed properly, they left port with a gap open and tried to close it properly outside;

**Note:** This was also observed by the watchman on the Sandhamn watch tower reported by visitors to the Second Exhibition of the 'German Group of Experts' in Stockholm.

- since March 1994 there frequently was a lot of water on the car deck which was not due to the fact that the visor could not be closed, but due to the untight bow ramp. The respective letter is attached as [Enclosure 12.4.4.162](#) with office translation.

• **Torbjörn Cederqvist - truck driver -**

*»When we came back down to the car deck before or upon arrival at either side I remember that the car deck was always wet with water standing in the indentations. This was particularly in the forward part of the car deck behind the bow ramp.  
I have frequently observed when sitting in my truck watching the berthing manoeuvre of "Estonia" in Tallinn and the opening of her visor that water was splashing out of the visor when it was opened. I have also observed in Stockholm after I had left the ferry via the stern ramp and was then driving alongside the vessel forward that water was still streaming out of the closed visor.«*

The complete statement is attached as [Enclosure 12.4.3.157](#).

• **Carl Övberg - truck driver and businessman -**

*»I saw welding and burning several times when the ramp was closed. It was the port side, mainly the lower bolt. There was always a ladder in the vicinity of the bow ramp. I once or twice came down to the car deck at sea during normal weather/sea state conditions, opened the door in the centre casing and saw at once that there was a lot of water on the car deck, I would estimate about 5 cm. This was the 2nd door from forward, i.e. in the forward third of the car deck. This was on voyage from Stockholm to Tallinn, because vice versa I had no reason to go to the car deck as I sold the cars in Tallinn.«*

The complete statement is attached as [Enclosure 12.4.2.151](#).

## 12.4.5 Other observations

• **Torbjörn Cederqvist - truck driver -**

*»I have seen that the flaps in front of the car deck, which close the gap between bow ramp and car deck when the ramp is open, were missing at port side when the ramp was closed. The flaps were then lying loose at the side. After the bow ramp was open I have seen crew members pulling the flaps across the gap by means of hooks. I have sometimes noted that some of the upper flaps of the bow ramp were missing, but were back in place later.  
There was always a garbage container standing in front of the centre casing which was never secured.  
I have been on the car deck at sea several times. The car deck doors were never locked, but I was chased away by crew members sometimes, i.e. I was not permitted to enter the car deck where some activities were going on which I could not identify.  
Trucks and personal cars were never secured, only the trailers were lashed.«*

See [Enclosure 12.4.3.157](#).

• **Carl Övberg - truck driver and businessman -**

*»When I was sitting in my car in a position close behind the bow ramp waiting for the ramp to open, I remember having frequently seen crew members pulling steel plates across the gap between the open bow ramp and the car deck. I know that this gap is normally closed by steel flaps, but these had been dismounted with certainty at the port side. There were now holes in the flaps on both ends into which crew members were putting hooks by means of which they were pulling the flaps across the gap when the ramp was open and to the side before the ramp was closed.  
The area with missing flaps at the port side of the closed bow ramp can be seen on the following video prints (see arrows).«*



*»The car deck doors were not locked at sea (although it was said by the crew that they were), thus I was able to go down on to the car deck at sea, also at night (although this was strictly forbidden). I did this frequently to take something to my car, or to take something out, or just to check the car in bad weather to make sure that nothing was touching it. The car was sometimes secured by wooden wedges being put in front and behind the wheels, the trucks were sometimes secured by belts, the trailers very often not at all.*

*In front of the centre casing there were always standing one or two garbage containers into which the crew put empty bottles, cartons and the like. In addition, I noticed that these containers were also sometimes standing at port side and at starboard side in the aft part of the car deck. I have drawn the position into a sketch of the car deck (attached as [Enclosure 12.4.5.163](#)). As far as I remember these containers were never secured and very often caused concern to me when my car was standing close to them. The port one is visible on picture 1, whereby arrow 2 is pointing to it.*

**Note:** Picture 1 can be found on the photo page attached as [Enclosure 12.4.5.164](#).

*When I was down on the car deck at night, I have several times seen the flashing light of welding being performed in the forward part of the car deck near or at the bow ramp. When I was standing with my car close behind the bow ramp I could look into the open control panel located at the port side inner bulkhead behind the bow ramp. I remember that at least during the last months before the catastrophe there were only 1 (one) green and 1 (one) red light visible on the panel. The operator was always an ordinary crew member with boiler suit and walkie-talkie.«*

The complete statement is attached as [Enclosure 12.4.2.151](#).

- **Karl Holmsten - shipyard welder - 44 years old.**

He remembers drunken crew members in boiler suits, this was especially so in the wintertime when there were not so many passengers.

He also remembers that he frequently noted with surprise, when driving on to the car deck at Stockholm, that timber boards were standing upright leaning against the bow ramp and that wooden pallets were lying in front of the bow ramp, which did not make sense to him unless they needed wood in Tallinn, e.g. to support the bow ramp. (See [Enclosure 12.4.3.155](#).)

- **Carl-Magnus Ring** - wrote to Minister President Göran Persson by fax of 18.04.96 that an ex Swedish crew member, who had worked on board, had told him the following:

*»The stoppers on which the bow visor was resting were ground down by the Estonians because they had no money to buy new rubber packings.«*

The fax with office translation is attached as [Enclosure 12.4.5.165](#).

- **Torbjörn Cederqvist -**

*»I have experienced 4-5 times that the ferry was turned round in Tallinn and made fast stern first. When we drove on board in Tallinn via the stern ramp it was difficult for the long trucks to make the turn in Stockholm, thus the crew opened the visor and lowered down the bow ramp on to which the long trucks then drove backwards in order to be able to make the turn.*

*During the ice winter in February/March 1994 the crew was unable to pull in the stabilisers which they had out for testing purposes and the vessel stopped outside Tallinn for quite some time until they managed to get in the stabilisers.«*

The complete statement is attached as [Enclosure 12.4.3.157](#).

- **Carl Övberg -**

*»I had frequently been on the forward part of the 8th deck upon departure from Stockholm and do remember having quite often seen the visor open.« (See photo below.)*



## 12.5 Maintenance, Damage and Repairs

Generally the information available from on board is restricted to the observations of passengers as basically reported in Chapter 12.4, because the crew members had been forbidden by their employer ESCO to talk about ESTONIA at all. Only very few have talked, although very carefully, as will be explained on the following pages.

It has also been very difficult to obtain information from N&T/Hornet AB/Estline or ESCO. Apart from the discussion with Ulf Hobro during the first meeting with the JAIC in Stockholm in February 1995, there are only some details available from the files of the public prosecutor and from those of the JAIC, which will also be discussed subsequently.

### 1. Maintenance

The vessel was drydocked at Turku between **4-8 January 1993** and the necessary inspections were carried out. At this time also some maintenance work was performed which had been partly ordered by the old owners, Wasa Line, and partly by the technical managers of the new owners, N&T, as outlined in detail in Subchapter 6.5.

Consequently in January 1993 during the time at the yard:

- a) the locking devices of visor and bow ramp were neither serviced nor strengthened, and
- b) the outer hinges of the bow ramp were not serviced nor were the bushings and bolts renewed, and
- c) 15 m of the rubber packings of the visor and 10 m of the rubber packings of the bow ramp were not renewed.

#### As to (a):

Since the crew was unable to service and strengthen **the locking devices of visor and bow ramp**, they were never serviced and strengthened until the casualty. Since the crew was also unable to service the hinges of the bow ramp and to renew the bushings and bolts, in particular the port outer hinge, it is a fact that nothing was done to rectify the poor condition of - at least - the port outer bow ramp hinge. It is, however, known from Börje Stenström, head of the technical group of JAIC, that the crew had put the damaged port outer bow ramp hinge on the repair list a number of times, but that repairs were postponed by the technical managers until the next scheduled yard stay, probably in January 1995. The respective memo is attached as Enclosure 12.5.166.

#### As to (b):

Also the **visor hinges** required professional maintenance which the crew was apparently also unable to provide, because according to the testimony of the 2nd engineer Peeter Tüür in June 1996, who is responsible for the technical functioning of visor and bow ramp - the crew had problems to have the hinges properly greased and even had to add oil to the grease to ensure that the grease reached all parts to be lubricated - see [Enclosure 12.5.167](#). Needless to say that the effect of grease is destroyed by adding oil. Due to the severely misaligned visor the hinges could no more be properly lubricated. This resulted in excessive wear of the bronze bushings which consequently had to be renewed. Such renewal is normally effected by drilling out the steel and bronze bushing by means of a particular milling installation in order to avoid damage to the hinge plates, which would be created if the bushings would be burned out. Whereas drilling, including proper welding of new bushings, takes about 2 days in port - whilst the visor is detached from the vessel and the vessel thus has to be taken out of service - burning is much faster, however, is combined with a loss of material of the hinge plates, the creating of deep

burning marks, each of which is a crack starter. It is obvious that such damage to the hinge plates reduced their weight carrying capacity and furthermore increased the propagation of fatigue cracks in the hinge plates. For further details see Subchapter 34.3. Although denied by the technical managers and crew, the steel bushings of both visor hinges were evidently burned out and replaced by new steel and bronze bushings which, however, were fitted in a very unprofessional way. This will be further explained in Subchapter 34.3.

#### As to (c):

On one hand the responsible inspector in the organisation of the technical managers, N&T, Ulf Hobro, stated before the JAIC on 17 February 1995:

*»... we did not care for the rubber packings, we have never renewed any of them nor was it ever our intention to do so. The visor was full of water at sea and this was known to everybody.«*

On the other hand, Lennart Klevberg, in charge of spare parts with N&T, did testify to the criminal police Stockholm, that

*»rubber packings for the visor had been ordered but were not installed because Capt. Andresson and Tomas Rasmussen had decided to wait until MARE BALISTICUM would be taken over in order to do the replacement on both ferries simultaneously.«*

This does not make much sense, however, based on the underwater videos it is indeed a fact that the rubber packings of the visor were missing from forward of the Atlantic lock along the whole port side and about 1 m up the front bulkhead, whilst at the starboard side there were some rubber packings from forward of the Atlantic lock to the "corner of the mouth", which was empty up to ca. 2 m of the front bulkhead.

It is obvious that the visor was no more watertight and thus full of water at sea up to the outboard level as evident from the watermarks inside of the visor.

## 2. Damage and Repairs

The crew also denied ever having carried out repairs to the visor, the bow ramp and/or to their locking devices. This is true as far as the major repairs are concerned which would have been necessary to bring the visor back into proper shape and alignment, but which were never carried out. The crew, however, is wrong as far as numerous smaller repairs and rectifications to the visor, the bow ramp and their locking devices are concerned which were frequently performed to avoid the worst and keep visor and bow ramp best terms possible in workable condition. This had been observed by many passengers as outlined in Chapter 12.4. and was even admitted by crew members, for example by the safety officer Ervin Roden who told Spiegel TV on 02.05.97, among other things: "Something was always being repaired on board. There was always welding work being carried out. I am uncertain whether also to the visor. But everywhere repairs were carried out, also in the area of visor and bow ramp and also by the Finns." The complete interview is attached as [Enclosure 12.5.168](#).

Apart from the damages existing already when the ferry was taken over from the previous owners and which were not repaired by the new owners/ managers, it is quite obvious that the ferry sustained more damage to the visor and consequently also to its fixing points, the hinges and locking devices, when for example forcing ice at excessive speed as observed by various passengers. The observation repeated below is just one example:

*»Observation by Henning Frederiksson on 24.03.94: It was stormy weather and "Estonia" was proceeding in open water at full speed with a following sea when she met pack ice, into which she crashed without any speed reduction. "Estonia" came fast into the pack ice with an enormous crash and had to go backwards and try again. There was 16 m/sec. storm, nevertheless, "Estonia" kept her high speed.«*



The results of such reckless navigation are clearly visible on the large photo on the previous page which was taken on the following day, 25 March 1994, in Tallinn by the professional photographer Li Samuelson.

The ice damage sustained by the visor during the months of February and March 1994, when the Gulf of Finland and the Northern and Middle Baltic where more or less continuously covered by ice (see Subchapter 12.4.2), were roughly repaired by replacing parts of shell plating and bottom of the visor in Tallinn whilst the vessel remained in service. The renewed parts are still visible on the visor.

This is also confirmed by the observation of the passenger Christer Eriksson, who reported the following:

*»I travelled to Tallinn on the "Estonia" on 3/4 May 1994 and left the vessel only at about 10.30 hours when all the other passengers had already gone ashore. The gangway was pulled in and I had to go ashore via the car deck and bow ramp. When I came down on the car deck I noticed a curtain of sparks falling down from the open visor on to the bow ramp and I managed to jump through it and saw on the bow ramp a giant red transformer turned 90° towards the ramp which in my opinion was Red Army surplus. Cables were running up to the port side of the forecastle deck/visor, where obviously heavy burning/ cutting work was in progress. When I returned from ashore at about 06.00 hours the workers were just collecting their tools, but the huge transformer was still on the bow ramp.«*

The fax exchange reflecting the above is attached as [Enclosure 12.6.169](#).

Although the work explained above doubtlessly falls into the category "maintenance & repair" and also could not be considered very minor, the repairs are not mentioned in the "List of Maintenance and Repair Works on M.V. 'Estonia'; April 1993 - August 1994" which is Supplement No. 230 to the Report of the JAIC. Since also other visible repairs do not appear on this list, it has to be assumed that the list is incomplete for obvious reasons.

Also Lars Gunnar Nyström informed the Swedish Commission that he had made many trips on the ESTONIA. In February and March 1994 he was on board when ESTONIA was forcing ice twice and arrived in Tallinn once with a delay of 1.5 hours.

The damage sustained by the visor while proceeding at full speed through ice barriers several meters high and using the vessel as an ice breaker is demonstrated by the preceding photo and can also be seen on the video image below made from a film of 30.03.94.



As a result of the sustained severe structural damages and in combination with the different lifting speeds of the actuators and severely worn out hinge bushings, the visor became increasingly misaligned and out of geometry.

All of this led to problems - observed and reported by passengers as described in Subchapter 12.4 - during the opening and closing which also affected the locking devices and reportedly the problems became worse and took more time to be overcome the nearer the day of ESTONIA's last departure came. This is demonstrated by the following examples:

- **Ake Eriksson** - who travelled on the ESTONIA in September 1994 reported: Upon departure from Stockholm the crew was unable to close the visor. Quite a number of crew members were jumping around on the forecastle deck until they finally managed. On departure from Tallinn, one week later, the departure was delayed by two hours because the visor could not be closed.
- **Anton B. Paulomo** - In July 1994 two of his friends were travelling by bus from a place in Lithuania together with a couple of others via Tallinn on the ESTONIA to Stockholm for shopping. On the way back they had to wait for 3 hours in Tallinn before the crew was able to open the visor, which was only possible after some burning/cutting had taken place. They left the bus and went up to the 8th deck overlooking the forecastle deck from where they observed what the crew and subsequently also workers from ashore were doing. The respective letter from Paulomo is attached as [Enclosure 12.5.170](#).
- **Gerhard Stenhammer** - Stockholm pilot and now retired, had observed shortly before the casualty that after departure from Frihamn Terminal the crew tried to close the visor for 15 minutes by opening/closing with loud bangs until it became silent. The master explained that the crew again had problems with closing the visor. The pilot asked the master whether the locking devices would still fit and the answer was "no problem". In the opinion of pilot Stenhammer the visor was 'out of geometry'.

**Note:** Rapid closing of the visor is only possible by opening the hydraulic valves at the actuators (hydraulic lifting cylinders) manually. Thereafter the simultaneous movements of the cylinders has to be readjusted by service engineers.

It had also been frequently observed that the lugs of the hydraulic side locks were cut off by burning and subsequently rewelded, which is confirmed by the following observations:

- **Torbjörn Cederqvist** had very often waited on the car deck for 1-2 hours, once in May 1994 even 4 hours before the crew was able to open the visor and/or bow ramp. In May 1994 the crew was unable to open the visor in spite of all sorts of attempts. Finally crew members brought two gas bottles plus burning gear to the door in the starboard side house. The two gas bottles were on wheels and were left in front of the door whilst the crew members pulled the hoses into the side house together with the burning gear. He was curious what they would now do and tried to enter the door, however, was blocked off by crew members. He saw sparks falling down further forward and after some time visor and bow ramp opened. The statement is attached as [Enclosure 12.4.3.157](#).
- **Jan-du-Rietz** - retired captain, ca. 70 years old. He made 4 trips on the ESTONIA, the last one was in May 1994. When he saw on board the ESTONIA how the ship was being run he realised that they still had a lot to learn, no doubt the master was under pressure but this is no reason to push the vessel so hard against heavy head seas; after departure the crew told every passenger that it was strictly forbidden to go to the car deck, he went down, nevertheless, because he was curious due to the strange behaviour of the crew and saw that they were welding the forward part of the car deck in at least 3 different locations, but he was chased away by a gorilla-type sailor. He does not remember having heard any grinding sound. The interview is attached as [Enclosure 12.4.1.148](#).
- **Anders** - travelled on the ESTONIA 26/27 June 1994. Observed on 26.06.94 at Stockholm that the visor was partly open and that the bow ramp was down. He saw the flickering blue light from welding under the bow ramp and that people were working in the area of the Atlantic lock below the ramp.

**3. The Bow Ramp** was the upper extension of the collision bulkhead above bulkhead deck and as such had to be mandatorily weathertight. Therefore the ramp required regular maintenance of the rubber packings, the hinge arrangement and the locking devices.

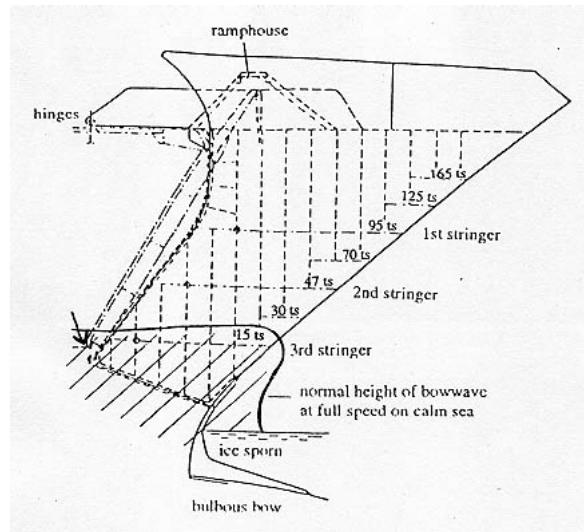
As stated before 10 m of the rubber packings should have been renewed already during the yard time in January 1993, however, this was never done up to the casualty.

The same refers to the locking devices of the bow ramp which should have been serviced and strengthened already in January 1993, which was also never done.

Whilst damaged and missing rubber packings cause a bow ramp which is otherwise in proper condition to leak, this becomes much worse if the bow ramp is visibly misaligned and twisted.

This had been the case on ESTONIA for several months before the casualty and the condition deteriorated as time went by. It is a fact that water was penetrating the bow ramp already in 1993 according to the evidence of passengers and pilots. In particular the statement of the Stockholm pilot Bo Söderman - see [Enclosure 12.4.4.161](#) - is striking.

The following drawing clearly demonstrates that already in calm sea the water rose above the 3rd stringer inside the also severely leaking visor due to the height of the bow wave at full speed.



Since the lower part of the deck opening with the missing and/or damaged rubber packings (see arrow on drawing) was below the 3rd stringer level of the closed visor, it is obvious that water penetrated the car deck already in calm sea when the vessel was on full speed (height of bow wave ca. 2.5 m). It is also obvious that the water inside the visor rose when the vessel was pitching in head seas. The height of the water inside the visor depended on the height of the outside water level, i.e. when the ferry was taking green water on the forecastle for a certain time the visor would fill up more or less completely with respective water pressure on the leakage of the bow ramp.

Since absolutely nothing had been done to improve the condition of the rubber packings and also no maintenance to the bow ramp had taken place since the vessel was put under Estonian flag, also the condition of the ramp hinges, in particular the port outer one, deteriorated continuously. This process was being sped up by the wrong loading of the car deck through the also apparently in this respect rather inexperienced Estonian officers, because the vessel frequently had a list during loading/unloading when the heavy trucks were rolling on/off board via the bow ramp and the effect on the already pre-damaged and weakened hinges of the bow ramp was disastrous. This finally led to the complete destruction of the port outer hinge and the breaking of the inner lug connecting the ramp to the vessel, whilst the outer lug slid off the hinge bolt apparently after the securing plate was broken off. The result is explained by a truck driver who witnessed this incident as follows:

*»I drove on board as one of the last trucks and after leaving my truck I saw that the crew tried to close the bow ramp, which was not possible because only the starboard side came up while the port side remained down. Only after several ups and downs of the ramp and some other things done by the crew did they finally manage to close the ramp. Ever since then the ramp was visibly twisted and when the visor opened and the bow ramp was still "closed", light fell in through the upper left corner.«*

The above is based on a telephone conversation in December 1997. It has not yet been possible to take the statement of the truck driver.

This severe damage to the port outer hinge and to the ramp itself was reported by the crew to the technical managers and also put on the repair list several times according to Börje Stenström (see Enclosure 12.5.166). However, nothing was done to rectify this damage despite the fact that it constituted a severe violation of the SOLAS - and Class - requirements because evidently the open car deck was, via the leaking bow ramp, connected to the visor which at sea was filled with water.

As no maintenance took place the crew tried to seal the leaks as best they could by putting mattresses, blankets and rags into the openings between the ramp and car deck/bulkhead at the port lower corner. As a further consequence of the detached port lower side of the bow ramp the port lower securing bolt no longer fitted into the ramp pocket, whilst the upper port bolt fitted only to a limited extent and it is doubtful whether the port ramp hook was able to engage the lug at the ramp side at all.

These very severe deficiencies led to continuous problems for the crew when opening and closing the bow ramp and/or the locking devices which had been observed by many passengers, in particular by the truck drivers using the ferry twice a week or more as summarised in Chapter 12.4. These observations prove that the bow ramp as well as its locking devices had been in a very poor state of maintenance and that they no more fulfilled the SOLAS and the Class requirements.

Only since the files of the Swedish part of the JAIC and the files of the Stockholm prosecutor, Tomas Lindstrand, have to a large extent, though not completely, been opened to the public, has more background information become available, which shall be introduced as follows:

(1) **Memo in one of the files of the prosecutor** concerning director S.-C. Forsberg's phone call to the office of the prosecutor on the day of the catastrophe, 28 September 1994, at 14.00 hours.

(2) **Explanatory letter written by S.-C. Forsberg to the Stockholm police on 01.11.1994.**

(3) **Statement of Inspector Ulf Hobro taken by the Stockholm police.**

(4) **Telephone interview of Tomas Ramusson, Hornet AB by the Stockholm police according to a transcript in the prosecutor's file.**

(5) **Statement of Lennart Klevberg, N&T, taken by the public prosecutor on 24.06.1996.**

(6) **Statements of some of the surviving crew members and of the member of a previous working team on board the ESTONIA.**

The statements of

- Sten-Christer Forsberg /N&T
- Ulf Hobro /N&T
- Tomas Rasmusson /Hornet AB
- Karl Karell /Hornet AB

taken by the Swedish part of the JAIC had been classified until publication of the Final Report of the JAIC, but are now only available on tape in Swedish, thus cannot be evaluated in this report.

as to (1): (Phone call Forsberg)

According to a **memo in the files of the prosecutor**, S.-C. Forsberg had reported the following by telephone at 14.00 hours on the day of the casualty, the 28 September 1994:

*"There are rumours going around town that burning and welding work has been carried out to the visor of the "Estonia". The owners do not know anything about this. It is, however, possible that the observations refer to de-icing of the visor in winter by means of burners."*

**Note:**

In this connection reference is made to the evidence of passenger Anders who had observed in Stockholm welding being done underneath the partly open bow ramp at the Atlantic lock and of passenger Christer Eriksson who had observed burning and welding of the visor in Tallinn in May 1994 which took a full working day (see [Enclosure 12.5.169](#)).

as to (2): (Letter Forsberg)

The letter dated 01.11.94 written by S.-C. Forsberg to the criminal police Stockholm shall be quoted and discussed. The complete letter in Swedish together with the office translation is attached as [Enclosure 5.2.110](#).

**Sten-Christer Forsberg**

- Manager of the Shipping Department of N&T
- Technical Director of N&T
- Board member of Estline AB
- (CV see [Enclosure 5.2.108](#))

a graduated naval architect of Chalmers University, Gothenburg, ex colleague of Börje Stenström, member of the JAIC, and Kaj Janérus - then managing director of Sjöfartsverket - from a mutual employment with Salén Shipping Company, Stockholm was directly responsible for the technical condition and performance of the ESTONIA and explains as follows:

*»Technical Supervision of the Vessel*

*N&T's shipping department was responsible for the technical supervision of the vessel. Under the manager of the shipping department, Sten-Christer Forsberg, Ulf Hobro was the inspector/ superintendent of the vessel for the whole time and spent a large part of his working time on MV "Estonia". Hobro checked the condition of the vessel regularly regardless of what the master, chief officer and chief engineer did.*

*Tomas Rasmusson, who is one of N&T's own chief engineers, assisted the N&T operations organisation with the preparation work for ca. 2 months before take-over of the vessel and also during the following months he helped the Estonian chief engineer to update the vessel's computer based maintenance program including establishing the part of N&T's organisation concerning supervision of handling and maintenance of the engine plant.*

*Lennart Klevberg, employed by N&T's organisation as the purchaser, was located at the Estline Terminal in Stockholm the whole time and was responsible for negotiating and purchasing spare parts, lashing material, and other technical equipment and consumables for MV "Estonia".«*

**Note:** According to von Tell GmbH, Hamburg the only spare part ordered by N&T in 20 months for ESTONIA was one new ice cylinder for the visor.

*»To assist the chief engineer in steering, controlling, and documenting the technical maintenance of the engineer on board there was the administrative data system/program (AMOS-D) available. The system delivered information concerning particular maintenance items to be dealt with and the system registered remarkable details. The system included the recommendations of the manufacturers as well as the requirements of the Classification Society and modified continuously the gained operation experience.«*

**Note:** Forsberg does not mention the 'Öberg-Data-System' which was installed on board and ashore and by which, among other things, repair lists respectively working lists were printed and monitored. Also the distribution of working lists is not explained,

- i.e. - original to repair firm
- yellow copy to N&T
- Technical Dept.
- green and blue copies for ship's file.

**Note:** Contrary to his earlier statements that he had received a copy of the repair list concerning the damaged bow ramp hinge from N&T, Börje Stenström later said that according to N&T all copies had remained on board. Even if it should be true, which is very doubtful because it is neither common practice nor does it make practical sense, the original went ashore to N&T and must be available.

The letter continues:

*»MV "Estonia" was taken over from her previous owners at the ship-yard in Turku, where the Estonian crew took possession of the vessel, the on-board organisation was established and the necessary work to adjust the vessel to Estline's traffic was carried out. Finnish speaking personnel from the previous owners Wasa Line (chief officer, 1st engineer, electrician and two repairmen) were hired from the start of the new traffic for between 21/2 and 5 months to assist their Estonian successors with practical advice in dealing with vessel's specific systems. This principle was always followed by the operations organisation of N&T when taking over vessels, independently of flag or nationality of crew ...*

*Earlier supervision of the vessel by maritime authorities and Classification Society had been carried out by B.V. in Finland, however, since the technical supervision of the vessel was to be dealt with by N&T Stockholm, N&T demanded that the vessel in this respect should be moved to B.V. in Sweden. Thereafter mainly the inspector Anders Wirstam of B.V.'s Stockholm office carried out the on-board inspection ...*

*In connection with an education program for Estonian ship inspector aspirants chief inspector Åke Sjöblom and 1st ship inspector Gunnar Zahlée from the Sjöfartsverket Inspection Office Malmö carried out an inspection on board the "Estonia" in the afternoon and evening of the 27 September 1994. Thereby no noteworthy deficiencies in relation to vessel's seaworthiness and safety at sea were discovered.«*

**Note:** In this connection see also Chapter 15, but - in particular - it has to be borne in mind that - according to sources from inside Sjöfartsverket - Åke Sjöblom and Gunnar Zahlée very well noted the obvious deficiencies of the bow ramp and demanded rectification before the ferry should be allowed to sail on 27.09.94. This was rejected by the Estonian authorities - their trainees - whereupon the managing director of Sjöfartsverket, Kaj Janérus, was phoned and asked what should be done. The managing director reportedly referred them to the Estonian authorities who did nothing and the ferry sailed into the catastrophe.

as to (3): (Statement Hobro)

**Ulf Hobro - CV see [Enclosure 5.2.109](#):**

*»Marine engineer with 20 years experience at sea, whereof 12 years as chief engineer; has also worked as safety inspector for Sjöfartsverket for several years; employed as a technical inspector with Nordström & Thulin AB, had been responsible for "Estonia's" running maintenance, budget and finances. His office is at Skeppsholmen in the old city of Stockholm. Has been engaged in "Estonia" since the plan to purchase the vessel arose, inspected the vessel before she was bought. His duty was to investigate the vessel and the vessel's general condition and to control the certificates required for the vessel. When visiting the vessel he discussed possible defects, damages, etc. with master and chief engineer on board. Defects were generally repaired by the crew, but often spare parts had to be ordered and this was dealt with by Lennart Klevberg in charge of the purchase of spare parts. In case of considerable damage special firms were engaged for the repair. Hobro was assisted by Tomas Rasmusson who had his office at the Estline Terminal and was working as assistant inspector. He was on board the vessel to and from Tallinn on several occasions and he was the contact person between the Master and Hobro. Rasmusson was in daily contact with the vessel.*

*Hobro stated that since the vessel started her service in January 1993, there have been no remarks on the bow visor. There may possibly have been some hydraulic leakages on some piston. No defect, however, has been brought to Hobro's knowledge. In case of any extensive defect to the bow visor, this would have been reported to Bureau Veritas.«*

The statement was taken by the Stockholm police on 22.11.94 and is attached as [Enclosure 12.5.171](#).

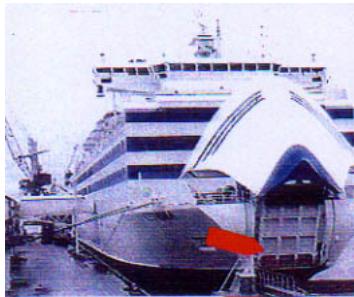
In addition, this 'Group of Experts' had the opportunity to ask **Ulf Hobro** questions in the presence of JAIC on 17.02.95 in Stockholm, which revealed the following:

- With the exception of the unscheduled drydockings due to the leaking stern tube seals in March and April 1993, the vessel under the management of N&T was only once at the Yard and in drydock, i.e. in January 1994 in Turku, when the stabilisers were installed and the ice paint was touched up the last time.
- At that time the B.V. surveyor Anders Wirstam carried out a Load Line Survey, which normally should have included the rubber packings of the visor.

**Note:** At that time Ulf Hobro knew very well from the specification of the previous crew that they had asked for a renewal of 15 m of rubber packing in way of the visor, which was never carried out.

- This was said to be the last time that Ulf Hobro had been inside the closed visor near the Atlantic lock. There were smaller leakages of the hydraulic cylinders of the Atlantic lock and the side locks as well as the bow ramp, which were said to be normal according to him. Larger hydraulic oil leakages inside the visor were said to be unknown to the Inspection Department of N&T.

**Note:** The picture on the next page was taken in October 1993 and shows the lower part of the closed bow ramp severely stained by oil, most probably hydraulic oil, which cannot just be explained by normal leakages.



- During the time between the take-over in January 1993 and the sinking on 28.09.94 no rubber packings had been renewed in way of the visor. "Why should they?" asked Ulf Hobro. "It was known to everybody that the visor was anyway full of water at sea and this was also the explanation for the white paint washed off in the area below the 3rd stringer."

- Upon being confronted with the photos showing the severely oil-stained 3rd stringer with rather fresh footprints Ulf Hobro stated that to be normal due to the crew carrying out maintenance work, but he did not state what was maintained.

- According to his knowledge there had never been problems, neither with the Atlantic lock nor with the side locks.

- Upon being confronted with the empty sensor plate of the Atlantic lock he reacted with surprise and then drew attention to the changed system on board of MARE BALTIMUM (where the sensors had been mounted higher up above the normal water level). He promised to clarify this with the electrician having survived, who was now serving on board of MARE BALTIMUM.

**Note:** The sensor plate of the Atlantic lock - see explanations in Chapter 2.6.2 - page 117 ff. - was noted to be empty, i.e. without sensors, on all the underwater videos, moreover the cables leading to the sensors were evidently cut. These facts were presented to Ulf Hobro, who apparently subsequently spoke to ESCO and the result was the 'Explanatory Note' with sketch dated 23.02.95 which was submitted shortly afterwards to JAIC. The note states "that contrary to the von Tell drawing 49111-373 showing mechanical sensors, there were installed 'magnetic sensitive elements' when the vessel was taken over, which were not replaced, but just the distance was regulated and the indication checked. It is assumed that these 'sensitive elements' had already been installed during newbuilding as the same type can also be found on various other installations, such as lifeboats, lifts, car deck platforms, etc."

The note does not state that the 'sensitive elements' were still in position on the last voyage nor does it give any explanation for the empty sensor plate.

Underneath the text the following names are listed without any signature:

the chief engineer of the other crew	H. Moosaar
the electric engineer of the other crew	M. Doronjuk
the electrician of the other crew	D. Salomon
the electrician, who survived	A. Rohumaa
the boatswain of the other crew	H. Leik

The 'Explanatory Note' is attached as [Enclosure 12.5.172](#).

- The proof for the empty sensor plate was also submitted to B.V. and a retrospective class withdrawal was suggested by this 'Group of Experts'. This resulted in respective questions by B.V. to N&T which forced N&T to examine the matter quite closely. The result is summarised in the letter of N&T to Börje Stenström dated 15.11.95 with enclosures - all of which are attached - with office translations - as [Enclosure 12.5.173](#).

- Part of the enclosures to the above-mentioned letter is a "Memorandum concerning a meeting on board MARE BALTIMUM on 6 November 1995 in Tallinn". At this meeting the three electricians and the boatswain of the Piht crew - Heino Leik - were questioned in respect of the following subjects.

- Service on board ESTONIA
- Maintenance of the magnetic switches
- Chronology of events
- Control panels inside of the ramp and on the bridge
- Drawing concerning electrical installations
- Bureau Veritas
- When were the magnetic switches installed?
- Technical comments.

It is revealed in this memorandum that the crew experienced problems with the magnetic switches between the spring of 1994 and September 1994 to the effect that the green light did not go on if the bolt was closed. The problem was said to be solved by a simple adjustment of the magnetic switch. These problems were mentioned already by Henrik Sillaste and Tanel Moosaar during the interview on 10.03.95 in Stockholm see [Enclosure 12.5.174](#).

According to information received by one of the Finnish engineers from one of the Estonian engineers shortly after the casualty the magnetic switches had actually been destroyed by ice hacking already in February/March 1994 and were not replaced, because crew members had to go down anyway to hammer close and open the bolt of the Atlantic lock - see statement Arvi Myyryläinen [Enclosure 12.5.175](#) - and therefore it was decided not to renew the switches for the time being.

- Stabilisers were installed into pockets already arranged at newbuilding with respective electrical connections. The installation - according to Hobro - became necessary after less than one year in service to be able to compete also in this respect with the Helsinki ferries from Silja and Viking.

**Note:**

- As a matter of fact, Hobro had asked the Turku Repair Yard already in April 1993 to quote for the installation of stabilisers, i.e. after less than 3 months in service the management had to realise that the vessel was now trading in a completely different sea area with a much rougher sea state. The quotation is attached as [Enclosure 12.3.143](#).

- Hobro did not say a word about the fire in way of the starboard stabiliser pocket at the time of installation of the stabilisers in the drydock of Naantali which - according to Henrik Sillaste - had caused damage and had cut the short time planned for installation of the stabilisers at the shipyard even

shorter. Reportedly the required careful welding work to install the starboard stabiliser therefore could not be carried out as it otherwise would and should have been the case.

- The damaged parts of the "Inerta" ice paint in way of the bootop strake including the lower part of the visor with stempost were touched up.

as to (4):

**Tomas Rasmusson:** (Telephone Interview)

- He had been on board WASA KING already to become acquainted with the vessel.
- His boss was Ulf Hobro
- he was between Hobro and the crew.
- He took part in the work in connection with changing flag to Estonia, lots of translations and the like.
- Everything functioned well between N&T/crew.
- His job was more social. He had no direct responsibilities.
- He carried out his own inspections and controls.
- He was also the contact between the crew and the spare parts handler Lennart Klevberg.
- At the beginning he was on board in 14-day periods, he and Anders Andersson relieved each other.
- Later he was more shore based and made one trip per week.
- He worked mainly with engine matters, Hobro and Klevberg.
- Everything was perfect. The crew never drank alcohol. The crew was ambitious and good. No incidents or problems whatsoever.
- ESTONIA was in very good condition. Deficiencies were rectified at once. Everything was listed by the data system AMOS-D. Each month a list was printed which showed what had been done and what had to be done. In case the chief engineer had done nothing, he was instructed by Hobro or himself what to do.
- He did not know if and how the visor was controlled. He never heard anything.

The above are notes made when sighting the files in the office of the prosecutor in Stockholm. A photocopy of the transcript is attached as Enclosure 12.5.176.

as to (5):

**Lennart Klevberg:** (Statement)

- He was frequently on board the ESTONIA.
- He ordered the hydraulic parts and valves for the visor and bow ramp.
- He had ordered rubber packings for the visor which were to be delivered together with the packings for MARE BALTICUM.
- Capt. Andresson and Tomas Rasmusson had told him to wait with the delivery of the new rubber packings until MARE BALTICUM would be taken over and then have it done for both ships at the same time.

**Note:**

Hobro stated that no rubber packings were ordered, nor was it their intention ever to order them.

Rasmusson stated not to have direct responsibility, however, he was the contact between the spare-parts man Lennart Klevberg and the crew, on the other hand he testified that he did not know if and how the visor was controlled and that he never heard anything in this respect.

Klevberg, however, testified that he had been told by Capt. Andresson and T. Rasmusson that he should wait with the delivery of the rubber packings for the visor of ESTONIA until MARE BALTICUM had been over.

as to (6): (Statements of some of the surviving crew members and the member of a working team)

a.) The **member of the working team** and then student at the Nautical Academy Tallinn, **Rain Oolmets**, has testified respectively had been interviewed three times about his observation on board and the respective statements/transcripts are attached as follows:

- Statement Rain Oolmets to the security police Tallinn on 03.10.94, Enclosure 12.5.177.
- Statement Rain Oolmets taken by JAIC at Hangö on 24.03.1995, Enclosure 12.5.178.
- Transcript of the interview of Rain Oolmets in April 1996, Enclosure 12.5.179. The interview is also available on video tape.

Rain Oolmets worked on board ESTONIA from 11 July to 11 September 1994.

The relevant parts of the testimonies shall be quoted as follows:

• **Statement in Tallinn on 03.10.1994**

*»I'm not quite certain of the exact date, but one afternoon after half past four I was busy with painting the bow visor on the deck. As the bow is in raised position only in Tallinn, I was painting the part that was otherwise not visible. Before painting I had also polished and primed the visor. While painting, I once again could not help noticing the cracks in the bow visor fastenings, which were the result of the fatigue of metal. When repainting the bow visor, I noticed them too. The cracks were visible only with the bow in raised position. The starboard side fastening mechanism/box of the visor had a crack of nearly 10 cm in length. The port side one had a 6 cm long crack. There was also a crack in the welding between the bow visor and the fastening beam, which was about 2 cm long. I am prepared to show the location of the cracks on drawings.«*

• **Statement in Hangö on 24.03.1995**

Q: When were observations made of cracks in the visor of "Estonia"?

A: I observed them while painting on the bow deck of the "Estonia" in early August 1994. Painting was done in the port of Tallinn.

Q: In what position was the visor when you were working?

A: The visor was open, otherwise we could not have seen the cracks.

Q: What colours did you paint?

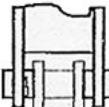
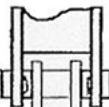
A: Both green and white (i.e. both the deck surface and areas rising from the deck).

Q: Can you show on the visor where the cracks were?

A: Those parts have been removed, this is why I cannot show the crack locations. (Upon instructions of Börje Stenström the hinge remains had been removed for metallographic investigations and mechanical testing already in January, that is why the crack locations could not be demonstrated.)

Q: Could you indicate on these sketches where the cracks were?

A: You have to look from forward to aft at the hinges to be able to see the cracks in the welding seams between the bushings and the hinge plates of the visor hinges (hinges at the visor). The cracks were opposite to the deck when the visor was closed. At the starboard hinge there were cracks in both welds. At port side there was only one crack in the weld. The drawing below shows the location and approximate length of the cracks.



View from under the visor toward the stern of *msv ESTONIA*. The observed cracks are indicated by narrow lines.  
The visor side hinges have been drawn bold.

The cracks were less than 10 cm long. (Reference is made to the statement taken by the Estonian police on 03.10.1994).

#### • Interview by Spiegel TV in April 1996

*Q: Could you tell us a bit more in detail about the paint work and the damage to the visor?*

*A: Actually the damage could only be seen when the visor was open. There were very many. On a drawing one could see that more in detail. Actually at one side there were these cracks. Possibly as a result of mechanical action.*

*Q: You said on one side the crack was 10 cm long and on the other side about 6 cm long? This is written in your statement.*

*A: This might have been so.*

*Q: Quite sometime has passed but I assume that you are not going to withdraw your written statement?*

*A: No.*

*A: I did not inform the boatswain about my observations. It was the time when the cars were rolling on board. And the boatswain ... you had to work with him. He did observe exactly. He disliked it if somebody did not work during his working time. Then I did not get a chance to tell him. I was actually of the opinion that it was known anyway. Therefore I forgot to report it.*

*Q: What was the condition of the visor when you started to work?*

*A: I did not have specific instructions to do something at a particular location. During my work I was climbing everywhere, cleaned and painted. This location was difficult to reach. Presumably the last time this area had been painted was when the vessel was painted white for the first time. I thought that certainly somebody from the administration knew about the cracks because the vessel was checked quite often. Also the boatswain checked our work. Therefore I believe that certainly somebody knew of the cracks.*

*Q: Thus you were convinced that due to the frequent checks that somebody knew about the condition of the visor and also of the cracks?*

*A: Yes, I was sure that they knew it.*

*Q: Did the crack appear only after you had removed the paint?*

*A: No, the crack was visible already before.*

*Q: It was consequently enough to climb there to see the crack?*

*A: Yes.*

The complete interview is attached as [Enclosure 12.5.179](#).

In summary of these three statements it has to be concluded that the welding seams between the bushings and hinge plates of the visor hinges were visibly cracked up to 10 cm at the beginning of August 1994, less than 8 weeks before the casualty.

The photo below shows a part cut out of the bushing recovered from the wreck. It is most probably the starboard inner bushing as will be explained in Chapter 30.



photo of stb. inner bushing recovered by divers

For a better understanding, the relevant parts have been numbered as follows:

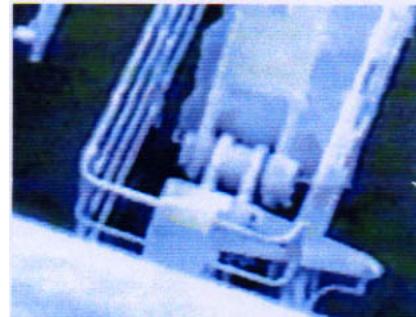
- 1 = steel bushing
- 2 = hinge plate
- 3 = area between hinge plate/bushing
- 4 = welding material
- 5 = arrow pointing to the large gap between bushing and hinge plate
- 6 = welding seams between bushing/hinge plate

Without going too much into detail, already now attention has to be drawn to some very obvious irregularities, viz.

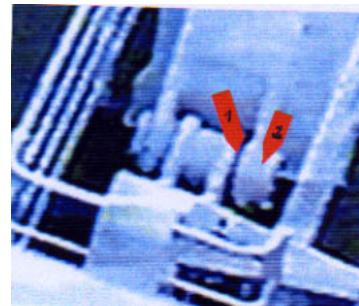
- The bushing had been too small for the bore of the hinge plate (2), therefore a gap (5) remained between bushing and inner surface of the hinge plate.
- The welding seams (6) are rather weak compared to the dimension of hinge plate and bushing.
- There had obviously been a crack at the left side in the welding seam (4) which had been tried to be closed by welding. This led to the accumulation of welding material inside the gap between bushing / hinge plate.
- The surface area between hinge plate/bushing (3) is severely corroded which would not have been possible if the inside had been airtight by intact welding seams. In other words, the apparent fact that the space between bushing/hinge plate could be attacked by corrosion as found is proof that the welding seams had been cracked over the full thickness for a longer time already.

b.) That there was something seriously wrong at least with the starboard hinge arrangement of the visor well before the casualty becomes very obvious when having a close look at the **video film made by a passenger upon departure from Tallinn on 17 September 1994**, i.e. 10 days before *ESTONIA*'s last sailing. He stood on the open forepart of the 8th deck and with his video camera filmed the closing of the visor. Thereby he zoomed in on the starboard hinge arrangement. The subsequent evaluation of the video proved that the starboard visor hinges were totally misaligned with the lower part of the outer bushing as well as the securing plate missing. The video was analysed and evaluated in detail by the Reconnaissance Expert Bryan Roberts of Churchgate/UK and his report is attached as [Enclosure 12.5.180](#).

The print is shown below and the enlargement is attached as [Enclosure 12.5.181](#).



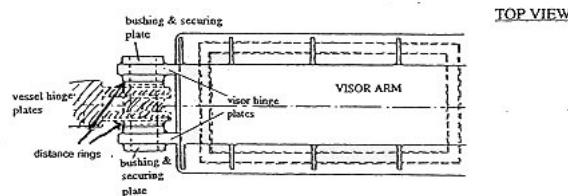
Although the distortion and misalignment of the starboard hinge is clearly visible to everybody, the Swedish part of JAIC gave a copy of the film to the Military Intelligence Service, who produced the picture attached as [Enclosure 12.5.181.1](#), which evidently shows the same. Nevertheless, the Intelligence people declared the whole film to be unreliable since 5 out of about 800 sequences had been slightly "jumping", which was accepted by the JAIC as well as N&T and the film from then on was ignored by the JAIC and consequently is also not mentioned in their Report. What the film really shows becomes clear on the enlargement below, viz. some major deficiencies:



- the gap between the starboard vessel hinge plate and the outer bushing is much too large (Arrow 1).
- the outer bushing is sticking much too far out of the outer visor hinge plate (Arrow 2) (which explains the large gap mentioned above).
- the lower part of outer bushing is missing.
- the securing plate is missing and the outer end of the bolt is not visible.
- the outer bushing appears to be twisted anti-clockwise.
- the inner bushing appears to be twisted anti-clockwise.

Bearing in mind that the nautical student Rain Oolmets reported the cracks observed at the beginning of August 1994 immediately after he had learned of the casualty to his uncle, who was then sailing as chief officer for ESCO, and the uncle went to the police who subsequently interrogated the student on 03.10.94, it is difficult to believe that Rain Oolmets had remained silent on the real damage to the starboard hinge, had it been there already.

On the other hand, he had told Klaus Rahka during the questioning at Hangö on 24.03.95 that he had painted the visor hinges green and white and - as clearly visible on the video image on the following page showing the starboard hinge bolt - there is quite a lot of green paint on the bolt which could not possibly have got there as long as the hinges were in their original, intact condition because then it was practically a closed system, i.e. paint could not reach the bolt. The intact system has no gap as can be seen from the drawing below showing the intact starboard hinge arrangement.



As it is, however, obvious from the video print below, showing the starboard bolt - without bushing - resting on the rail bar, there is a stripe of green paint at the bolt. Measurements reveal that the paint is in way of the gap between the outer bushing and the vessel hinge plate which is visible on the enlarged video print on the previous page (Arrow 1).



Therefore it has to be concluded that the gap must have been there already when the green paint was applied, however, this will be evaluated more in detail in Chapter 29/30. Oolmets commenced his job mid July 1994 and left the vessel on the 11 September 1994. He had discovered up to 10 cm long cracks in the weldings between bushings and visor hinge plates both at port side and starboard side of the visor hinges when the visor was open. This was in early August, at a time after 16.30 hours when the loading of the trucks had already commenced. The boatswain then on board was Vello Ruben, thus it was the Andresson crew. Considering the fact that the Andresson and Pihl crews relieved each other every 14 days, further that the Andresson crew would have been relieved on the 29.09.94, thus came on board on 15 September 1994, going back from that date in 14-day intervals, it becomes obvious that the early August time for the Andresson crew with Vello Ruben as boatswain ended on 4 August 1994 in Tallinn. As on that day the crews would change in the morning, the loading of the trucks after 16.30 hrs was already attended by the boatswain of the relief crew, Heino Leik. As on the day before, 3 August 1994, the vessel had been in Stockholm, it has to be concluded that Rain Oolmets found the cracks on **2 August 1994** as this is the only day in early August when Vello Ruben was on the car deck after 16.30 hours. The Andresson crew returned on 18 August 1994, but this date or later would hardly be considered early August by Rain Oolmets. On 11 September 1994 he left the vessel (see time schedule of crew change - [Enclosure 12.5.182](#)).

If he had finished painting the starboard hinges, which has to be assumed as he stayed on board for another 6 weeks after discovery of the cracks in early August, there must have been quite a gap between the inside of the outer visor hinge plate and the outside of the outer hinge plate at the vessel's side, as otherwise it would not have been possible for such green deck paint to reach the bolt.

This could indicate that the repairs to the starboard hinges of the visor had already been carried out when Rain Oolmets discovered the reported cracks on 2 August 1994. It would, of course, mean that he told the criminal police as well as JAIC only part of the truth, which would not be surprising.

c.) According to the statement of **2nd engineer Peeter Tüür** he was also responsible for all watertight (weatherlight) openings of the vessel, their maintenance and proper functioning. In his statement taken on 3 October 1994 by the Estonian security police in Tallinn - see [Enclosure 12.5.183](#) - **Peeter Tüür**, who is the highest ranking officer to have survived, has testified:

*»I am the 2nd Engineer. Each engineer has his tasks. Part of my tasks were the watertight openings and to keep the technical functioning in order. It was also my responsibility to see that the visor was in order, but I was specifically responsible for the hydraulic of the visor. The closing of the visor was carried out by the boatswain, however, I am unaware who was directly responsible for the closing, possibly the mate. Behind the visor is the ramp. This should also be hermetically tight, there are just a few places where the ramp does not close hermetically. The visor is closed hydraulically and securing wedges fix the visor in closed condition. There are 5 fixing points.«*

This statement of Peeter Tüür is in many respects of great importance, because he has stated that

- he was responsible for keeping the visor in order;
- the bow ramp behind the visor **should be hermetically tight**, but there were just a **few places** where the **ramp did not close hermetically**.

Further it shall be mentioned that N&T supplied the JAIC with the 47-paged "List of Maintenance and Repairs Works on M.V. 'Estonia', April 1993 - August 1994", which is drawn up in a rather peculiar way and is signed by the chief engineers Moosaar and Leiger. The list contains for example many repairs to dish washing and slicing machines in the galley as well as the cleaning of search lights, ventilation pipes, etc., however neither bow ramp nor visor are mentioned at all, although the crew and external repairmen did a lot of burning and welding and other maintenance work.

The only 10 items of interest on the 47 pages of the above-mentioned list have been summarised and are attached as [Enclosure 12.5.184](#).

Finally, the transcript of the interview of Sten-Christer Forsberg (SCF) by Erik Ridderstolpe (ER) from Swedish Radio in December 1997 after publication of the Joint Accident Investigation Commission's Report shall be quoted. The transcript was also found in the files of the prosecutor and is attached as [Enclosure 12.5.185](#).

After Forsberg had admitted that N&T was responsible for the condition of the ferry upon departure from Tallinn, he was confronted with the last repair list of the Finnish crew by Ridderstolpe and the following Q/A developed:

SCF: *I have seen this repair list for the first time in the Final Report of the Commission.*

ER: *And you did not receive any information in this respect beforehand?*

SCF: *No, it was not available to us.*

**Note:** This is wrong. The repair list - [Enclosure 3.4.96](#) - and the yard quotation - [Enclosure 3.4.97](#) - were handed over during the yard time in January 1993 from Wasa Line to N&T. N&T did subsequently order some of the items which were carried out by the yard. The subsequent yard invoice - [Enclosure 3.4.103](#) - issued to N&T contains only the reference nos. of the repair list without any text. Thus N&T could interpret and understand these items only by means of the repair list.

ER: *Silja had a maintenance contract with MacGregor concerning rubber packings, locking devices, etc. which you cancelled immediately.*

SCF: *We did have the time and capacities to do everything in port ourselves. The acting of the previous owners was more directed by short stays in port and lack of capacities.*

ER: *The vessel had a wrong PSSC.*

SCF: *The wrong construction of the vessel since newbuilding is mainly to be blamed for the casualty, not so much the wrongly issued certificate.*

ER: *The vessel was loaded totally wrong in Tallinn.*

SCF: *The wrong loading is regrettable. It would, however, also have been done by any other crew.*

ER: *The safety equipment did not comply with the regulations.*

SCF: *The bad and overaged safety equipment was accepted by Sjöfartsverket, otherwise we would have renewed everything.*

ER: *In my opinion N&T acted with gross negligence.*

SCF: *I cannot accept this, but insist to the contrary that we had a very well maintained and very well managed ship, which had been seaworthy in every respect. If anybody is of a different opinion and is able to prove it on basis of the now available report, then he is welcome do so.«*

In the following chapters the condition of the "very well maintained" and "very well managed" vessel which was "in every respect seaworthy" upon her last departure from Tallinn shall be presented.

## 12.6 Further Evidence

No further evidence has been discovered since the end of 1999.

## IV THE LAST VOYAGE

### CHAPTER 13

#### THE CREW AND THE ADVISORS

The 27 September 1994 was the last day of ESTONIA in Tallinn and the 13th day of the current 14-day duty period of her crew - the Andresson crew. Before the departure a crew list was handed over to the Harbour Master of Tallinn, which according to a fax from Andi Meister to Hans Rosengren - attached as Enclosure 13.186 - must have contained 187 names, i. e. 149 crew members on duty, 6 trainees, 4 crew members off duty and 28 advisors/ entertainers, although in the fax it is stated that only 27 persons were listed on the advisors/entertainment list, but one more - Andrus Kullamäa - came on board after the master had already signed the list, thus the second list should contain 186 names, but 187 persons were on board.

According to a crew list subsequently submitted by the Estonian part of the JAIC, however, actually 188 persons should have been on the crew lists of which 3 were not on board, which reduces the number to 185, but 2 others were on board but not on the lists, which increases the number to 187. Nevertheless the Estonian count is 186 - see Enclosure 13.187 - which is not correct because the nautical adviser Juri Aavik is nowhere mentioned.

One of the crew members off-duty was the master of the second crew, Avo Piht, who was on board to be examined for his pilot exemption certificate when entering the Stockholm archipelago at the Söderarm entrance. For this purpose the sea transport area chief Dan Myrberg and the senior pilot of the Stockholm Pilots' Association Karl-Gustav Sundius, together with their ladies, were also on board.

According to the files of the Stockholm public prosecutor there were in addition about 25-30 Pakistani workers and an unknown number of relatives of the crew on board who were not registered anywhere.

For a better understanding of the professional background of the officers and ratings of the ESTONIA some information about the history and the types of vessels used in the Estonian merchant navy shall be presented at the beginning of this Chapter.

In 1991 Estonia as well as the other two Baltic States, Latvia and Lithuania became independent and the country received 3.2% of the tonnage of the former Soviet Russian merchant navy fleet. This tonnage consisted mainly of several dozens conventional type general cargo vessels which were mostly 20 or more years old, and which were supplemented by 15 somewhat newer Ro-Ro/cargo vessels. A group of 6 large and medium sized modern bulk carriers completed the fleet. Container- and reefer-vessels as well as tankers were missing.

Some passenger/car ferries employed mainly since 1991 demonstrate the restructuring process in progress. Before the take-over of the ESTONIA in January 1993 the car/passenger ferry GEORG OTTS - built for the Olympic Games in 1980 - was the largest Estonian ferry

All the sea-going vessels were owned by the National Estonian Shipping Company (ESCO) controlled by the Ministry of Transport and Communications. The members of the Board of Directors were mainly high ranking civil servants from this Ministry while the management consisted of previous master mariners of Estonian nationality but with Russian education at the Leningrad Maritime Academy.

In the following the vessels on which ESTONIA's first and last master, Captain Arvo Andresson, obtained most of his sea-going experience, shall be introduced:

car/passenger ferry GEORG OTTS



#### Technical details:

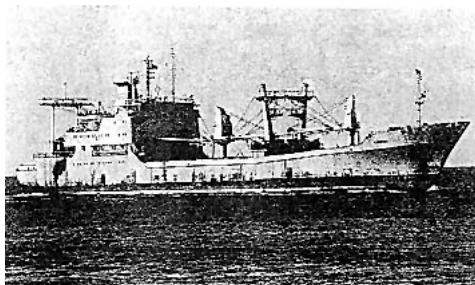
GEORG OTTS (ESBH) Passenger and car motor ship  
 11 498 BRT / 4 805 NRT / 1 363 TDW;  
 134.82 m / 125.00 m - 21.80 m - 5.46 m / 12.60 m;  
 4 SULZER - 6-cylinder 4-stroke diesel engines /  
 17 400 HPE / 20.0 kn / 2 propellers;  
 1 200 passengers, cars, trailers;  
 11.1979/1980 - Stocznia Szczecinska im. Adolfo Warskiego, Szczecin/PL (B 483/01)  
 1980 GEORG OTTS Estonskoye Morskoye Parochodstvo, Tallinn/SU  
 1991 GEORG OTTS Eesti Merelaevandus A.s., Tallinn/ES

Also the technical details of the ANTSLA-type vessels on which Captain Arvo Andresson spent 101/2 of his 201/2 years as nautical officer - are reported as follows:

ANTSLA (ESBZ) Freight motor ship, ship type series "B 46"  
 6 555 BRT / 3 333 NRT / 7 400 TDW;  
 135.41 m / 122.48 m - 18.04 m - 6.63 m / 7.46 m;  
 1 SULZER - 5 cylinder 2-stroke diesel engine /  
 6 100 HPE / 15.0 kn / 1 propeller;  
 Container capacity: 112 TEU  
 27.01.-30.09.1972 - Stocznia Szczecinska im. Adolfo Warskiego, Szczecin/PL (B 46/01)

1972 LENINSKAYA GUARDIA - Estonskoye Morskoye Parochodstvo, Tallinn/SU  
 1992 ANTS LA - Eesti Merelaevandus A.s., Tallinn/ES

Further the fleet list of 1994 of all ESCO vessels is attached as Enclosure 13.188 and in the following are two photos showing ANTS LA-type vessels.



Next, the details of the professional careers of master, nautical officers, radio operator and engineers - as presented to JAIC by ESCO - shall be stated.

#### Captain

Name: Arvo Andresson ((,), date of birth 03.02.1954.  
 Education: 1969-1973: Tallinn Marine School  
 1977-1982: Leningrad Maritime Academy.  
 Proficiency Certificates: KK0000001, issued 02.01.94 and 604/86 foreign-going master.  
 Training Certificate accepted by IMO 1990 and 46/1992.  
 Radiotelephone Operator Certificate RB 0000040, issued 09.03.94.  
 Refresher courses 05.03.1991.  
 Preparation for ESTONIA and pilot exam in Sweden 1994.  
 Record of service:  
 1/74 - 3/76: 4th officer, ship type ANTS LA dwt 7,400  
 4/76 - 7/77: 3rd officer  
 5/82 - 3/83: 2nd officer, passenger ferry GEORG OTTS  
 4/83 - 2/84: chief officer, passenger ferry GEORG OTTS  
 5/84 - 5/86: chief officer, ship type ANTS LA dwt 7,400  
 6/86 - 10/87: captain, ship type ANTS LA dwt 7,400  
 11/87 - 3/92: captain, ship type Ro-Ro dwt 4,600  
 4/92 - 12/92: captain, passenger ferry GEORG OTTS  
 1/93 - 28/9/94: captain, passenger ferry ESTONIA  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Captain Enn Neidre

When the ESTONIA was bought Arvo Andresson was appointed her first captain. He was from the start involved in the transfer of the ship and development of the organisation on board. After the creation of the new Estonian Maritime Administration, he received in 1994 the first master mariner's certificate issued after Estonia's Independence. He held a pilot exemption certificate for the entry at Sandhamn into the fairways through the Stockholm archipelago. He had just before the accident passed his examination for the entry at Söderarm into the fairways of the archipelago to Stockholm.

Arvo Andresson had also attended several relevant courses, e.g. in "Passage Planning in Narrow Waters".

Apart from his native Estonian, he was able to communicate in Swedish, English, Finnish and Russian. Reference is also made to Subchapter 7.1.3.

#### Chief Officer

Name: Juhani Herma ((,), date of birth 06.08.1964  
 Education: 1982-1988 Leningrad Maritime Academy. Proficiency Certificate: LS00000032, issued 09.05.1994.  
 Radar Simulator Certificate: 1993.  
 Training Certificate accepted by IMO in accordance with STCW/78 - 132/1989.  
 Radiotelephone Operator Certificate No. 89, 1993.  
 Refresher courses at EMK 1993.  
 Preparation for ESTONIA and pilot exam in Sweden 1994. Attested 12.08.1994.  
 Record of service:  
 6/89 - 4/90: 3rd officer, ship type NAISSAAR dwt 6,070  
 5/90 - 6/91: 4th officer, passenger ferry GEORG OTTS  
 7/91 - 10/91: 3rd officer, passenger ferry GEORG OTTS  
 1/92 - 12/92: 2nd officer, INREKO ships  
 2/93 - 8/94: 2nd officer, passenger ferry ESTONIA  
 9/94 - 28/9/94: chief officer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian, Finnish  
 Recommended by: Technical department, ESCO Senior Captain, ESCO, Enn Neidre

#### Second Officer A

Name: Tormi Ainsalu (( ), date of birth 04.12.1963.  
 Education: 1982-1988 Tallinn Maritime School including (3 years in Leningrad Maritime Institute)  
 Proficiency Certificate: 2078/88, issued 01.09.1988  
 Radar Simulator Certificate: 1991, ARPA 1992  
 Training Certificate accepted by IMO in accordance with STCW/78 - 289/1991.  
 Radiotelephone Operator Certificate 1991. Attested 21.07.1992.  
 Record of service:  
 11/88 - 2/91: seaman, ship type Ro-Ro dwt 4,600  
 3/91 - 6/92: 3rd officer, ship type Ro-Ro dwt 4,600  
 7/92 - 12/92: 2nd officer, passenger ferry GEORG OTTS  
 1/93 - 28/9/94: 2nd officer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **Second Officer B**

Name: Peeter Kannussaar (( ), date of birth 20.06.1964.  
 Education: 1988-1991 Leningrad Maritime Academy.  
 Proficiency Certificate: LS000005, issued 19.09.1994.  
 Radar Simulator Certificate: 1991.  
 Training Certificate accepted by IMO in accordance with STCW/78 - 1991 in Leningrad. Attested 29.09.1992.  
 Record in Service:  
 ~ 9/91 - 9/92: 3rd officer, on general cargo vessels  
 10/92 - 12/92: 2nd officer, passenger ferry GEORG OTTS  
 1/93 - 28/9/94: 2nd officer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **Third Officer**

Name: Andres Tammes (( ), date of birth 25.08.1966.  
 Education: 1984-1988 Tallinn Fishery Marine School 1990-1992 Kotka Marine School  
 Proficiency Certificate: 1266/92, issued in Finland.  
 ARPA 19.03.1992, issued at the Kotka Marine School Training Centre.  
 Radiotelephone Operator Certificate: 1207, issued 27.04.1992 in Helsinki.  
 Training Certificate accepted by IMO in accordance with STCW/78 1991 and 1992 (ARZAMAS and KORALL).  
 IMO accepted courses in Proficiency in Survival Craft, Basic Fire-fighting issued 11.01.91 in Rauma Marine College.  
 Record of service:  
 11/88 - 2/91: seaman, ship type Ro-Ro dwt 4600  
 1/93 - 4/94: 4th officer, passenger ferry ESTONIA  
 5/94 - 28/9/94: 3rd officer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian, Finnish  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **Fourth Officer**

Name: Kaimar Kikas (( ), date of birth 09.04.1973.  
 Education: 1988-1992 Estonian Maritime Education Centre, Tallinn  
 Proficiency Certificate: LL0000034, issued 28.04.94.  
 Radar Simulator Certificate: 10.09.1993.  
 Radio-telephone Operator Certificate 1207, issued 27.04.1992 in Helsinki.  
 Training Certificate accepted by IMO in accordance with STCW/78 217/1992.  
 Record of service:  
 1/93 - 4/94: seaman, passenger ferry ESTONIA  
 5/94 - 28/9/94: 4th officer, passenger ferry ESTONIA  
 Language: Estonian (native tongue), English, Russian, Finnish  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

In summary the following can be concluded:

- The master and senior officers received their basic education at the Leningrad Maritime Academy, an Institute which is not known to impress upon its students to act and decide on their own.
- The juniors, Tammes and Kikas, were educated in Kotka and Tallinn after the political change.

**Note:** As will be seen later, it was Tammes who took the lead in the transmission of the 'Mayday' calls after Ainsalu had almost spoiled the situation, and although he was not on watch, he had apparently returned to the bridge on his own initiative.

**Captain Arvo Andresson** spent 101/2 of his 201/2 years at sea on a vessel of the ANSLA type, which is an old conventional cargo vessel, furthermore he was employed on board of GEORG OTTS as 2nd officer for 17 months, as chief officer for 5 months and as master for 4 months, before he took over the ESTONIA in January 1993. The car/passenger ferry GEORG OTTS was exclusively employed between Tallinn and Helsinki, i.e. she sailed no more than 20 nm from the nearest land "in sheltered waters".

**Chief officer Juhani Herma** had only been at sea **for 5 years** in total, of which 10 months on a cargo vessel and 16 months on GEORG OTTS as 4th and 3rd officer, whereafter he left ESCO and sailed on INREKO ships from February 1993 until August 1994 - according to the statement of ESCO - although at the same time he was already 2nd officer on ESTONIA, which, of course, is not possible, thus there must be something wrong. *Only in September 1994, thus shortly before the casualty, did he become chief officer.*

**2nd officer Tormi Ainsalu** had been at sea for 51/2 years only, of which 21/2 years as sailor and 3 years as officer, 6 months of which he had been on GEORG OTTS as 2nd officer before he joined ESTONIA in January 1993.

**2nd officer Peeter Kannussaar** had been at sea **for 3 years** only, of which for 1 year he was employed on an unknown vessel as 3rd officer and for 3 months as 2nd officer on GEORG OTTS before he joined the ESTONIA in January 1993.

**3rd officer Andres Tammes** had been at sea for **only 2 years** and 4 months as sailor on a Ro-Ro cargo vessel, whereafter he attended the Kotka Marine School for 2 years and signed on ESTONIA in January 1993 as 4th officer and had been 3rd officer since May 1994.

**4th officer Kaimar Kikas**, finally, was only 21 years old. His first and only ship was the ESTONIA. He was employed for the first 12 months as AB and became 4th officer in January 1994.

The above evaluation reveals that master and senior officers were Russian educated, that only the master had spent some considerable time at sea, however, that also his experience with car/passenger ferries was restricted to the GEORG OTTS employed between Helsinki and Tallinn, which is in no way comparable to the Tallinn-Stockholm trade with ESTONIA. The chief officer as well as 2nd officer A - Tormi Ainsalu - had been at sea each for about 5 years only with 16 months respectively 6 months on GEORG OTTS as with ESTONIA. The chief officer as well as 2nd officer A - Tormi Ainsalu - had been at sea each for about 5 years only with 16 months respectively 6 months on GEORG OTTS as with ESTONIA. The chief officer as well as 2nd officer A - Tormi Ainsalu - had been at sea each for about 5 years only with 16 months respectively 6 months on GEORG OTTS as with ESTONIA. It has to be concluded that neither the master nor the nautical officers had had any previous experience with a comparable vessel when they joined the ESTONIA and that the only one with considerable sea experience was Captain Arvo Andresson, whilst all the others, including the chief officer and the 2nd officer A, could only be considered junior officers.

#### **Radio Officer**

Name: Tiit Soosaluste ((,), date of birth 08.09.1966.  
 Education: 1960-1962 Tallinn Technical University 1983-1986 Tallinn Marine Fishery School  
 Proficiency Certificate: 997/1974, issued 10.06.74, 1st class radio operator.  
 Courses at St. Petersburg Marine Academy in 1982. Attested in 1988, 1993.  
 Record of service:  
 6/62 - 2/93: radio operator, ship type TARTU, POVENETS  
 3/93 - 28/9/94: radio operator, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **The Deck Ratings**

The boatswains and all the able seamen had attended the general ship safety course on the training vessels ARZAMAS or KORALL. The A.B. seaman of the watch during the critical hours of the accident, Silver Linde, was born in 1970. He was employed by ESCO in January 1993. Before serving on the ESTONIA, he had worked on board the Ro-Ro ferry TRANSESTONIA and on the GEORG OTTS. According to his own statement he was holding a mate's license.

#### **Chief Engineer**

Name: Lembit Leiger (missing), date of birth 01.12.1950.  
 Education: 1967-1971 Tallinn Marine School 1981-1989 Leningrad Marine Academy  
 Proficiency Certificate: MK0000001, 05.01.1994  
 Training Certificate accepted by IMO in accordance with STCW/78 458/1990 (ARZAMAS).  
 Refresher courses in Estonian Marine Education Centre. Attested: 12.01.1993.  
 Record of service:  
 1/72 - 12/74: motorman, ship type TARTU 1 x 740 kW  
 1/75 - 12/78: 3rd engineer, ship type HEINLAID 1 x 1550 kW  
 1/78 - 7/81: 3rd engineer  
 8/81 - 4/86: 2nd engineer  
 5/86 - 6/89: chief engineer, ship type KOLGA 1 x 850 kW  
 7/89 - 11/89: 2nd engineer, ship type E.KIVISTIK 1 x 12205  
 12/89 - 2/90: chief engineer, ship type KOLGA 1 x 850 kW  
 3/90 - 12/92: chief engineer, car ferry TRANSESTONIA 2 x 3309 kW  
 1/93 - 1/93: chief engineer, passenger ferry SAINT PATRICK 2 x 6951 kW  
 2/93 - 28/9/94: chief engineer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian, Finnish  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **First Engineer**

Name: Arvo Tulvik ((,), date of birth 19.10.1952.  
 Education: 1971-1976 Leningrad Maritime Academy  
 Proficiency Certificate: 1271/83 - 2nd engineer.  
 Training Certificate accepted by IMO in accordance with STCW/78 191/1991 (ARZAMAS).  
 Refresher courses in St. Petersburg Maritime Academy 1990. Attested: 1990.  
 Record of service:  
 9/78 - 11/78: 4th engineer, ship type ANTS LA 1 x 4490 kW  
 12/78 - 5/81: 3rd engineer  
 6/81 - 12/83: 3rd engineer, passenger ferry GEORG OTTS  
 1/84 - 9/86: 2nd engineer  
 10/86 - 3/88: 2nd engineer, ship type ANTS LA 1 x 4490 kW  
 4/88 - 4/90: 2nd engineer, ship type RAKVERE 1 x 4490 kW  
 5/90 - 6/91: 2nd engineer, ship type G.SULE 1 x 7500 kW  
 7/91 - 12/92: 2nd engineer, ship type E.KIVISTIK 1 x 12205  
 1/93 - 5/94: 2nd engineer, passenger ferry ESTONIA  
 6/94 - 28/9/94: 1st engineer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian, Finnish  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **Second Engineer**

Name: Peeter Tüür, survivor, date of birth 06.08.1947  
 Education: 1963-1968 Tallinn Marine School 1975-1981 Leningrad Maritime Academy  
 Proficiency Certificate: 929/72.  
 Training Certificate accepted by IMO in accordance with STCW/78 47/1991 (ARZAMAS). Attested: 08.12.1992.  
 Record of service:  
 2/68 - 12/82: 3rd engineer, 2nd engineer, ferries SÖPRUS, TEHUMARDI  
 1/82 - 12/92: 3rd engineer, ship type HAAPSALU 1 x 4490 kW  
 1/93 - 28/9/94: 2nd engineer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **Third Engineer**

Name: Margus Treu, survivor, date of birth 28.08.1964.  
 Education: 1985-1990 St. Petersburg Maritime Academy  
 Proficiency Certificate: 814/990.  
 Training Certificate accepted by IMO in accordance with STCW/78 37/1992 (ARZAMAS). Attested: September 1994.  
 Record of service:  
 1990 - 1993: motorman & engineer on ESCO ships  
 07.01.1993: 4th engineer, passenger ferry ESTONIA  
 16.09.1994: 3rd engineer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **Fourth Engineer**

Name: Agur Targama (()), date of birth 18.12.1966.  
 Education: 1982 - 1986  
 Proficiency Certificate: 1324/86.  
 Training Certificate accepted by IMO in accordance with STCW/78 - 1990. (ARZAMAS). Attested: 1994.  
 Record of service:  
 1/89 - 7/91: motorman, ship type TARTU 1 x 740 kW  
 8/91 - 12/93: 4th engineer, ship type POVENETS 1 x 2390 kW  
 1/94 - 8/94: chief motorman, passenger ferry ESTONIA  
 9/94 - 28/9/94: 4th engineer, passenger ferry ESTONIA  
 Languages: Estonian (native tongue), English, Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO

#### **Electric Engineer**

Name: Anatoli Ivanov (()), date of birth 16.03.1951.  
 Education: 1969-1974 Leningrad Maritime Academy  
 Proficiency Certificate: 671/1984.  
 Training Certificate accepted by IMO in accordance with STCW/78 - 1253/1991 (ARZAMAS).  
 Refresher courses 1985. Attested: 1989.  
 Record of service:  
 4/77 - 10/77: electrician, ship type POVENETS 1 x 2390 kW  
 11/77 - 5/79: electric engineer, ship type TARTU 1 x 740 kW  
 1/80 - 7/88: chief electric engineer, ship type RAKVERE 1 x 4490 kW  
 8/88 - 12/92: chief electric engineer, ship type E.KIVISTIK 1 x 12 205  
 1/93 - 28/9/94: electric engineer, passenger ferry ESTONIA  
 Languages: Russian (native tongue), English Recommended by: Technical Department, ESCO Senior Captain, ESCO

#### **Systems Engineer**

Name: Henrik Sillaste, survivor, date of birth 13.09.1969  
 Education: 1986-1991 Tallinn Marine Education Centre.  
 Proficiency Certificate: 1560/1991  
 Training Certificate accepted by IMO in accordance with STCW/78 - 176/1992. (ARZAMAS). Attested: 03.05.1992.  
 Record of service:  
 8/91 - 3/92: 4th engineer, ship type POVENETS 1 x 2390 kW  
 4/92 - 12/92: 2nd engineer, ship type VORMSI 2 x 110 kW  
 1/93 - 28/9/94: systems engineer, passenger ferry ESTONIA, survivor.  
 Languages: Estonian (native tongue), English, Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

#### **Refrigerating Engineer**

Name: Andres Verro, survivor, date of birth 08.09.1959.  
 Education: 1974-1978 Tallinn Fishery Marine School  
 Proficiency Certificate: 34/1992.  
 Training certificate accepted by IMO in accordance with STW/78 - 8/1993. (ARZAMAS). Course of Proficiency in Survival Craft -1993. Attested: 28.12.1992.  
 Record of service:  
 4/78 - 12/92: refrigerating engineer at 'Hiiu Kalur' collective farm, 4th engineer  
 1/93 - 28/9/94: refrigerating engineer, passenger ferry ESTONIA, survivor.  
 Languages: Estonian (native tongue), English, Russian  
 Recommended by: Technical Department, ESCO Senior Captain, ESCO, Enn Neidre

To sum up the professional careers of the engineers it has to be concluded that the senior engineers, at least, were much better qualified and comparatively also more experienced than were the nautical officers, with the exception of Captain Andresson.  
 Not much can be said about the radio operator. He appears nowhere and also the statement of ESCO about the dates of his professional carrier must at least be partly wrong. Some information was received from the Maritime Department of the Polytechnic Kotka, which is attached as Enclosure 13.189.

Next, the first crew list of ESTONIA is attached as Enclosure 13.190 on which the survivors are marked with an "S".

#### **Finally the statements of**

Electrician Arvi Rohumaa - Enclosure 13.191  
 Motorman Elmar Siegel - Enclosure 13.192  
 Motorman Ivan Ziljajev - Enclosure 13.193

are attached, which were taken in July 1996 and which provide some general information about the crew, although not very much. Video tapes of these interviews are available. In addition to the standard crew there were six trainees for the new vessel DIANA II - planned to be renamed VIRONIA - on board of whom only the officer Einar Kukk, who survived and whose testimony is of relevance in many respects.

#### **The Engine Ratings**

There were eight ratings in the engine department: four senior motormen, two electricians, one welder and one turner. All were said to have passed the general ship safety course on the training vessels ARZAMAS or KORALL.

#### The Advisers

Furthermore, there were said to be nine advisors on board, one Finn and eight Swedes, all of whom were employed by AB Hornet, the ship management company used by Nordström & Thulin. According to the list submitted by ESCO  
- Enclosure 13.187 - however, there were only 8:

Jan Bergendahl - FIN  
Magnus Andersson - SWE  
Mikael Dahlin - SWE  
Hans Svensson - SWE  
Toni Heinonen - SWE  
Carita Baransinski - SWE  
Paula Liikamaa - SWE  
Peter Järvinen - SWE

The list does not include Captain Juri Aavik who was nautical adviser and the off-duty adviser Susanne Pundi, while the others mainly belonged to the catering department, among them Jan Bergendahl from Mariehamn, in charge of the hotel and restaurant sections, and Magnus Andersson, an expert for the ship's computer system. Only two of these nine Hornet employees - Paula Liikamaa and Peter Järvinen - survived and for the time between the big heel and the sinking there are only very few indications in the survivors' statements referring to those not having survived.

In any event the crew list of ESCO - Enclosure 13.187 - is incomplete and consequently the total number of people stated to have been on board in the JAIC Report is wrong which means that also the number of people not having survived the catastrophe is wrong.

## CHAPTER 14

### THE DAY IN TALLINN

On 27 September 1994 ESTONIA was lying at her berth in Tallinn with open visor and open bow ramp, whilst the crew was carrying out some maintenance work and was preparing her for the take-over of passengers, cars, trucks, and trailers in the late afternoon.

While a number of deckhands were clearing up and cleaning the car deck, provisions and stores were taken over and brought down to the provision area on the 1st deck by means of the big lift at the aft end of the centre casing. At the same time one AB was painting the port anchor from a cherry picker standing on the open bow ramp. Even in summer the port anchor with pocket had to be painted quite often as the anchor was frequently used during berthing manoeuvres at Tallinn when Captain Arvo Andresson was in charge, who was still unable to manoeuvre the big vessel the way his colleagues in Finland and Sweden had done during the past 14 years without problems.

Other AB's were painting in the forepart of the car deck near the control panel for visor and bow ramp and the upper flaps of the bow ramp.

At noon two representatives from the Swedish Sjöfartsverket, chief inspectors **Ake Sjöblom** and **Gunnar Zahlée**, came on board together with a group of nine high ranking officials in Estonian Ship Safety, who were to be trained in Port State Control matters. ESTONIA was selected to be the test vessel for this day (see details in the following Chapter 15). **Captain Andresson** was said to be ashore, thus the chief mate **Juhan Herma** and the chief engineer **Lembit Leiger** were in charge of the ferry.

Most of the passengers who returned with the ferry to Stockholm the same evening were ashore on sightseeing tours whilst others attended on board seminars and did not go ashore at all. Among them was a group of Statoil Sweden employees and a group of 68 police civil servants belonging to the ST section of the Stockholm police. The seniors of this group had cabins on the outer and inner side of deck 6 while others were staying in cabins of the 5th and 4th decks.

Two members of another group, **Rolf Sörman** and **Nebosja Grkovic** - see Enclosure 21.3.3.35.1 and Enclosure 21.3.4.348 - had returned from shore early and were having their lunch in the restaurant "Poseidon" in the aft part of deck 6. They observed six or seven persons at the big table in the centre, one of whom was the master of the second crew, **Captain Avo Piht**. Another one was an officer wearing a blue uniform. Furthermore there were two ladies and two gentlemen in civil clothes probably the two Stockholm pilots with their ladies. There was a friendly atmosphere. A walky-talky was standing upright on the table and was obviously turned on channel 16 because they heard a gale warning in English.

Among the new passengers coming on board in the course of the afternoon was the weapons dealer **Alexander Vorodin**, his father-in-law **Vasili Krjutkov**, and his cousin **Vassili Vorodin**, who received either cabin 6320 or 6230. This is of some importance because later, during the diving survey in December 1994, the suitcase of **Alexander Vorodin** was taken out of cabin 6230 by a diver. It was the second cabin on the port side in front of deck 6 which however - according to the survivor purser **Andres Vihmar** - had been assigned to **Captain Avo Piht**. - See Andres Vihmar's statement attached as Enclosure 14.195. On the other hand, **Vasili Krjutkov** did testify in his first statement - Enclosure 14.196 that their cabin had been 6230 and only in his subsequent statement - Enclosure 14.197 - said, it had been 6320 while his nephew **Vassili Vorodin** stated that they had looked out of the window after the abrupt starboard heel. This would not have been possible from cabin 6320 which was an inside cabin without windows. Thus it has to be assumed that the Vorodins were in cabin 6230.

Also the Swedish press photographer **Håkan Isefjord** came on board with his camera equipment, of which he should later hide one camera with 2 films in lifeboat no. 9 which was the last lifeboat on the starboard side of ESTONIA. When the lifeboat was found several days after the casualty on the Estonian north coast the camera, with two films, was found jammed inside the lifeboat and subsequently delivered to the Swedish Embassy in Tallinn from where it was sent by diplomatic mail to Stockholm. According to the files of the public prosecutor the films, however, were not in the camera anymore.

Another passenger was the auditor **Peeter Riit** who reportedly came on board rather late since he had missed the last plane to Stockholm and therefore took the ferry. **Peeter Riit** was employed by the Stockholm auditors KPMG who had been instructed by N&T to examine the books of Estline, Tallinn. Reportedly **Peeter Riit** had completed this job on 27 September 1994 and was now on his way back to Stockholm with a number of, for ESCO, rather damaging documents.

Among the passengers were also a considerable number of businessmen, such as **Per-Erik Ehrnsten**, **Carl Övberg** and **Tony Spuhl**, who had made many previous voyages on board the ferry and thus knew the vessel and crew quite well, which also goes for many truck drivers who came up to the Reception Desk after having driven their trucks on to the car deck and were shown to cabins on the 4th deck reserved for truck drivers only. Most of them sensed a certain state of nervousness with the crew members they met which they had never done before on the many earlier voyages.

The reason for this certain nervousness of some of the crew members could have been the attempt of the Swedish Safety Inspector **Ake Sjöblom** to stop the ferry from departing which was certainly realised by some crew members and then quickly spread around.

**CHAPTER 15****THE SJÖFARTSVERKET INSPECTORS  
AND THEIR TRAINEES**

In accordance with the treaty between the Swedish and the Estonian Governments "Maritime Transport and Safety at Sea and Prevention from Pollution on Marine Environment Projects, Phase IV", signed 03.02.93, the Swedish Sjöfartsverket had sold an education package to the Estonian National Maritime Board (E.N.M.B.) which was paid for by the Swedish Board for Investment and Technical Support (BITS) and which, among other things, required Sjöfartsverket to train and educate Estonian master mariners and engineers employed with the E.N.M.B. to carry out Port State Control (PSC) surveys on own and foreign vessels and to issue the respective certificates.

In Annex A of the treaty the "Scope of Services" is outlined and with reference to "Port State Control" (PSC) the following is explained:

*»Brush-up seminars and on the job training for ship inspectors in Tallinn, implementing the Port State Control methodology. The training will be carried out in Tallinn.«*

In Annex B the obligations of the Estonian side are specified. Under item 7 it is stated:

*»To provide all necessary permits, including facilitation of visa formalities and authorisations for the carrying out of the services.«*

On 02.02.94 the board of BITS agreed to provide the required amount of SEK 574.340,-. The respective agreement contains the following definition in respect of PSC:

*»The training will be performed in Estonia in one-week seminars for 8-14 participants in accordance with international standards. The seminars include on-the-job training, i.e. in practice actual inspections of vessels in international trade. Our inspectors do expect participants from the E.N.M.B., those responsible for PSC in Tallinn as well as those responsible for safety in ESCO.«*

It is revealed from the above that the Estonian authorities did initiate and order the advisory services of Sjöfartsverket. As regards the PSC these services should consist of **on-the-job training and actual inspections on board of vessels employed in international trade in the port of Tallinn**. According to the treaty the **Estonians were obliged to authorise the Swedish inspectors properly for this job**.

This could only mean that in the light of the treaty and also through the confirmation by the board of BITS, these **on-the-job inspections were considered to be normal PSC inspections by properly authorised inspectors**.

As to the legal background for these inspections - the SOLAS 1974 Convention and the Paris Memorandum of Understanding - the Paris MOU - reference is made to the report of the Independent Fact Group, Stockholm about the "Forgery of Documents to hide the initial Unseaworthiness of the 'ESTONIA'", which is attached as Enclosure 34.1.429 in the Swedish original and as Enclosure 34.1.429\_1 in German translation.

The task to train the Estonians was assigned to the Shipinspec office Malmö headed by chief inspector Åke Sjöblom. With regard to this project he reported to Willand Ringborg of International Projects at the head office of Sjöfartsverket (HK = Huvud Kontor = head office) at Norrköping. (See also Subchapter 6.3.1.)

In compliance with the agreed training program chief inspector Åke Sjöblom and inspector Gunnar Zahlée travelled to Tallinn on 26 September 1994 and met their high ranking Estonian trainees on the morning of the 27th at the offices of the Estonian National Maritime Board (E.N.M.B.). These were according to the draft report of Åke Sjöblom:

Uku Tiik	Harbour Master, Pärnu
Enn Tiits	Surveyor, Pärnu
Arvi Buddel	Deputy Harbour Master, Tallinn
Hugo Ink	Harbour Master, Saaremaa
Andres Piirikivi	Harbour Master, Haapsalu
Peep Hint	Deputy Harbour Master, Maapsalu
Harri Allik	Deputy Harbour Master, Maapsalu
Jaak Arro	Principal Specialist on Dangerous Goods, E.N.M.B Sea Safety Director
Arne Valgma	Head of the Ship Inspection Division, E.N.M.B.

After they had spent the morning with the theoretical part of the job the trainees decided to carry out the practical part of it on board of the ferry ESTONIA considered to be the best vessel of the national fleet in every respect. Consequently the group proceeded on board after lunch and carried out a Port State Control inspection during the "on-the-job training", the results of which were and still are the subject of dispute, misinterpretation and misunderstanding. Therefore the documentation available shall be analysed and interpreted as follows:

After the casualty Åke Sjöblom and Gunnar Zahlée frequently reported about their subsequent findings, partly in writing and partly verbally. In detail:

- Report "On the Job Training PSC in Estonia" dated 24.10.94 - Enclosure 15.198.
- Letter to Willand Ringborg of 24.10.94 - Enclosure 15.199.
- "Report of Inspection in accordance with the Memorandum of Understanding on Port State Control" - Enclosure 15.200.
- Transcript of an interview by a Spiegel TV team held in Tallinn on the evening of 28 September 1994 - Enclosure 15.201.
- Report on a telephone interview by criminal inspector Egon Bergqvist from the Stockholm police on 31.10.94 - Enclosure 15.202.
- Transcript of the questioning by the Swedish part of JAIC on 02.11.94 - Enclosure 15.203.
- Furthermore, one of the trainees, the head of the Ship Inspection Division of the Estonian National Maritime Board (E.N.M.B.), Arne Valgma, was heard by the criminal police in Tallinn already on 29.09.94 and the respective statement is attached as Enclosure 15.204.
- Reportedly Åke Sjöblom and Gunnar Zahlée were heard by the Estonian Security Police in their hotel during the night 28/29 September 1994. The statements are not available.

The statement of Ulf Beijner is, however, available. He has testified that at a confidential meeting at the Sjöfartsverket's head office about 10 days after the casualty Åke Sjöblom explained what they had really found on board the ESTONIA, viz. the absolutely disastrous condition of the bow ramp, the mattresses, blankets and rugs plugged into the gap at the lower corner in way of the severely damaged port hinges, where the bow ramp was already detached from the vessel. Further that they had consequently demanded from their highest ranking trainee, the head of the Ship Inspection Division of the E.N.B.M., Arne Valgma, that the ferry should under no circumstances sail in this condition, which was said to have been rejected by him and subsequently by the Estonian authorities up to the highest level.

The above has been confirmed by a colleague of Ulf Beijner, the next-in-charge of another district, who added that Åke Sjöblom then - after the Estonians had rejected to stop the ferry - spoke first to his direct superior, Sea Safety Director Bengt-Erik Stenmark, who felt unable to do anything because they had no authority in Tallinn, and subsequently, to the General Director of Sjöfartsverket, Kaj Janérus, who felt also unable to do anything to stop the ferry. The result is well known and 8 hours later the ESTONIA was down at the bottom of the sea and about 1000 people had lost their lives.

The available information and documentation shall now be discussed in detail, always with reference to the Report of the Independent Fact Group - see Enclosure 34.1.429.

The task of chief inspector Åke Sjöblom and inspector Gunnar Zahlée was to demonstrate to a rather high ranking group of Estonian Ship Safety officials, among them the head of the Ship Inspection Division of the Estonian National Maritime Board, Sea Safety Director Arne Valgma, the meaning and importance of Port State Control inspections. The test object was ESTONIA, believed by the Estonian trainees to be the best vessel of the Estonian merchant navy fleet.

At the end of the inspection a "Report of Inspection in accordance with the Memorandum of Understanding on Port State Control" was jointly drawn up on a Sjöfartsverket form - see Enclosure 15.200 - which is frequently referred to and of which apparently several versions do exist, because according to Arne Valgma's testimony to the police - see Enclosure 15.204 - there were only eight items noted on this document which was signed by himself and he expressly confirmed that it did conform with their real findings and that no other defects were noted. He declared further that of these eight items, six were coded 99, i.e. could be rectified subsequently and only two were coded 17, i.e. to be rectified before departure and this was just the replacement of a wing screw from a galley window on the 7th deck and the closing of two covers on car deck. This document is not

available to this 'Group of Experts'. The number and status of crucial items look quite different in the "Report of Inspection in accordance with the Memorandum of Understanding on Port State Control" (hereafter called "The Report of Inspection") which was submitted by Åke Sjöblom to the JAIC ([Enclosure 15.200](#)) and which contains in total 15 items including the eight mentioned by Arne Valgma in his statement and which is also signed by Arne Valgma, although this "Report of Inspection" is on a form of the National Maritime Administration (of Sweden). The additional items are

1280	Sounding pipe aux. engine room	code 17
0720	2 portable fire extinguishers missing	code 17
0710	Fire Prevention: Navigation bridge door, Boiler room closing device missing, Fire door in galley not working properly	code 17

These five items had to be rectified before departure and were not mentioned by Arne Valgma, probably because it is doubtful whether the crew could have managed to rectify them before departure or he knew that they had not rectified them before departure.

The other four items are coded 99, i.e. to be rectified subsequently. It means, however, that several different "Reports of Inspection" must exist, viz. the one which was attached to the statement of Arne Valgma to the Estonian Police (not available), the one attached as [Enclosure 15.200](#) and other versions as shown on pages 12 through 15 in the Report of the Independent Fact Group (IFG) - see [Enclosure 34.1.429](#) - and all were signed by Arne Valgma.

It is obvious that Arne Valgma tried to hide the real findings from his superiors and the Estonian police, because he, in his capacity as Director of the Sea Safety Division of the E.N.M.B., had been obliged to make sure that the items had been rectified before departure and if that could not have been achieved by the crew, the ferry mandatorily should have stayed in port until all items had been rectified to the satisfaction of the authorities. This is the reason why Arne Valgma tried to play down the problems discovered on board and testified wrongly and incompletely to the criminal police and, in addition, committed forgery of documents - see [Enclosure 34.1.429](#) - Report of the Independent Fact Group.

Next the various interviews/statements shall be scrutinized as follows:

In the telephone interview with the police inspector Egon Bergqvist - see [Enclosure 15.202](#) - Åke Sjöblom expressed himself rather vaguely, however, in his draft report and in the interview with the journalist from Spiegel TV - see [Enclosure 15.201](#) - on the day after the catastrophe, and in particular, in the interview with the Swedish part of JAIC on 02.11.94 - see [Enclosure 15.203](#) - he and Gunnar Zählée went much more into detail. On the other hand, it is quite obvious that during the latter interview the tape was switched off when the really crucial parts, i.e. visor, bow ramp, car deck, competency of crew, etc., were discussed and if really something had remained on the tape, on the transcript it reads »unclear, disturbed, difficult to understand«.

This interview was held on 02.11.94 in Stockholm and the participants were (as far as is revealed from the tape):

Olof Forssberg (OF)  
Åke Sjöblom (ÅS)  
Hans Rosengren (HR)  
Olle Noord (ON)  
Gunnar Zählée (GZ)  
Bengt Schager (BS)  
Sten Andersson (SA)

**Note:** Sten Andersson from the legal department of Sjöfartsverket was the observer who attended all the relevant meetings and also participated in the drafting of the part report and the final report.

The evidence available from the above-mentioned documentation is divided into

(a) On the procedure  
and  
(b) Findings

- (1) Certificates and other documents
- (2) Mimic panel on the bridge
- (3) Watertight and fire doors
- (4) Lack of respect for load line matters on car deck, bow ramp and in the visor
- (5) The chief officer
- (6) Cargo securing devices
- (7) The chief officer and the crew in general
- (8) The indicator lights

In detail:

**(a) On the procedure:**  
In the draft report of ÅS:

»27.09.94: Introduction to PSC and theoretical lessons were given. The afternoon subject for "On the Job Training" was chosen by the trainees. The inspection was roughly planned.

12.00-18.00: MV "Estonia", an Estonian passenger ship, was inspected as a port state control case and we all started in the wheel house by introducing ourselves to the commanding officer on board (chief officer) and explaining the purpose of our visit.

The chief officer had no objections and we started with certificate and document control. Then we split into two groups. One, accompanied by chief engineer, started in the engine room and worked upwards. The other, accompanied by the chief officer, started in wheel house and worked downwards.

Around 16.30 hours we were all gathered in the officers' mess for summoning our 'findings'. These 'findings' were then discussed and agreed upon with chief officer and chief engineer. We then left the ship around 17.30 hours and closed the day.«

In the Spiegel TV interview:

»We explained why do you look at certain things on board, explained about certificates and what is the meaning of certificates - you certify to the international community that you have surveyed this vessel. We explained to them a lot of things, and so and so. This is the normal way when you have trainees. In the afternoon we came on board "Estonia" at 12:30 and we spent 5-6 hours. We left at 05:30 just before loading of the vessel.«

**Note:** According to Gunnar Zählée loading had commenced already when they were still on the car deck, but Åke Sjöblom had presumably gone upstairs then already.

»We split up into two groups, one group started down in the engine room and walked up, the other group started up in the wheel-house and walked down. We did not meet the captain on board. He was said to be ashore doing some pilot examination, we don't know what it is. So the man in charge on board, the chief officer, was accompanying us all day together with the chief engineer. The 2 highest officers on board were together with us all day. We had an open, very nice atmosphere together with our trainees. There were 9 and, of course, there were some findings. All these findings were discussed altogether, understood and there shall be no misunderstanding, we have not inspected the vessel, it has been an on-the-job-training and what we saw on board is, of course, .... we made notes, it is just working papers for this trainee program and the officers on board, of course, they listened and we fully agreed that some of these findings needed immediate action, and they did, no problem.«

**(b) Findings:**

The findings are divided into "areas of relevance" and the first one is:

**(1) The certificates and other documents**

**To Spiegel TV :**

AS: "We found some other things. The documentation was not to our satisfaction. This cannot be settled immediately, it has to be done by someone and it will take some time. It was the safety plan, the muster list. It is the alarm list on board, it is the alarm list on board telling what everybody has to do in case of an emergency. It was not completed according to regulations. They could not show us a damage control plan, they could not show us a cargo securing manual."

**To the JAIC:**

AS: "We went through all their certificates, we asked them to show us some manuals, the stability booklet, etc. They hesitated slightly already from the beginning. We were not shown the stability booklet which we wanted to see, however, we are not saying that it was not on board, but the chief officer having the final responsibility also had no access to this material and obviously he did not know where he should actually search for it. What we were missing was also an approved stability manual. They were unable to read a damage control plan. Bridge instructions were not available on the bridge then. The vessel's characteristics, in case of damage, we also could not view."

AS: "After we had overcome the documentation check, with which we were not fully satisfied, however this was more in detail, we were missing the exemption certificate for their liferafts. This was SOLAS, Part B, Liferafts and had they ever used them it should have been placed somewhere where it could be found. The exemption issued by the authority having certified the vessel was missing. We were not surprised that not all of the requested documents were on board, but the chief officer, the acting commanding officer, was unable to show any of them to us, without any explanation."

OF: "As to the missing documents, did you ever get any explanation where they were?"

AS: "Yes, we dropped it."

**Note:**

Arne Valgma has stated the contrary to what Åke Sjöblom said in the Spiegel TV interview, viz.

**0920 - Safety Plan:**

Arne Valgma: Was on the bridge, but not in English. Åke Sjöblom: It was not completed according to regulations.

**2030 - Damage Control Plan:**

Arne Valgma: Was on the bridge, but not in English.

Åke Sjöblom: They could not show us a damage control plan.

**2045 - Cargo Securing Manual:**

Arne Valgma: The manual was on the bridge.

Åke Sjöblom: They could not show us a cargo securing manual.

**(2) The mimic panel on the bridge** (this panel shows the location of the many watertight doors and the fire doors with numbers, and with one red and one green lamp each indicating whether the door is open or closed): Not mentioned to Spiegel TV.

**To the JAIC:**

AS: "On the bridge we had a dispute about the mimic panel ..... there it is written ..... why I do not mean that everything is wrong. It was not so that it did not function. Now we did not test any closings of ..... But aren't there maybe 500-600 people on board down there? This is completely impossible. Gunnar ..... carried out certain local tests down there.

As far as the mimic panel is concerned, it was actually so that the chief officer did not really know what was open and what was closed. There was green light and the chief officer was of the opinion that this meant that it was closed. And this is what it should be according to the new SOLAS rules, however, on this vessel it meant that they were open."

- "This is just equipment which is incorporated into the Damage Control Plan, this must close directly. And this closes from above to below in case of emergency. This is just normal minimum knowledge that they know whether they are open or closed, that's what I wanted to say."

**(3) The watertight doors and the fire doors**

GZ: "We closed the watertight doors manually, but they came back almost immediately to 'open' position because the input on the bridge was 'open'. It was not possible to close all doors simultaneously with all the many people on board.

We checked the fire doors and found a problem, I believe, in the galley area, where they had completely sabotaged the fire protection, without really understanding what they had done. In the area of the boiler room nothing fitted at all."

**(4) Lack of respect for load line matters on car deck and bow ramp, in the visor****To Spiegel TV:**

AS: "We went down to the car deck. We experienced a lack of respect for load line matters, and when we say this, and we discussed it with the chief officer, we said we don't understand how came that this hatch cover is open here? It has always to be closed and it has not been closed for the last 1 or 2 years, and so on. I think it was in 2 or 3 places. Of course they closed it immediately, but for us it was extremely important that they understood what we were talking about. If you run aground with your ship or sail against some rocks or something, then the water comes up from below, then it must be closed tight on the freeboard deck so that you don't get water all over the ship."

**To the JAIC:**

AS: "Then we went around on the car deck and had a look at the fire-main section valves and fire stations, which were all ok. Then we went out and had a look at the ramp. Then we saw that there was damage to the packing, big damage, about half a meter on each side, there, in way of the 'corners of the mouth' as it is called, where it settles down quite heavily. We could not see whether there was more damage further forward because the ramp was down. And it was a clear mechanical wear. If I should explain this now here, one has to imagine that one is standing there and chopping it off by means of an axe to the effect that it is flat, but not completely gone. However, it can never have been tight the way it looked. Similar on both sides. Then I said to the chief engineer: 'This has to be rectified.' He replied: 'Yes, we have ordered them when we go into the shipyard', and it was my impression that this would be soon." (Discussion not recorded.)

BS: "Those here which you found in the 'corners of the mouth'. What are the most probable causes for this?"

GZ: "I believe that they did seal (difficult to understand), so they did .... very many."

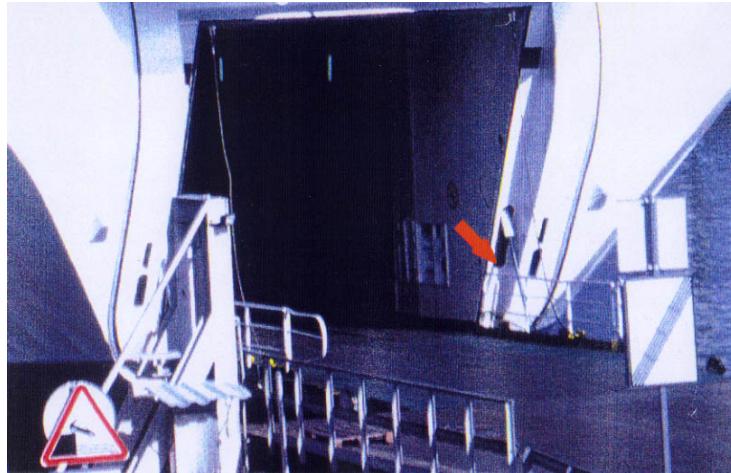
AS: "We discussed the matter with the bow visor with the chief officer and also the damaged equipment, although small. Gunnar explained the damage to me and some form of mechanical damage which would indicate that something did not fit properly. It was also known to us that B.V. had been on board about one month before and we thus asked the chief officer whether B.V. had made any recommendations in respect of such equipment. He had absolutely no idea. We raised questions and discussed everything with our trainees, the fact that it was quite something for recommendations to have been written on board and that the chief officer knew absolutely nothing about them, and this in his capacity as the commanding officer."

AS: "The visor, yes. As we had discussed before, we were practically dis-satisfied with it, as we did say to the chief officer. We had the impression that there was a lack of respect for load line matters. We had an argument with him and he was very open and he accepted all of this. It is, of course, with the result known, I mean it is in hindsight very easy to think a particular way."

GZ: "You asked whether there was ramp and visor. I looked at the ramp just visually and I could not see any damage. This goes automatically, the eyes look round and round."

**Note:**

The picture following this demonstrates the conditions that the Swedish inspectors and their trainees found on the open bow ramp. The arrow points to the location where at that time an angle iron was fitted.



GZ: "I did not look at particular scuppers, do you mean whether they were open or closed?"

ON: "How did they look, full with rubble, debris or ?"

GZ: "No, no, this was actually not so."

ÅS: "On the car deck I went along with the chief officer and stirred up load line matters. There were also hatches open which absolutely never had been closed. They were closing them thereafter; however, without understanding why it had to be done, in case water would come up and the consequences. Before the background of what has happened it is, of course, natural that also Gunnar and I connect certain things together. But it is a fact that we had formulated exactly: 'We have seen a lack of respect for load line matters', and with this we were practically very dissatisfied."

SA: "Did you make a complete round of the car deck?"

ÅS: "We just looked at the fore part."

SA: "It is possible that the hatch remained open thereafter?"

ÅS: "Yes, we do not know whether it is true if you say that she went down that extremely fast, then she must have been water filled. Normally she would settle on one side, there is always air ..... which are closed? Yes, but this cannot come in that extremely fast, not into the whole vessel."

To Spiegel TV:

AS: "Then we noticed this defect on the rubber packings of the bow door, the outer bow door. You have a 'bowvisier' as we say in Sweden. It is a bow door, it is more or less for cosmetics. It is normally not watertight, it is weathertight. There are rubber packings. Inside you have a watertight bow door. Here. What we found were some defects on port side and starboard side on the packings, not on the steel construction itself. Just on the packings some defects and there should be no defects, so we informed chief officer."

#### Note:

The expressions "weathertight" and "watertight" in relation to the visor need to be explained and the exact definition of these terms according to SOLAS is as follows:

**The definition for "weathertight"** according to SOLAS, Chapter II-1, Regulation 2, paragraph 11 is:

»Weathertight means that in any sea conditions water will not penetrate into the ship.«

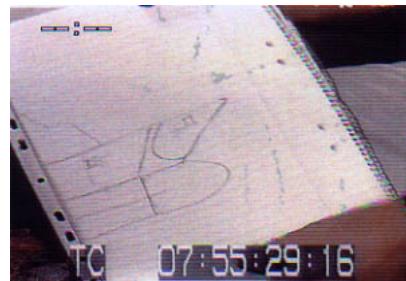
**The definition for "watertight"** according to SOLAS, Chapter II-1, Regulation 18 is:

»Construction and initial tests of watertight doors, side cuttles, etc., in passenger ships and cargo ships.

2 In passenger ships and cargo ships each watertight door shall be tested by water pressure to a head up to the bulkhead deck or freeboard deck respectively. The test shall be made before the ship is put into service, either before or after the door is fitted.«

The picture behind this page shows the car deck opening with the open bow ramp. The arrow points to the position from where Sjöblom/Zahlée looked over the rail of the bow ramp. It is quite obvious that they could not see much of the rubber packing.

Ake Sjöblom made the following drawing and points to the area which is indicated by the arrow meaning both port and starboard side.



#### Note:

It should be noted that Åke Sjöblom has placed the bow ramp, which is the **upper extension of the collision bulkhead on top of the collision bulkhead** which was not the case on ESTONIA and also not on DIANA II, the near-sister, for which he had then been responsible for about 2 years already with his Malmö inspection office of Sjöfartsverket as the National Maritime Administration.

Arne Valgma stated in this respect only:  
**»Note 1284 'Bow door':**

*Under 99 reference is made to the rubber seals of the bow door which were found ripped/scored up to 30 cm, with a depth of 2-3 mm, which could have been caused by mechanical contact. As this was not considered to be a remarkable damage, a notation was made and attached to the code 99, which means that repairs can be carried out subsequently.*

**Note 1250: 'Covers on bulkhead deck to be closed.' 17.**

*This refers to 2 hatches on the car deck aft part which should be closed, which was also done in our presence.«*

#### (5) Stability calculations

AS: "I do not know all the findings by memory, but we had a dispute. Yes, this with the stability. We asked the chief officer, who carries out the stability calculation before sailing, and he said: 'The 2nd officer.' We never met the 2nd officer, I waited, but he must have been busy somewhere else. We also did not meet him later on. However, as mentioned before, we were somewhat concerned."

Arne Valgma did not comment on this important subject at all.

#### (6) Cargo securing devices

To Spiegel TV:

AS: "We found some cargo securing devices with defects. This is a device you use to secure lorries, cars, trucks, containers, anything. Normally you take this type of damaged device away so that you don't use them by accident, because they will not work and we asked the chief officer if they used them? His answer was: If necessary. OK, this might mean that they have them as spare parts, as extras. We don't know. It is the captain's responsibility anyway not to use damaged cargo securing devices. It is absolutely forbidden, so."

To the JAIC:

- "Defect span lashings and lashing arrangements were noted as well."
- "You will, of course, never use them? They should go ashore. He replied: 'If necessary', which means in principle that they were keeping them as spares."

Arne Valgma stated in this respect:

**»Note 1199: 'Cargo securing devices' 99.**  
*Refers to securing devices on 'car deck' (about 2-3) which were no more to be used. Could be done subsequently.«*

#### (7) The chief officer and the crew in general

No comments to Spiegel TV and no comments by Arne Valgma.

To the JAIC:

BS: "The chief officer, how was his attitude when he was unable to submit these documents?"

AS: "Yes, he was stressed. We demanded possibly too much. What disturbed him most, I believe, was that we had detailed remarks on the B.V. certificates, this appeared to him to be very irritating. He thought that it was extremely embarrassing that they did not have an exemption certificate for the liferafts."  
 - "There were also no indications that a .... should occur. **The damage to the packings of the visor are of absolutely no importance, more maybe dropping leakage, it is in principle just weathertightness that one focuses on and there is always water inside the visor, on all vessels, there is nothing abnormal with this.** But, of course, we have in hindsight no foundation for that. **This was also the lack of respect for load line matters, not just those but moreover a lack of understanding.** We have discussed quite a lot with the chief officer."

BS: "In what way did the lack of understanding become obvious?"

AS: "It actually began with the mimic panel. One would assume that the chief officer of a vessel with direct responsibility for ... (tape apparently switched off). If there is uncertainty one has to .... and small pieces of rags are fitted to .... When we point out this lack of respect we mean this hatch on the freeboard deck which was open, at least one of them then closed this hatch by using force."

OF: "Don't you have comments about the crew, the master? Just between us, how did it function? Do you know anything about this? The question which always comes up, Russian culture and a very authoritarian system, the master more or less a Godfather, etc., do you know anything about this? Can you comment on this?"

GZ: "Actually not, at least I cannot."

AS: "No, also not me. We formulated in each case, so was at least assured that we had drawn attention to it and left it with the commanding officer. **We had the impression that the endeavours on board in this respect remained limited.**"

BS: "This means safety culture or what?"

AS: "Oh, yes."

OF: "But this means also that had it been a normal PSC, you would have put more pressure on them to submit the really important documents, is that so?"

AS: "No, that I do believe. As they looked they had presumably real problems with the certificates."

#### (8) The indicators lights

To Spiegel TV:

AS: "A lot of locking devices on both these doors with indication up in the wheel-house and this indication was in full operation when we were on board. It was red light because it was, yes, it was open because they were taking garbage out, dirty linen, clean linen in, so this was before loading."

He did not mention this to JAIC, at least it is not on the tape or in the transcript. Arne Valgma mentioned nothing in this respect.

#### (9) Interview by public prosecutor Tomas Lindstrand

Ake Sjöblom was interviewed in February 1998, after the prosecutor had been in Papenburg, and stated the following:

- it had just been for training purposes, thus no valid PSC;
  - visor and bow ramp were open;
  - it had been a limited inspection during which only certain damage to the rubber packings of the visor in the "corners of the mouth" were noted;
  - it looked as if the visor did not fit correctly anymore;
  - perhaps it could be compared with a misaligned car door which was hanging down somewhat but could still be closed and locked properly;
  - it is likely that during opening and closing there might have been a squeaking sound, this, however, is no reason to question in hindsight the functioning of the visor and locking devices.
- To the question: "Did you try to stop the vessel from leaving Tallinn?", he replied: "I have never said that I had tried to stop the vessel. I had no chance to stop it since it was an exercise and not a Port State Control."

In summary of the aforementioned it has to be concluded that two top inspectors from the Swedish Sjöfartsverket and nine (or ten) of the highest ranking government civil servants from Estonian Ship Safety had inspected the ESTONIA during the afternoon before her last departure from Tallinn for ca. 4-6 hours. They were accompanied by her chief officer and her chief engineer when they made the relevant observations which they have commented as follows:

(a) The documentation was not to their satisfaction because:

- the safety plan and muster list were not according to regulation;
- the chief officer could not show them the damage control plan nor could he show the cargo securing manual;
- the chief officer could not submit the stability booklet and did not know where to search for it;
- also he could not submit the approved stability manual;
- the chief officer was unable to read a damage control plan;
- bridge instructions were not available on the bridge;
- vessel's characteristics in case of damage could not be viewed.
- the exemption certificate for liferafts was missing.

In summary they concluded that the chief officer, who was the acting commanding officer since the master was ashore, could not show them any of the relevant documents/certificates and did not give them an explanation for this.

(b) The mimic panel on the bridge:

- the chief officer did not really know which light meant open and which meant closed.
- he was of the opinion that the green light meant "closed", although actually it meant "open".

(c) The watertight doors and the fire doors:

- there was a problem in way of the galley where they had completely sabotaged the fire protection;
- in the area of the boiler room nothing fitted at all.

(d) Lack of respect for load line matters was noted on the car deck and in way of bow ramp/visor:

- hatch covers were found open which should have been mandatorily closed, but had been open for the last one or two years (in two or three places).
- there was big damage to the rubber packings of the visor in the "corners of the mouth", it was clear mechanical wear, about 0,5 m each side, it can never have been tight the way it looked.
- there was also some form of mechanical damage (to the visor) which indicated that something did not fit properly.
- it looked as if the visor did not fit anymore correctly, perhaps it could be compared to a misaligned car door which was hanging down some-what, but still could be closed and locked properly.
- they knew that B.V. had written recommendations about one month before, but the chief officer knew absolutely nothing about them and he was the commanding officer.
- they were particularly dissatisfied with the visor and said so to the chief officer, they had the impression that there was a lack of respect for load line matters.

**Note:** The written recommendations by B.V. issued about one month before, i.e. probably on 25.08.94, are unknown and are neither mentioned in the Final Report of the JAIC nor are they part of the available documentation.

(e) Stability calculations:

- they asked the chief officer: "Who carries out the stability calculations before departure?", and he replied: "The 2nd officer." They waited for him but he never showed up, which concerned them.

(f) Cargo securing devices:

- they found some cargo securing devices defect and asked the chief officer whether he would ever use them and he replied: "If necessary."

(g) The chief officer and the crew in general:

- they formulated their findings in each case so it was at least assured that they had drawn attention to it and left it with the commanding officer. They had the impression, however, that the endeavours on board in this respect remained limited.

The Sjöfartsverket inspectors finalised their comments by stating that:

*»Before the background of what has happened, it is, of course, natural that also we make a connection of certain things. But it is a fact that we had formulated exactly: "We have seen a lack of respect for load line matters", and with this we were particularly very dissatisfied.«*

In a subsequent phone call Ake Sjöblom told Bengt Schager, the psychological expert of the Swedish Commission, that the crew on board the ESTONIA was the worst he had ever met in his long years of experience. On the other hand, Ake Sjöblom does not create the impression that he has a bad conscience or feels guilty, which is obviously due to the fact that he had tried whatever was in his powers to stop the ferry from departing which, however, was in vain. Contrary to Arne Valgma, who could have stopped the ferry, Ake Sjöblom indeed could have done no more.

In summary it has to be concluded here, that it is quite obvious that the Sjöfartsverket's inspectors had found the ESTONIA to be unseaworthy in several respects and consequently had done their utmost to avoid her departure which, however, had been in vain since they did not have the authority to enforce this, although they should have according to the treaty and the BITS agreement. See page 355. After the casualty up to day everything has been done to keep this matter, with the consent and assistance of the JAIC, unexplained. It is for this reason that the Swedish side and, in particular, Ake Sjöblom have emphasised time and again that the inspection was not a proper PSC but just on-the-job training, while the Estonian side, up to Minister level, still stresses that it was a valid PSC and that the vessel had been found to be seaworthy otherwise she would not have been permitted to sail.

**THE CONDITION OF "ESTONIA" AND THE STATUS OF HER MAIN CLASS AND SAFETY CERTIFICATES BEFORE COMMENCEMENT OF HER LAST VOYAGE**

### 16.1 The Certificates

The vessel participated in the "Continuous Class Survey System" for Hull and Machinery (CSH/CSM) of Bureau Veritas and was inspected in regular intervals.

The 3rd period of class for hull and machinery was running from 3 July 1990. Therefore, the next due date for completion of this Class Renewal III would have been 15 July 1995. The last drydocking was in Turku/Finland in January 1994, when inter alia the periodical bottom survey was carried out and the stabilisers were installed as per Hull Survey Report STK/94/3 A - see Enclosure 16.1.205. The last annual survey was carried out from 23rd to 25th August 1994 while the ferry was in service. No remarks about deficiencies affecting the class were noted in any of the reports by the attending surveyor Anders Wirstam - see Enclosure 16.1.206 - Survey Statements STK/94/77A-F dated 25.08.94 - see also the previous Chapter 15.

As part of this survey the following items were checked and apparently found to be to the surveyor's satisfaction:

- The hull and its closing appliances, as far as can be seen;
- The anchoring and mooring equipment, as far as practicable;
- All watertight doors in watertight bulkheads including testing locally and remote, as far as practicable;
- The watertight bulkhead penetrations, as far as practicable.

Since the ferry had been taken over by her new owners, Estline AB - c/o Nordström & Thulin, Stockholm - in January 1993, Bureau Veritas was also authorised by the Government of Estonia to issue Safety Certificates pursuant to the following conventions (specified abbreviated):

LOAD LINE 1966  
SOLAS 1974  
MARPOL 1973  
TONNAGE 1969

Thus B.V. issued also the following certificates on behalf of the Estonian National Maritime Administration allegedly after having performed the respective surveys according to the "Survey Report for Issue of PSSC" dated 27.01.94 - attached as Enclosure 16.1.207.

Passenger Ship Safety Certificate	issued	Stockholm	27.01.94
Interim- <u>Enclosure 16.1.208</u>	valid until		27.06.94
Passenger Ship Safety Certificate	issued	Copenhagen	23.06.94
- <u>Enclosure 16.1.209</u>	valid until		26.01.95

**Note:** Although it should have been issued "Interim" it is a normal unlimited/unrestricted Certificate issued by the Copenhagen office of B.V. and a completely different form from the one used by the Stockholm office before.

International Load Line Certificate	issued	Stockholm	11.04.94
Interim - <u>Enclosure 16.1.210</u>	valid until		11.09.94

**Note:** According to the Report of the JAIC a new "Interim" Certificate had been issued by B.V. on 09.09.94 which, however, is not available and apparently was also not available to N&T in October/November 1994, because it is not mentioned in the letter of S.C. Forsberg to the criminal police dated 01.11.94 - see Enclosure 5.2.110.

International Oil Pollution Prevention	issued	Stockholm	15.03.93
Certificate	valid until		15.07.95

#### Conclusion

From the available certificates it has to be concluded that

- the hull certificates were valid and in order;
- the PSSC was falsely issued;
- the available LOAD LINE (L.L.) CERTIFICATE was interim and had expired on 11.09.94.

**Note:** The reasons for the L.L. Certificate having been issued "interim" only were

- (a) the "temporary" stability booklet which was not approved by B.V. (on behalf of the Estonian Board of Navigation);
- (b) the too small cross-flooding valve between the heeling tanks.

The reason why the PSSC was issued wrongly was the fact that the vessel did not comply with the requirements of SOLAS 1974 for the "intended trade", i.e. proceeded more than 20 nm from the nearest land, as stated annually in the "Survey Report for the Issue for PSSC - Clause 1 - General Information" and, thus, the bow ramp plus front bulkheads, as upper extension of the collision bulkhead above bulkhead deck = car deck, were ca. 5.8 m too much forward (see Subchapter 2.4.4 above).

The last issued L.L. Certificate had already expired on 11.09.94 and apparently a further interim one had not been issued by B.V. for reasons unknown to this 'Group of Experts'. In any event, according to the certificates issued after the surveys carried out between the 23-25 August 1994 by Anders Wirstam, the Load Line Survey was apparently carried out and Annex A - to Report No. STK/94/77E - see Enclosure 16.1.206 - was filled out although, as it looks, no new Interim L.L. Certificate had been issued by the time of the casualty.

This was, at least, the situation in October/November 1994, since it has to be assumed that N&T would have submitted the L.L. Certificate valid at the time of sinking, had they had it. However, when the Final Report of the Joint Accident Investigation Commission was published, it was most surprising to note that they stated on page 46, item 3.6.2 that there had been a valid L.L. Certificate issued on 9 September 1994. In any event, also this certificate was issued falsely because visor and bow ramp had been leaking for many months before the casualty.

Based on the status of the class and safety certificates only, it could be assumed that the vessel ESTONIA was in an acceptable condition when she departed from Tallinn on 27 September 1994. This, however, was definitely not the case as will be demonstrated in the following subchapters.

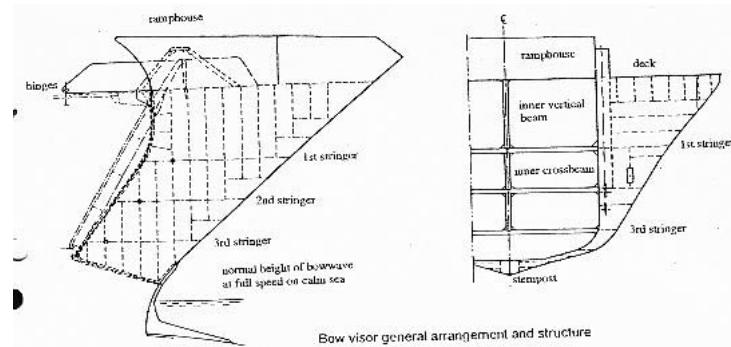
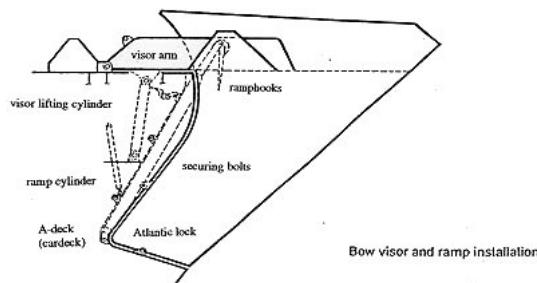
## 16.2 Condition of the Bow Area

Based on the information contained in the previous chapters 3.5 and 12 regarding the vessel's performance until 27 September 1994, in particular the various observations of passengers, crew members and other persons on or from the car deck or other decks of the ferry, it has to be concluded that

- (1) the visor, its locking devices (hinges) and rubber packings;
- (2) the bow ramp, its locking devices, hinges and rubber packings had been in a very bad condition respectively were non-existent when the ferry commenced her last voyage on the evening of 27 September 1994.

This conclusion is in direct contradiction to the statements made by Bureau Veritas in the many certificates issued by them in respect of all the safety relevant parts of the vessel and it is indeed the question on what basis these certificates have been issued.

Before the observed deficiencies shall be explained in detail the relevant parts of the foreship, which played a crucial role in the casualty sequence-of-events, shall be shown below and on the following page again for easy reference.



In addition, these deficiencies are shown on a drawing of the foreship with open visor which is integrated into this report and forms the following page.



## In detail:

(1) The visor, its hinges, locking devices and rubber packings:

## In detail:

The problems with the visor were initiated by two different circumstances, viz.

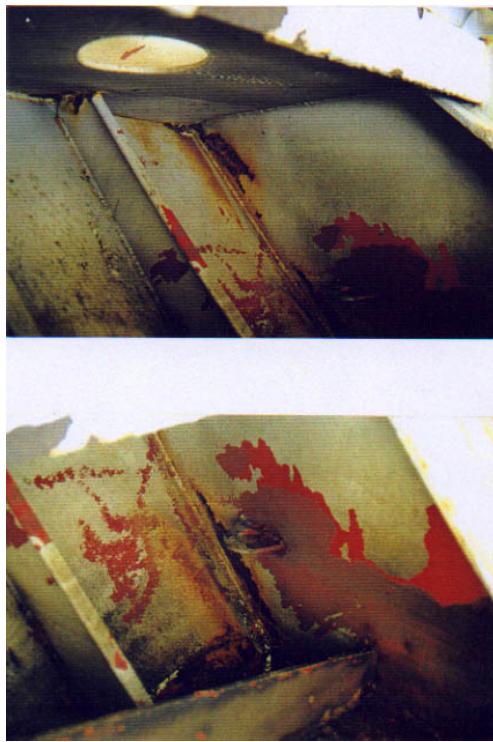
- severe structural damage caused by proceeding through heavy ice at excessive speed.
- the decision of the Technical Managers, N&T, not to renew the rubber packings, assuring weather(water-)tightness of the visor and preventing the visor from vibrating and thereby avoiding cracks emanating therefrom.

**Structural damage:**

The shell plating as well as the internals are very severely damaged in two places, viz. there is a deep vertical indentation in the bow leading upwards from the stempost for about 2 m, as can be seen on the picture below from the outside,

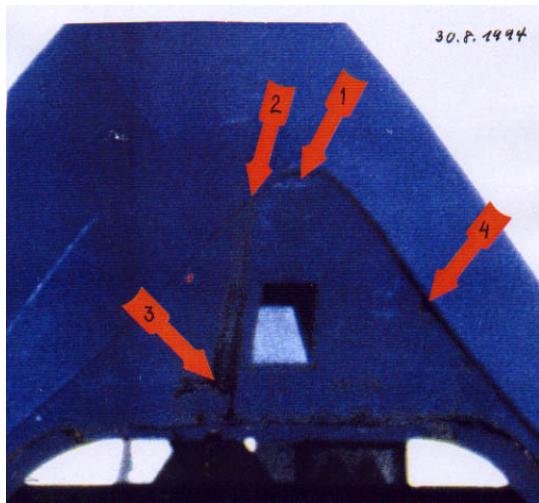


The arrow points to the deep indentation which is completely painted and the paint does not show contact marks. The following photos showing the inside of the same area do confirm the deep indentation in a very strong part of the visor to be of old origin.



Furthermore, the shell plating as well as the 3rd stringer at the port side are severely indented and set up with the frames buckled which had been sustained already some time before the casualty. - See the pictures above.

The condition of the visor bottom with stempost is evident from the picture below taken on 30.08.94.



**Arrow 1** - Indentation in the foremost part of the visor bottom indicating that the visor's initial position was changed to forward most probably due to misalignment of the whole structure. This led to contact between the visor bottom and the stempost on the forepeak deck. Since the visor bottom in this area is not constructed to take up load, the bottom became indented and cracked.

**Arrow 2** - Indicates a cracked welding seam through which water penetrated and created the rust stripes.

**Arrow 3** - Indicates transverse cracks in the visor bottom in way of the contact area with the starboard steel pad welded to the forepeak deck and which should take up about 10% of the visor's weight in closed condition. Since the corresponding port side is not affected at all, it has to be assumed that the starboard side absorbs all the weight which is another indication for the complete misalignment of the visor.

**Arrow 4** - Indicates a further probably cracked area.

In summary of the above it has to be concluded that the visor was completely misaligned in longitudinal, transverse and vertical direction which led to considerable problems during opening and closing. These problems increased all the more as time went by as confirmed by the many observations, e.g. of previous passengers, in particular the truck drivers having spent hours on the car deck waiting for the crew to be able to open the visor (see Subchapter 12.4.3 above).

The difficulties with the visor are also confirmed by previous crew members and pilots having observed the frequent opening and violent closing until the locating horn on the forepeak deck (pyramid) finally fitted into the mating pocket in the visor bottom (see Subchapter 12.4.3 above).

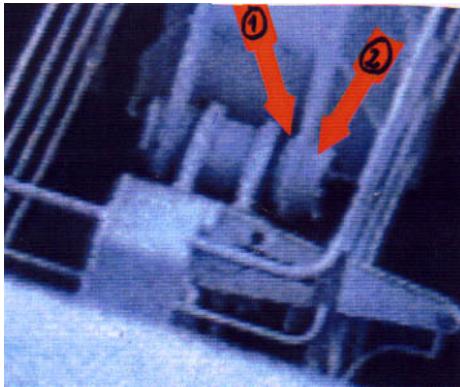
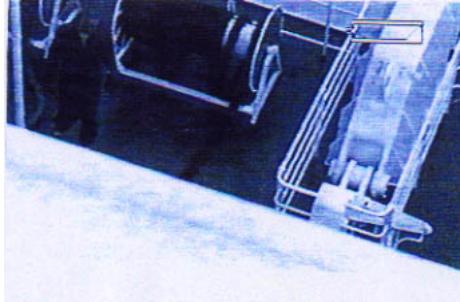
**Consequences of the misaligned visor**

Due to the increasing misalignment it was at first difficult to close the locking devices and subsequently to open them.

Reportedly it had not been possible to open and close the **Atlantic lock** hydraulically for several months prior to the casualty and the crew members had to go inside the visor before arrival and after departure from Tallinn and hammer open respectively closed the bolt of the Atlantic lock which, among other things affected the load-carrying capacity of the lugs. Also the **hydraulic side locks** were difficult to close and subsequently to open. Reportedly on many occasions after arrival in Tallinn the lugs had to be cut off the visor by flame-cutting to be able to open the visor. Subsequently the lugs were rewelded to the visor bulkheads which continuously reduced the load-carrying capacity of these lugs (see Subchapter 12.4.3, and Chapter 30).

Obviously also the **visor hinges** had become affected because on 17 September 1994, i.e. 10 days before the last departure, a passenger filmed the visor and, in particular, the starboard visor hinges in Tallinn during the closing procedure.

The passenger was standing in front of deck 7 and filmed the closing of the visor, finally zooming in on the starboard hinges. The video-prints below are part of the film. Picture 2 is an enlargement of Picture 1.



On Picture 2 there are obviously several major deficiencies visible, viz.

- (a) the gap between the starboard vessel hinge plate and the outer bushing is much too large (arrow 1).
- (b) the outer bushing is sticking much too far out of the outer visor hinge plate (arrow 2) [which explains the large gap mentioned above].
- (c) the lower part of outer bushing is missing.
- (d) the securing plate is missing and the outer end of the bolt is not visible.
- (e) the outer bushing appears to be twisted anti-clockwise.
- (f) the inner bushing appears to be twisted clockwise.

See also Subchapters 12.4.3, 12.5 and Chapter 30.

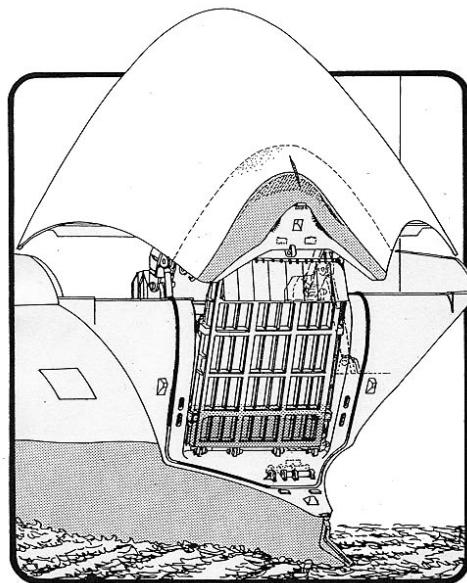
All this indicates that the steel- and bronze-bushings of the starboard visor hinge arrangement had been replaced some time ago in a very unprofessional way with an extremely poor standard of workmanship.

Also the member of a working team, the nautical student Rain Oolmets, who stayed on board from 15 July to 11 September 1994, had discovered cracks in the welding seams up to 10 cm long between the steel bushings and the visor hinge plates of the port and starboard visor hinge arrangements which underlines the generally poor condition of these safety relevant components. See Subchapter 12.5.

It is obvious from the above description of the visible deficiencies that the **condition of the visor hinges rendered the vessel already initially unseaworthy**.

**Consequences of missing rubber packings**

The last Finnish crew had requested the renewal of 15 m of rubber packing in way of the visor for the then planned yard time in January 1993, because the rubber packing had last been renewed in January 1991. This meant a renewal of the entire packing on the forepeak deck plus about 2 m up each front bulkhead as demonstrated by the following drawing.



Since the new technical managers N&T were of the opinion that visors are full of water at sea anyway, the rubber packings were not renewed in January 1993 and also not later. This means that the visor became quickly filled up with water at sea up to the height of the outside water level. In calm sea it was the height of the bow wave which filled the visor up to the 3rd stringer, however, the worse the weather was and the deeper the bow was diving into the waves, the higher the water rose inside the visor.

The following picture shows the ESTONIA in Tallinn, with open visor but closed bow ramp so that the otherwise invisible underside of the bow ramp is shown with the lowest section being dark - see arrow. Doubtless this was caused by the water inside the visor with hydraulic oil from the leaking cylinders swimming on top of the water surface. When the vessel reduced speed and the bow wave became smaller and finally disappeared completely when the vessel was alongside, the water streamed out of the visor and the oil settled everywhere inside the visor, also on the bow ramp which forms the aft inside of the visor.

The water streaming out of the visor was observed by many passengers when the vessel was alongside in Stockholm with closed visor and, among others, also by the skipper of the Sandhamn pilot boat as well as by several pilots when the ferry was slowing down during the approach to the pilot boat.



The bow wave became smaller and the water streamed at once out of the visor. (See Subchapter 12.4.4.)

It is obvious that at sea inside the visor the conditions in a partly filled ballast water tank did exist with resultant sloshing effects causing additional loads on hinges and locking devices and vibrations to the whole visor, the consequences of which are described in Subchapter 34.3.

#### (2) The bow ramp, its locking devices, hinges and rubber packings:

The **bow ramp** was part of the upper extension of the collision bulkhead above bulkhead deck and as such had to be mandatorily watertight based on the stringent requirements of SOLAS 1974. This, however, was obviously not the case because back to December 1993 there is reliable evidence that frequently there had been a lot of water on the car deck - see Subchapter 12.4.4. There is also a lot of evidence that the bow ramp was severely misaligned and - in fact - was no more connected to the port outer and probably also inner hinges for some time - see Subchapter 12.4.3. It has thus to be assumed that the water penetrated onto the car deck from the visor, which was filled up to the outside water level, as soon as the vessel was on full speed and the bow wave had risen to ca. 2.5 m height. Since even in calm sea the visor was filled above the level of the 3rd stringer, which is above the car deck level, it is apparent that even in good weather conditions water was streaming onto the car deck. Most of it was most probably absorbed by the 12 scuppers at each side, some of which, however, were reportedly always blocked by stones and other debris.

**Consequently it has to be assumed that there was already a deadly connection between the always water-filled and -refilled visor and the large, open car deck via the open port lower edge of the bow ramp since some time before the last departure.**

The **locking devices of the bow ramp** were difficult to lock and, once locked, even more difficult to unlock. There is lots of evidence from truck drivers and other passengers having waited for hours on the car deck watching the fruitless attempts to open respectively close the securing bolts hydraulically and, finally, watching them being opened by flame cutting of the upper parts of the mating boxes, which should have been subsequently rewelded but frequently were not. When the crew did not succeed in closing the bolts hydraulically, they tried it by hammering, even by using sledge-hammers and very often gave up, i.e. the ramp remained - at least partly - unsecured! (See Subchapters 12.4.3 / 12.4.5.)

All this led, of course, in time to a considerable reduction of the load-carrying capacity similar as with the hydraulic side locks of the visor. Also the **hinges of the bow ramp** were severely affected, in particular the **port outer hinge**. This very heavy hinge arrangement was already damaged before the vessel was taken over by her new owners in January 1993, because the old Finnish crew had already requested renewal at the planned yard time in January 1993 - see Subchapter 6.5.1. Nothing was done by N&T and since the mates of the ESTONIA performed the loading and discharging of the cars and trucks reportedly rather carelessly, the vessel very often had a list during loading or unloading which finally broke the port hinge completely according to the report of a truck driver being an eye witness.

The crew had severe problems to lift up the ramp at all which was only possible after some temporary measurements had been carried out. Ever since, the misalignment of the ramp increased visibly and the problems were growing daily.

Also the **rubber packings** around the car deck opening, which should be sealed tight by a properly closed and locked bow ramp, apparently did no more seal watertight since

some considerable time already, because the last Finnish crew had ordered **10 m of rubber packing to be renewed** at the next yard time which was planned for January 1993 - see Subchapter 3.4. - as mentioned before. This was more than half of the total length of the rubber packings, but also these packings were never renewed.



## CHAPTER 17

### THE LOADING AND SECURING OF THE CARGO

#### 17.1 The Loading

The loading commenced at about 17.00 hours and was supervised by the 2nd mate Tormi Ainsalu assisted by some of the deckhands, such as Valdur Matt, Arne Koppel, Aulis Lee and others. Subsequently also the trainee mate Einar Kukk attended.

According to the surviving crew members having worked on the car deck, the hanging decks had not been in use and the car deck had been full with trucks and cars. Directly in front of the centre casing there had been 2 garbage containers standing one in back of the other towards the bow ramp.

The available cargo documentation consists of the **cargo manifest** which was received from the Joint Accident Investigation Commission in the early days of the investigation and was said to reflect the description and numbers of trucks/trailers actually loaded, see Enclosure 17.1.211. Only recently the **freight manifest** - Enclosure 17.1.212 - and the **customs list** - Enclosure 17.1.213 - were received.

Both the cargo manifest and the freight manifest initially contained 38 trucks - although in the consecutive numbering a 39th and 40th truck had been included, of which the 39th was added in handwriting on both manifests. The recently received customs list however reveals that there were actually 40 trucks and trailers loaded.

According to the customs list the 40th truck, missing on the cargo manifest although the consecutive number on the manifest - 43 744 - had been left open, was a Scania truck with the registration no. AG 565 and with the Latvian driver Gunnar Gobins (()). Since the customs list does not state dimensions, weight or type of cargo, no more details are known. The 39th truck added to the cargo manifest in handwriting under the consecutive no. 43 749 was also a Scania truck with the registration no. NRY 806 and with the Swedish driver Leo Sillanpää (()). In the freight manifest - Enclosure 17.1.212 - which is the cargo manifest with added freight figures, both trucks are missing although the consecutive numbers 43 744 and 43 749 were left open. It is unknown whether this means that these trucks were carried free of charge and whether this could mean that these are the two trucks escorted into the port and on board by military personnel. (See Subchapter 17.3.)

**Note:** According to information received from a prisoner in the jail of Vaasa/ Finland (after the Luttunen interview) his friend Leo Sillanpää was the driver of a truck which had plutonium hidden between the regular cargo.

It is also evident from the customs list that the truck or trailer no. 46 with the number plate 417 EEE had no driver registered. It is thus possible that this was the truck or trailer which had been shipped on board the ESTONIA on the basis of incorrect documents and which contained between 148 and 174 Iraqi Kurds according to information from the files of the public prosecutor Tomas Lindstrand, Stockholm.

According to the statement of an Estonian lawyer, someone from Estline, Stockholm flew to Tallinn by the first plane on the morning of the catastrophe, collected all the cargo and passenger documentation available and flew back by next plane to Stockholm, whereafter the cargo manifest was made up. According to other sources the Estonian Security Police collected already in the early morning hours of the 28th the complete cargo documentation from the Estline office in Tallinn.

The responsible customs chief of Frihamn Terminal, Stockholm told Spiegel TV that they had always received the cargo manifest on the evening of the departure by fax, which, however, had not been the case on the evening of 27 September 1994. Even after several reminders they received the cargo manifest only in the afternoon of 28 September 1994 from Estline, Stockholm.

On the other hand, there is another 'cargo manifest' available, which, according to the print-out at the top of the pages, had already been sent at 18.38 hours on 27 September 1994, i.e. more than 30 minutes before the departure of ESTONIA, from Estline, Tallinn to presumably Estline, Stockholm. In any event, on 29 November 1994 it was sent by N&T to Industrietechnik, which was the old firm of Börje Stenström, where he worked until his retirement in April 1995, and from whom a member of this 'Group of Experts' received it in March 1995.

Although the contents appear to be identical on both 'cargo manifests' which were made up by the same E. Kurvits, the handwriting at the end of page 4 is different. This 'cargo manifest' is attached as Enclosure 17.1.214.

Consequently there were doubts from the beginning as to whether the submitted 'cargo manifest' actually reflects all the trucks/trailers having been on board and these doubts have now been confirmed by the customs list hidden for so long, as explained on the previous page. In fact, this list was sent already on 14 October 1994 by fax from the Finnish Embassy, Tallinn, to the head office of the criminal police, Helsinki.

The combined weight of all trucks/trailers was 970 ts according to the cargo manifest - Enclosure 17.1.211 - and the JAIC states the total truck/trailer-weight to have been 1000 t, therefore it has to be assumed that the weight of the 40th truck was 30 t.

On the basis of these weights a stowage plan has been made up always bearing in mind that as much weight as possible had to be placed on the starboard side. The stowage plan is attached as Enclosure 17.1.215 and reveals that it was impossible to place enough weight on the starboard side to create the alleged departure condition. There must have been about 200 tons of weight more at the starboard side elsewhere in the ferry.

This is confirmed by the calculations of Shipconsulting Oy, Turku - see Enclosure 17.1.194 - according to which there must have been about 200 tons more weight at the starboard side. Such a weight distribution would have created a 10° starboard list without the full port - and the empty starboard heeling tanks, which allegedly reduced the list to 1° starboard.

According to survivors trucks and trailers had been more or less equally distributed between the port and the starboard sides of the car deck, thus, a wrong loading of the car deck cannot have been the reason for the excess weight at the starboard side. Consequently it has to be assumed that there has been water in tanks and/or void spaces at the starboard side which was unpumpable. The reason could be that these spaces were holed and thus connected to the outside and therefore could not be pumped empty at all, e.g. the starboard heeling tank.

An indication for such reason could be the image from the "Mudline video", shown below which was made during the diving investigation between 1 and 4 December 1994 - See Chapter 27. The image evidently shows a big hole in way of the starboard hull -bottom plating area probably in way of the bilge strake. The enhancement of this part of the video tape by means of special equipment confirmed that the plating was indeed holed. - See Subchapter 34.6.



Those who know about this issue remain silent and so does the JAIC although they had the right and obligation to ask the relevant questions.

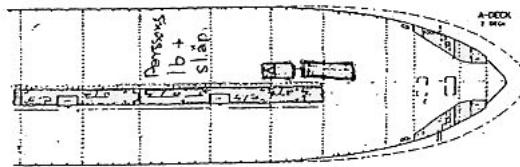
The responsible director of the technical managers and part-owners N&T, Sten-Christer Forsberg, replied when being interviewed by Erik Ridder-stolpe on 10.12.97 - Q: "The vessel was loaded totally wrong at Tallinn?" A: "The wrong loading is regrettable. It would, however, have happened to any other crew!"

This indicates that the "wrong loading" could have occurred independently of what the crew did or could have done, i.e. it has nothing to do with the loading of the car deck but was caused by circumstances beyond the control of the crew, e.g. the holed bottom plating.

## 17.2 Testimonies concerning Cargo Lashings

The evidence available in respect of the securing of trucks/trailers and other vehicles is naturally controversial. While the crew members testified to having secured all the trucks and trailers, though in different ways, this is confirmed by only very few of the truck drivers/personal car drivers. The majority of the drivers state that the trucks and trailers as well as the personal cars remained unsecured. The truth is probably somewhere in between, i.e. probably the trailers without own truck and the trucks loaded first were secured to the deck with belts, some additional trucks having wedges in front of and behind the wheels, and a certain number of trucks coming on board last as well as all vans and personal cars were not secured at all. This with certainty had also been the case with the truck and trailer of **Per-Arne Persson** according to his statement from which the following is quoted:

*»Has made at least 15 trips on "Estonia". The actual voyage was made with a Volvo truck, type F12, reg. no. MOW 996, with trailer no. AN 069. Persson left his truck with trailer on the car deck as per drawing below which is attached to his statement.*



*Accordingly the vehicles were placed next to the forward port side of the centre casing with the aft end of the trailers being only about 20 m away from the bow ramp. Truck and trailer were loaded with plywood. The trucks were not secured by any means, they were just standing there without any fastenings. Persson did not note any other routine than on the previous voyages. As the vehicles were again placed so close together that any securing was impossible, he shouted to the crew: "You will never secure the trucks."«*

The truck is entered into the 'cargo manifest' under running no. 43773, the weight of truck, trailer and plywood cargo was 55 ts, the distance to the bow ramp was only about 20 m and the truck was not secured because this was not possible due to the limited space between the trucks. The complete statement with drawing is attached as Enclosure 17.2.216.

In order to get a better picture, the respective parts of the statements from crew members and passengers having been on the car deck during and after the loading shall be quoted below:

**Einar Kukk - trainee officer** in his statement on 29.09.94 at Turku - Enclosure 17.2.217.

*- »I commenced this additional training on the "Estonia" on 27.09.94 at 16.20 hours when the loading of the trucks began. I myself was on the car deck until 18.45 hours. I remember that at that time all large trucks had already been taken over and just the personal cars had to be loaded. The loading of those cars was carried*

out by the 2nd mate. I can only recall his first name, Tormi, his surname is unknown to me. As far as I know, he was in charge of the loading.

As to the question whether the vehicles loaded were secured to the vessel I can reply: Each large truck was secured to the vessel. The personal cars, in my opinion, were not secured, however wedges had been placed in front of the wheels. I know nothing about a possible later securing. The question whether I was on the car deck until the last truck had been loaded I am unable to answer with certainty, because I left the deck some time before the loading had been completed.

As to the question how and in what sequence the loading was carried out I can reply: Loading in the port of Tallinn was performed via the bow ramp by at first taking on board the heavy trucks, which were placed in the stern part of the vessel and secured. Into the forepart of the vessel the smaller trucks and personal cars were loaded. Into the middle part there were also large and smaller trucks.

As far as I remember the car deck was full with cars.«

#### A.B. Aulis Lee at Tallinn on 29.09.94 - Enclosure 17.2.218.

- »During loading of the cars I was on the car deck. There were a lot of trucks/trailers. The vehicles were placed by the 2nd mate. It was our job to make sure that the trucks got their right place. All cars were secured to rings. Only trailers and large trucks were secured by belts to the deck.«

**Note:** This does not make much sense and has possibly been translated incorrectly.

#### Car deck worker (Lagerarbeiter) Valdur Matt at Tallinn on 29.09.94 - Enclosure 17.2.219.

- »I saw for myself and I was myself busy with fastening the trailers to the car deck. Each trailer was secured by four belts. I do not know exactly how many trailers there were on board on the car deck. Before the ferry's departure I had secured the trucks on the right side of the car deck. Passenger cars were not secured by wedges. The passenger cars had gears in shift and the hand-brake tight. Towards the bow there were two personal cars. The distance between the trucks is short, or narrow, not more than ten centimetres.

The placing of the trailers is very exact. On the right side the trucks are in 3 lanes. Trailers are placed in a row, one after the other along the yellow line. The personal cars stood in the forward part. There was no free space on the car deck. The personal car deck (hanging deck) was in its normal, common position. I want to point out that this time the trailers were in a line at the outer deck. In the third line there were trucks. I can guarantee that the visor was closed. The locks were closed by an hydraulic lock.«

Also a number of passengers, some of them truck drivers, have made valuable statements as to loading and securing, which shall be quoted in the following:

#### Truck driver Stephan Duijndam at Turku on 30.09.94 - Enclosure 17.2.220.

- »When I am now asked why I was on the "Estonia" I reply that I was on a working trip carrying fish and peat by truck from Estonia to Holland and Belgium. As already mentioned during the introductory hearing with the police, the truck was not secured at either side after we had driven on board in Tallinn. This is true and I remember that I therefore asked a crew member on the car deck, whose appearance I do not remember as I came rather late to the vessel and we were in a great hurry. I seem to remember that the man was wearing an orange boiler suit.

I remember that this man said repeatedly "nix problem" - "no problem" and did not give any other explanation. I remember that the vessel was almost full of cars and, at least, my truck and also the other trucks in the surroundings were not secured to the vessel.

I have been driving this route regularly every week between Holland - St. Petersburg - Holland - Estonia, and I remember that generally, when bad weather was expected, the trucks were secured to the vessel by chains. Now there were so many cars that it was apparently considered to be too difficult due to the tight positioning of the trucks to each other and time was also short when I came on board. Loading had apparently been carried out in a hurry.«

Cargo manifest no. 43763.

#### Truck driver Eckard Klug on 01.10.94 - Enclosure 17.2.221.

- »Klug had a truck with trailer. The car deck was locked during the voyage. It was quite narrow on the car deck during the voyage. The cars were stowed quite close together and the driver of each truck had to get out of his driver's cabin before the next truck was parked. Klug's truck was not secured. It had never been secured on any of the other voyages. Klug stated that he had been travelling on the ferry on this particular route ca. once a week for the last 11/2 years.«

1 truck Reg. no. DDG 182

1 trailer Reg. no. AZW 134

cargo: Textiles

Cargo manifest no. 43766

#### Passenger Tambet Herbert Lausma at Tallinn on 29.09.94 - Enclosure 17.2.222.

- »I was on board with the car M 2141 and 743 AEV. Before leaving the car deck I pulled the brakes tight and locked the doors. The car was not secured. The car was parked on the right side of the car deck looking forward. I did not check the car during the casualty.«

#### Truck driver Jaak Mullo at Tallinn on 29.09.94 - Enclosure 17.2.223.

- »I had on board a truck of type Ford without trailer. I did not note whether my car was secured or not. The cars stood so close together that there was no space anyway for securing. My vehicle was parked in the aft part of the vessel, almost against the stern ramp. Before me was just a parcel truck. During the casualty it was impossible to check how it stood with the car.«

Cargo manifest no. 43750.

#### Part-Statement of Mikael Öun - Enclosure 17.2.224.

a.) taken by criminal police Helsinki 29.09.94:

»I drove in my truck, which was a so-called 10-tonner, 9 m long, to the left side of the car deck looking forward. In Tallinn the cars are always driving on board from forward, my truck was placed as 2nd last car astern. Before me was a small delivery van. On the car deck there are 4 car lines and my car was placed in the 2nd line seen from the wall. Before I left the truck I pulled the hand-brake and locked the truck. Directly after departure I did some tax free shopping, whereafter I went back to the car deck and put my shopping into the truck. This must have been before 19.30 hours, because the doors to the car deck are locked half an hour after departure.«

#### b.) taken by criminal police Söderläjön on 04.10.94 - Enclosure 17.2.225.

Travelled together with Tamara Alep. They had brought donation goods to the Estonian Help Centre by the Scania truck, type P 93, reg. no. AEC 769, which was now empty. He reported that immediately after departure he had been down to his truck to find out whether it would be at all possible to get into it. After he had been down to the truck he went back up and into a shop to buy some things, which he subsequently took down to the truck. This took about half an hour after the vessel had left Tallinn. Mikael reported that he had been completely alone on the car deck, there had been nobody except himself. He does not remember whether the cars were secured. He believes to recall that he saw some wedges behind some wheels. Cargo manifest no. 43757.

#### Truck driver Indrek Pungar at Tallinn on 28.09.94 - Enclosure 17.2.226.

- »On board I had my truck, type Volvo with registration no. 125 TAU, 10 m long. It was not secured to the deck nor to the ceiling of the deck. I myself shifted in the gear and pulled tight the manual brake. A voice shouted alarm when the vessel was sinking and the people were already out.« Cargo manifest no. 43767.

#### Passenger Hannu Seppänen on 05.10.94 - Enclosure 17.2.227.

- »He drove his car on to the car deck and went straight to his cabin. He had already made about 30 trips on the "Estonia". While Seppänen was sitting in the Night Club he felt heavy shaking of the vessel. This shaking really made the vessel vibrate and although Seppänen was not uneasy that the vessel might sink, he nevertheless began to think about whether the trucks were really well secured. When he had parked his car on the car deck he saw that 2 trailers were fastened by 2 ropes. According to Seppänen this looked like a rather weak lashing. A lashing which could hardly hold if the trailers started to move. He did not observe any other securing arrangement. He had not been down to the car deck during the passage because the doors were locked.«

**Passenger Tony Spuhl on 06.10.94 - Enclosure 17.2.228.**

- »In the port of Tallinn Tony Spuhl drove on board with his Volvo 740, silver metallic, reg. no. CWD 853. The vessel was berthed in such a way that one could only drive in by the bow. He drove in to the port side, parked on the port side and had a truck parked beside his car. When he looked forward in driving direction it looked as if the vessel was full of trucks. Tony Spuhl stood with his car in driving direction towards aft. He noted that the truck which stood to the left of his car was not secured to the deck.«

**Truck driver Ainus Toobal at Tallinn on 29.09.94 - Enclosure 17.2.229.**

- »I had a Volvo 1613 on board. I drove on board in the middle of the left side, closed the truck door and went up. I did not see whether or not the truck was secured. I can say nothing about the cause of the casualty but that at the vessel's forepart, where the cars are driving in, water had started to flood in.«

**Truck driver Raivo Tönisson at Tallinn on 29.09.94 - Enclosure 17.2.230.**

- »The only one I knew on board was a distant relative with first name Jaak (ca. 30 years and chauffeur). On board I had my truck, Volvo SH 12, reg. no. 533 EEB. Cargo was milk powder. I left the car deck a quarter of an hour after the ferry's departure. Up until then the truck had not been secured apart from the hand-brake, which I pulled tight myself. At 20.00 hours the car deck was locked and consequently I could no longer go down to the truck. On the day before the casualty, when I came with the vessel from Sweden, my truck was not secured.« Cargo manifest no. 43775.

**Passenger Rein Vaaske at Tallinn on 29.09.94 - Enclosure 17.2.231.**

- »They drove on board from forward at ca. 18.40 hours. The car was registered under Ella Vaaske. It had the reg. no. ODT 471 and was a Toyota Helix Pick-up, 4-wheel drive, dark grey and a '89 model. It was Rein Vaaske who drove on board the ferry. Rein V. drove the car to the left side of the ferry, i.e. the starboard side. He said that the number of personal cars was not that large, instead there were a large number of trucks on the ferry. Rein V. said that he drove about 30 m inside, then it was full ahead of him. There appeared to be not so many trucks on the right side, i.e. port side of the ferry. R. Vaaske went down again to the car deck when the vessel had just begun to move away from Tallinn to pick up a cushion which he had left behind. At this time he noted that cars were also parked behind his car. He did not have a closer look whether the trucks were secured. He did not think about it. He did not see anybody securing cars when he drove on board.«

**Passenger Holger Wachtmeister on 01.10.94 - Enclosure 17.2.232.**

- »He had made 10 trips on "Estonia", always with his car. He had never seen that his car was secured nor had he ever seen that other cars or trucks were secured.«

In summary of the above quoted statements it has to be concluded that naturally the crew members having worked on the car deck do state that all trucks/trailers were secured, whilst Einar Kukk said, the personal cars had wedges in front of the wheels, Valdur Matt stated, passenger cars were not secured by wedges.

As to the passengers including truck drivers a total of 14 stated something about parking/securing their trucks/cars on the car deck, of which 10 testified that their trucks/cars were not secured and also that they had not seen any other secured or properly secured trucks/trailers/cars and 3 did not know or were unsure.

The conclusion of this 'Group of Experts' is that it has to be assumed that the trailers without own truck and the trucks loaded first were secured to the deck by belts, that some additional trucks had wedges in front of and behind the wheels, and that a certain number of trucks, which had come on board last, and all vans and personal cars were not secured at all. This refers also to the truck/trailer of Per-Arne Persson, 24 m long, 55 ts. weight and only 20 m behind the bow ramp, and to the heavy garbage containers stowed between the centre casing and the bow ramp and in the aft part.

There are rumours that Estline had informed the freight forwarders around noon of 27 September 1994 that bad weather had to be expected and that the cargo in/on the trucks had to be secured. It is, however, unknown whether any cargo in the trucks was secured at all. In any event, when the last car had rolled on board the car deck was practically full and the vessel reportedly had a 1° list to starboard.

This weighs particularly heavy since as of noon the south-west storm warning was known to those in command of ESTONIA, i.e. the storm would be hitting the ferry from port, which would increase the already existing starboard heel further. Under these circumstances it would have been not only a matter of good seamanship but a question of ship safety to plan the loading of the car deck in such a way that there was more weight at the port side to compensate for the heeling moment to be expected due to the wind pressure on the port side. See the statement of Captain Per Ringhagen - Enclosure 5.3.111.

This would have been of particular importance because the heeling tanks could not be used to adjust the heeling to be expected. The engineer on watch in the engine control room before and at the time of the casualty - Margus Treu - has consequently testified in his first statement on 29.09.94 at Turku, inter alia:

»The port heeling tank was full, but a starboard list of 1° remained. This was, in my opinion, one of the causes of the casualty, because later when the vessel was heeling to starboard there was no possibility to counteract.«

### 17.3 Other Information

According to information from Tallinn, about half an hour before the loading of the car deck was completed two big trucks were escorted on board by military personnel whereby the whole area around ESTONIA's berth was shut off by military forces. This was also the reason why passenger Carl Övberg almost missed the ferry, because his friend could not drive - as usual - to the terminal building to drop Carl off in time. He just made it and as soon as he was on board the gangway was pulled in - see the statement Carl Övberg - Enclosure 12.4.2.151. Names and ranks of the soldiers having escorted the two trucks on board are known to this 'Group of Experts'.

Reportedly the two trucks were loaded with sensitive military equipment of unknown origin which were sent by the Estonian Army directly to the Swedish military for on-transport to another Western country. The transport was accompanied by militaries of unknown nationality who were not identified as such on the passenger list respectively who were probably not even entered on the passenger list.

## CHAPTER 18

### WEATHER FORECAST / STORM WARNINGS

On 27 September 1994 the responsible government organisation in Estonia, the Estonian Meteorological and Hydrological Institute (EMHI), issued several weather prognoses and forecasts for the Baltic Sea and for the Port of Tallinn. These were valid for 12, 24 and 48 hours and were broadcasted by the ESCO radio centre at 06.00 hours, 12.00 hours and 21.00 hours (all times UTC = Estonian time minus 2 hours) and also sent by telex to the Port of Tallinn authority which took care of the distribution to the vessels in port. Additional prognoses were sent twice a day via the NAVTEX system. Storm warnings were issued according to necessity and distributed via the above explained channels. A prognosis included the wind speed in m/sec, the wind direction, visibility, precipitation, wave height and air temperature.

The ESTONIA was equipped with a NAVTEX receiver, thus received the prognosis and the storm warning through this system in addition to what was directly received from the Port of Tallinn. Reportedly Stockholm Radio transmitted 2 weather forecasts from MET CENTER Tallinn (EMHI) on 27 September 1994 which were apparently also sent by telex from EMHI to the Port of Tallinn directly, viz.:

at 11.00 hours UTC = 13.00 hours Estonian time,  
when ESTONIA was at her berth:

quote

WARNINGS  
STRAIT OF MUHU ISLANDS SAAREMAA AND HIIUMAA  
NORTHERN BALTIC  
SOUTH-WESTERLY 12 TO 17 M/S=  
GULF OF RIGA  
CENTRAL BALTIC SOUTH-WESTERLY 12 TO 17 M/S

unquote at 18.00 hours UTC = 20.00 hours Estonian time,  
when ESTONIA was proceeding along the Estonian north coast.

"SW 10 - 15 m/sec." at 22.00 hours UTC = 24.00 hours Estonian time, when ESTONIA had left the shelter of the Island Hiumaa already and was less than 1 hour apart from the catastrophe:

quote WARNINGS=

WESTERN PART GULF OF FINLAND SOUTH-WESTERLY WESTERLY 12 TO 17 M/S=  
EASTERN PART GULF OF FINLAND SOUTH-WESTERLY WESTERLY 15 TO 20 M/S=  
STRAIT OF MUHU ISLANDS SAAREMAA AND HIIUMAA NORTHERN BALTIC SOUTH-WESTERLY 12 TO 17 M/S GUSTS 20 M/S=  
GULF OF RIGA CENTRAL BALTIC SOUTH-WESTERLY 12 TO 17 IN GUSTS 22 M/S=

unquote

The above forecast is confirmed by the recordings of the station Ristna on 58°55' N, 22°04' E, i.e.  
ca. 30 nm SSE of ESTONIA's position which were at 01.00 hours Estonian time = 23.00 hours UTC:  
Wind : W average wind speed 16 m/sec. max. wind speed 21 m/sec. in gusts 22 m/sec.

The above stated information has been taken from the documentation submitted by EMHI to the JAIC, all of which is attached as Enclosure 18.233.

#### **Special Prognosis for "ESTONIA"**

In addition to the above stated information received from the Estonian side, the ESTONIA was a subscriber of the Swedish Meteorological and Hydrological Institute (SMHI) and received daily by fax a so-called "special prognosis". This had also been the case on the afternoon of the 27 September 1994 when the SMHI sent, by fax at 13.11 Swedish time = 14.11 Estonian time, this "special prognosis", the receipt of which was reportedly confirmed by the ESTONIA. In this special forecast ESTONIA's command was advised that they had to expect on the leg between north of the island Osmussaar and south of Bogskär, i.e. between ca. 21.00-03.00 hours: »SW-W winds of 15-20 m/s with significant wave heights of 2.5 - 3.5 m and max. wave heights of 5.5 m«.

The complete wording is attached as Enclosure 18.234.

Furthermore, SMHI - sea weather reports were transmitted all day via Radio P1, the coastal stations and NAVTEX. In detail

- at 06.56 UTC 08.56 EST - Gale warning - from afternoon SW-ly 14-17, this evening further increasing. Tonight 20. Central and Northern Baltic 25 m/s.
- at 08.05 SWE - SW 14-17, at night storm 25.09.05 EST
- at 13.00 SWE - SW 17-22, at night storm 25.14.00 EST
- at 15.55 SWE - same text as to Northern Baltic 16.55 EST
- at 18.56 UTC - Around West, 17-25. 20.56 EST
- at 21.50 SWE - Around West - 17 to storm 25. 22.50 EST

The above weather documentation is attached in one bundle as Enclosure 18.235 together with office translations.

In summary of the above it has to be concluded that the command of the ESTONIA, at the latest upon receipt of the "Special Prognosis" from the SMHI at 14.11 Estonian time, should have been aware that storm force winds from SW-westerly direction with wind speeds of up to 25 m/s corresponding to Bft. 9-10 and wave heights of up to 5.5 m would be met in the open sea. This was about 3 hours before loading commenced when the master was said to have been ashore and two groups of Estonian "safety inspector trainees" led by two Swedish Sjöfartsverket inspectors were inspecting the ferry accompanied by chief officer Juhan Herma and chief engineer Lembit Leiger (see Chapter 15). The inspection ended only about 11/2 hours before departure and had created considerable problems for the chief officer and the chief engineer who were of course aware of the very severe deficiencies of bow ramp and visor.

According to the evidence available no particular precautions were taken by the deck crew on the car deck. While the engine room crew got instructions from the chief engineer to make seafast all moveable things in the engine room as bad weather was to be expected. (Interview motorman Elmar Siegel - July 1996 - Enclosure 13.192). Nevertheless, the forecasted wind speeds and wave heights would be no reason for concern to those in command of a vessel like the ESTONIA, provided, that the vessel was in a seaworthy condition and that her cargo was stowed and secured in accordance with good seamanship. Both criteria, however, were not fulfilled by ESTONIA.

## CHAPTER 19

### THE DEPARTURE

ESTONIA pulled back from her berth on 27 September 1994 between 19.15 and 19.30 hours.

According to the JAIC the vessel departed at 19.15 hours which is said to be a compromise between the Swedish/Finnish and the Estonian Commission members. While the Estonians insisted on 19.00 hours at the beginning (because the departure time has effect on the speed), the Swedes and the Finns referred to the statement of Bengt Nilsson - see Enclosure 20.238 - who had testified as follows:

»The vessel left the berth when they entered the restaurant, thus it must have been 19.30 hours or later, because the restaurant only opens at 19.30 hours.«

Andi Meister has written in his book "The Unfinished Logbook", chapter 7, page 118, that the time 19.15 hours for ESTONIA's departure could be found in the logbook of the harbour master of Tallinn.

Upon departure the vessel's trim was said to have been 0.5 m by stern and she had a list of 1° to starboard, although the port heeling tank was full and the starboard heeling tank was said to have been empty and in spite of the fact that gale force winds had been forecasted from SW-ly direction, i.e. from port side, thus increasing the starboard heel without any possibility to counteract. When interviewed in 7/1996 motorman Elmar Siegel stated in this respect:

Q: "Did "Estonia" leave Tallinn with some list?"

A: "Yes, a list to starboard. Leiger (chief engineer) had phoned the engine room and asked whether it was possible to correct it. It was a mistake made during loading. The tank at the side, which would have to be filled to correct the list, was already full and the tank at the other side was already empty. Therefore we had no possibility to correct the list. It was 1°-2° and due to the waves up to 3°-4°."

The full wording of the interview is attached as Enclosure 13.192.

According to the crew member - car deck worker Valdur Matt - the bow ramp and visor were properly closed and secured. He was probably the one who moved the turnable forward parts of the bow-ramp rails into backward position and who secured both parts by putting the pins into the respective holes before the bow ramp was lifted up. Also the passenger Mikael Öun and others have stated that the visor was definitely closed or, at least, looked closed from the open 8th deck when the ESTONIA pulled back from her berth. Thereafter the passengers left the open deck because it was windy and uncomfortable. Since 17.00 hours on the same day the ferry SILJA FESTIVAL had been berthed opposite the ESTONIA as pictured below.

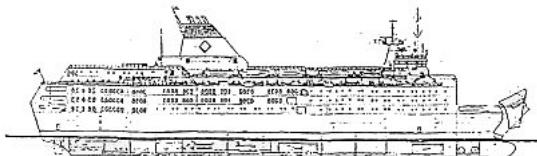


In the cafeteria of SILJA FESTIVAL on the 4th deck a Finnish Doctor was having coffee with his son and thereby observed the unberthing manoeuvre of the ESTONIA. Her report - submitted to the Finnish part of JAIC on 10.01.95 and received by this 'Group of Experts' only in December 1998 - reads as follows:

*»On Tuesday, 27 September 1994, at 13.00 hours, I boarded the SILJA FESTIVAL in Helsinki for a 24-hour cruise. I was accompanied by my son and we had a cabin together. The ferry arrived at Tallinn at 17.00 hours the same day for a 4-hour stay. Most of the passengers went ashore, but I stayed on board with my son and we were walking around the vessel. At about 19.00 hours I was together with my son in the cafeteria on the 4th deck having coffee. I saw through the window that a vessel with the name ESTONIA was leaving the harbour at a distance of about 20-25 m away from us. I knew the vessel from previous times.... The weather was overcast and it was blowing moderately ..... The day was just at dusk. I saw the vessel moving backwards from her berth and saw that her bow visor was open. It seemed to me that it was not fully open, but only half ..... I watched the ESTONIA for some minutes whereafter her foreship disappeared from my view. I did not see whether the vessel's so-called inner door was closed. While the vessel resumed her voyage I saw that both stern ramps were closed. I followed ESTONIA's departing for about 5 minutes whereafter the vessel disappeared into the darkness.*

*I mentioned to my son that the bow visor stood open and told him that for the same reason a Belgian vessel had sunk some time ago. I was informed by crew members of our vessel on the next morning at about 10.00 hours that the ESTONIA had sunk.«*

The complete statement is attached as Enclosure 19.236.



DEPARTURE TALLIN

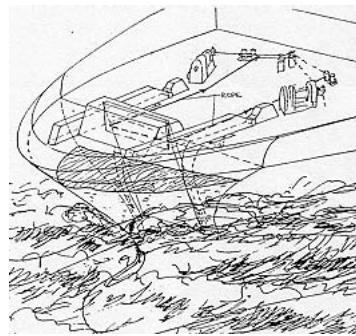
The above drawing shows ESTONIA with half open visor. This means that the crew apparently at first closed the visor while the vessel proceeded backwards from the berth and, subsequently, when she had turned inside the breakwater opened it again to a certain extent, possibly half, and passed the breakwater in that condition. The explanation for this somewhat unusual behaviour was most probably the impossibility for the crew to close the bow ramp completely, i.e. the ramp was closed by the actuators to about 4-5 cm, whereafter normally the two ramp hooks would engage the mating lugs at the upper part of the ramp and pull the ramp tight against the rubber packings, whereafter the securing bolts would move one after the other into mating pockets at the ramp; This was, however, no more possible due to the severe twisting/misalignment of the ramp. This is subsequently explained in detail in Subchapter 29.2, viz.:

- (a) the port upper pocket was intact and only slightly bent towards the centre-line of the ramp with metal at both sides of the pocket slightly ripped which was probably caused by the bending; the bolt was fully extended and about 100 mm below the pocket;
- (b) the port lower pocket was found to be intact with the bolt only partly extended and about 100 mm below the pocket;
- (c) The starboard upper pocket was noted to be without cover plate which had been burnt off by the crew in the morning of 27 September 1994 after arrival when it turned out to be impossible to open the bolt; the bolt was fully extended; there was apparently no misalignment between bolt and pocket;
- (d) the starboard lower pocket was crushed together to the effect that the bolt - noted to be fully extended - could never have entered the pocket.

Consequently it has not been possible for the crew to secure the bow ramp at all by its four securing bolts. The same refers to the port ramp hook which could not engage its mating lug at the ramp, due to the misalignment of the port ramp side as it was demonstrated already by the distance of ca. 100 mm between the mating pockets and bolts. The obvious fact that the port ramp hook had never engaged its mating lug is further confirmed by the intact hook and the intact, unbroken lug. Both hook and lug are visible among other things on the diver video B40a. - See also Subchapter 34.6.

The starboard ramp hook, however, is nowhere visible and the location where it should be, is empty. It has thus to be assumed that also this hook had not engaged its mating lug at the ramp, which means that the ramp had just been closed by the actuators - as stated before - to an remaining opening of 4-5 cm.

Due to several mooring ropes and two wires found in way of the ramp and respective indications on the ramp - see Chapter 29.2 - it has to be assumed that the crew tried to close the ramp completely by means of mooring ropes and/or wires probably pulled tight by means of the mooring winches on the forecastle deck.



Subsequently the visor was closed and locked - see Subchapter 29.2 and Chapter 30 - while the ferry proceeded already outside the breakwater towards the VTS between the Island Nayssar and the mainland on her last, fatal voyage in a condition which shall again be summarised as follows:

- Severely damaged and misaligned visor, which at sea quickly filled up with water to the outside level, which was also insufficiently locked and secured, and the hinges of which were considerably pre-damaged and weakened, in particular the starboard hinge.
- Severely damaged and misaligned bow ramp, which was not locked at all but most likely held by one or more mooring rope(s)/wires, which was open to the water-filled visor, with the port hinges being broken and the ramp detached from the vessel at this side.
- The car deck loaded with only partly or not all secured trucks/trailers and other vehicles.
- The port heeling tank full while the starboard one was allegedly empty, a condition depriving the vessel's command subsequently of being able to counteract when the vessel's starboard heel increased due to the forecasted wind pressure on the port side.
- One or more ballast water tanks and/or void spaces being holed/leaking and consequently open to sea. In short, the ferry ESTONIA was in many respects unseaworthy when she departed from her home port for the last time as it is also demonstrated by the images below.



(click for full page image)

## CHAPTER 20

### THE ROUTE - WIND AND SEA CONDITIONS ACTUALLY ENCOUNTERED - THE SPEED

According to the Swedish Meteorological and Hydrological Institute (SMHI) the weather situation explained below developed during the course of 27 September 1994:

»The weather conditions on the 27th September were dominated by a "strong and extensive area of low pressure with several lows" which covered northern Scandinavia and the Arctic Sea. See the weather chart for Europe in Enclosure 1 from 12.00 hours UTC on the 27th September.

One of these lows deepened on the 27th and moved rapidly east via southern Norway and eastern Svealand towards southern Finland. The low remained relatively strong and the centre was near Oslo on the 27th at 12.00 hours UTC with a low pressure of 995 hPa, on the 28th at 00.00 hours UTC it was over the south-eastern part of the Gulf of Bothnia with a low pressure of 980 hPa. On the evening of the 27th a warm front connected to this low with occasional rain showers passed quickly eastward over the northern Baltic. South and south-west of this low pressure a wind change from SW to west occurred and the westerly wind was very squally.«

The SMHI has investigated the weather conditions before, during and after the casualty on behalf of JAIC. The results are summarised in a weather opinion with the title "**The Estonia' Casualty - Weather Conditions 27/28 September 1994**".

The complete opinion together with 26 Enclosures and the office translation are attached as [Enclosure 12.2.139](#).

On pages 6 and 7 of the Swedish original SMHI has stated, beginning with the estimated departure from Tallinn at 18.00 hours (all times quoted by SMHI are in Swedish time) and from 18.30, every hour

- wind direction and speed
- wind speed in squalls
- significant and max. wave height

which were then prevailing according to SMHI's investigations.

In the translation this can be found on pages 9 and 10 under "*Estimated Conditions on Estonia's last Voyage*", whilst reference will be made to these estimations by SMHI in the following comments on the route and the casualty.

After having passed the breakwater (see Chapter 19) ESTONIA proceeded between the mainland and the Island Nayssar and - after having passed the buoy off Suurupi Lighthouse - altered course to 262° on the gyro-compass. This was confirmed by passenger Anders Ericson, who had been on the bridge between 20.00 - 20.30 hours ET - see his statement Enclosure 20.239 - and saw the course digitally shown to be 262°, which is actually the true course to the waypoint on 59°20' N; 022°00' E. He also realised that the wind speed was then already 20 m/sec.

The apparent fact that ESTONIA had taken her normal route was further confirmed by the observations of the meeting vessel AMBER. The M.V. AMBER is a Polish Ro-Ro vessel, then on voyage from Gdynia to Helsinki when she met ESTONIA. The watch officer of AMBER has only recently been traced and questioned.

According to his testimony AMBER passed ESTONIA at 22.15/20 hours CET = 23.15/20 hours Estonian time. ESTONIA was on a course of about 260/265°, at a position about

18 nm before the waypoint on 59°20'N; 022°00'E. She was running apparently on full speed against heavy head seas which the watch mate on board of AMBER described as follows:

*»The ferry was brightly illuminated and appeared to proceed against wind and sea at full speed, which I could hardly believe. According to data from the ARPA her speed was about 18-19 kn. She was pitching heavily and I saw how she was taking a lot of water on the forecastle deck which smashed against the superstructure and was thrown up to the bridge windows and spray was all over the vessel. When her bow smashed into the waves I had the impression that she almost stopped and subsequently built up speed again when the foreship rose. In my opinion those in charge on the bridge of the ESTONIA must have been crazy, absolutely incompetent and inexperienced. I had never seen anything like this before.«*

The complete statement is attached as [Enclosure 20.237](#).

The evidence of the trainee mate Einar Kukk, having been on the bridge until about 00.35 hours, also confirms that ESTONIA at first proceeded to her normal waypoint. In summary of the aforementioned it has to be concluded now that the ESTONIA took the southerly route, i.e. her normal route, to the waypoint on 59°20'N, 022°00'E and that she had apparently no problems until about 23.30 hours, when she was last seen by the watch officer of AMBER. Nevertheless, it has to be mentioned that in the files of the public Nevertheless, it has to be mentioned that in the files of the public prosecutor Tomas Lindstrand the copy of a navy chart was found which indicates that ESTONIA took a course of about 270° true from the end of the Traffic-Separation-Scheme (TSS) between the mainland and the Island Nayssaar straight up to Söderarm. This could have been realistic since it was known from the beginning that she had to enter the archipelago Söderarm because of the pilot examination of Captain Avo Piht. Therefore it would actually not have been necessary first to go down to the waypoint and then go up to the North again. On the other hand, it could also be argued that sailing as long as possible in the shelter of the Estonian North coast would be for the comfort of the passengers, although evidently this was the last thing Arvo Andresson cared about. The navy chart is attached as [Enclosure 20.240](#).

According to the Finnish Navy, however, ESTONIA took with circa 90% probability a completely different route. Allegedly after having crossed the TSS north of Nayssaar she did follow the westbound lane along the Finnish coast, but subsequently altered course to the south-west. In the opinion of this 'Group of Experts' this is the less likely version because it is the longest distance and simply impossible for ESTONIA to pass within the time available. The radar track of this possible route of ESTONIA along the Finnish coast is attached as [Enclosure 20.241](#) together with the memo about the information received from the head office of the Finnish Navy in December 1998. For more details see Subchapter 22.3.

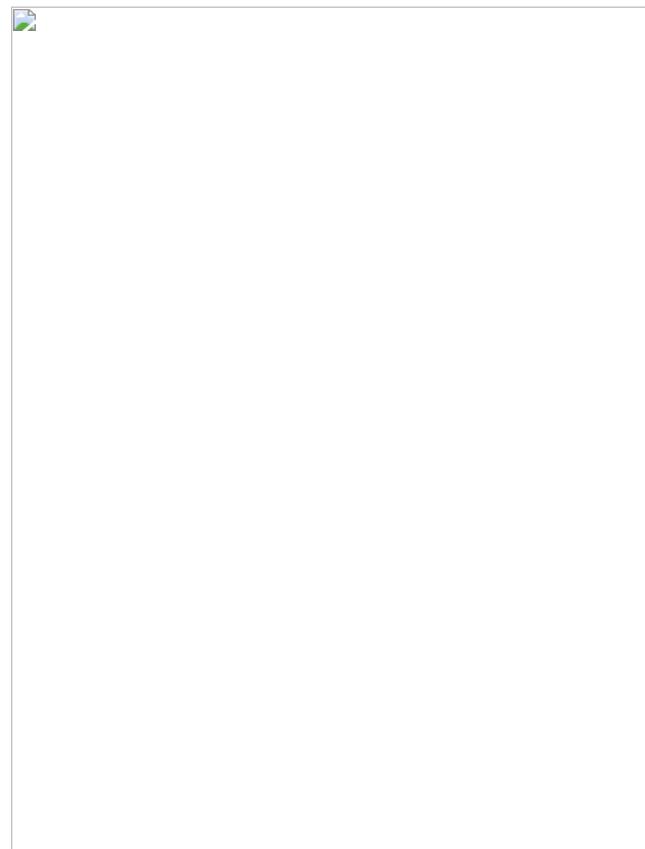
Since the evidence of the survivor Anders Ericson as well as that of the watch officer of AMBER appears to be reliable and do confirm the normal route along the Estonian North coast to the waypoint, it has to be concluded that this was the route the ESTONIA took on her last voyage.

The next image is part of Sea Chart BA 2241 on which all the relevant positions and course lines are shown. At 21.00 hours the watch on the bridge was taken over by 2nd officer Peeter Kannussaar and 3rd officer Andres Tammes. Trainee officer Einar Kukk was also on the bridge since about 20.30 hours.

**Note:** Due to gale force winds from SW the starboard list increased to 2°-4°. (Statement Einar Kukk taken by the Finnish police on 29.09.94 - [Enclosure 17.2.217](#)).



(click for full page image)



Even with calm sea the water level inside the visor was rising above the 3rd stringer when the vessel was at full speed. The lower side of the bow ramp was below 3rd stringer level, thus even in calm sea the water from the visor was penetrating the gap in the bow ramp and was flooding onto the car deck.

At 22.00 hours AB Silver Linde came on watch and went safety rounds every hour, which commenced 30 minutes after the full hour and ended just before or on the full hour. These rounds included 0-deck (sauna/swimming pool compartment), 1st-deck in way of passenger accommodation and car deck, where he spent some 15 minutes. He had to activate control clocks at various check points. For more details see Subchapter 21.2.2.

At ca. 22.45 hours after having made a distance of 48 nm at full speed - ca. 20.0 kn - the vessel left the shelter of mainland/islands and due to increasing sea/swell from SW-ly directions the speed went down, although the 4 main engines continued on full power. At about that time ESTONIA was overtaking MARIELLA off Hangö.

**Note:** Trainee officer Einar Kukk has meanwhile left ESCO and is thus free to talk. He has recently told Joel Haukka that the officers on watch were frightened about the much too high speed, but did not dare to reduce the pitch without instructions from the master.

Next some statements of passengers shall be quoted in respect of their observations and feelings whilst ESTONIA was proceeding with full power against an ever increasing sea state.

**Leif Bogren** - cabin 5128 (5th deck, port side forward)

**Protocol 01.10.94** - Enclosure 20.242

- to bed at 23.30 hours (Swedish time);

- vessel behaved like a small boat also does when slamming over the waves - explains the many noises created by a vessel proceeding against heavy seas, in particular the time and again increasing and fading very heavy vibrations accompanied by indefinable noises, which were disturbing;

- so he was lying there listening and was fascinated and scared about why they were proceeding so fast?

**Per-Erik Ehrnsten** - Enclosure 20.243 - cabin 6304.

- »Before the accident I tried to sleep, but was woken up from hard noises created by the ferry slashing into heavy seas. In particular, however, I was woken up by indefinable vibrations, which deviated from the normal noises of the ferry. I had been in my cabin since about 23.00 hours ship's time, looked through some papers and went to sleep, however, woke up time and again from the vibrations caused by the waves. In my opinion the ferry was just pitching, not rolling.«

**Mats Hillerström** - Enclosure 20.244 - on deck.

- After dinner Hillerström went out on deck and noted that it was blowing quite frightening and that it was raining.

Later Hillerström and his colleagues went up to the deck where the lifeboats and the liferafts were. They wanted to see how the waves were slashing against the bow of the vessel and therefore were looking down on the bow several decks below them where the waves were smashing against the bow. The waves were smashing so strongly against the bow that the spray water came up to them and they had to protect themselves by seeking shelter behind the steel-sheet covered railing.

The bow area was illuminated by a search light to the effect that one could see what it looked like. Hillerström was out on deck 2-3 times, the last time at about 22.30 hours ship's time.

It kept blowing quite strongly, it was raining and the waves were high. The whole evening Hillerström had heard heavy banging throughout the vessel's hull, which was sometimes felt. Hillerström got the feeling that the vessel was slamming against the waves. He compared it with a motorboat speeding over choppy waves. He did not feel well and at about 23.30 hours ship's time he went to the aft part of the 6th deck, there he found some shelter at starboard behind the wall of the restaurant and the face plate. Although he stood at lee side, there was a lot of spray in the air.

The following pictures show the position of Mats Hillerström which in the light of his subsequent observations - see Subchapter 21.3.4. - is important.

**Juuse Veljo** - Enclosure 20.245 - cabin 1007.

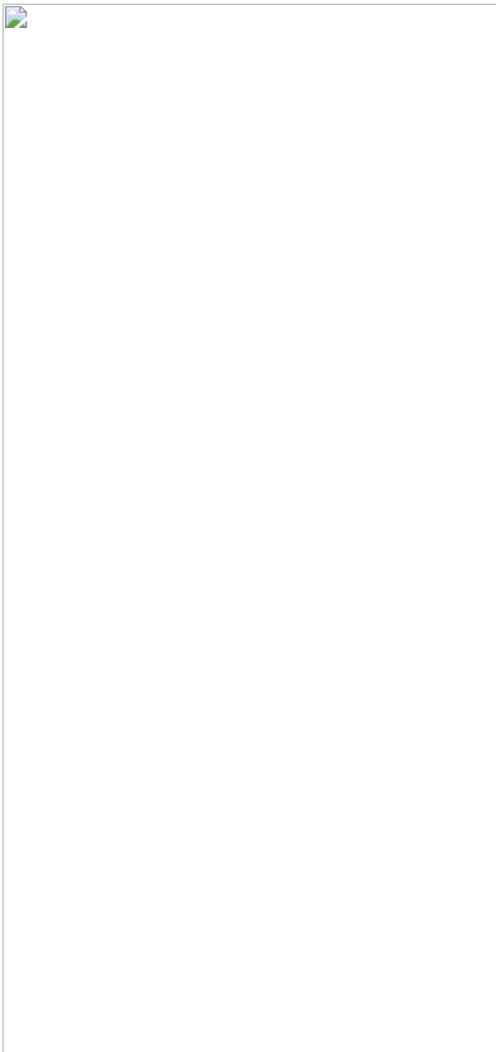
- »Due to the heavy labouring of the vessel one had to hold oneself on to something in order not to be knocked off one's feet.«

**Valters Kikusts** - Enclosure 20.246 - on 6th deck in the stairway overlooking the forecastle deck.

- »The vessel pitched so much in length direction that the water surface at times was almost on the same level as the forecastle deck. In lower position a lot of water gushed in on the deck through the bulwark of the forecastle deck.

The waves became heavier and more water seemed to come in on the foredeck.«





**Tony Spuhl - Enclosure 17.2.228 - cabin 4313.**

- »Spuhl and his friend René went to bed already at about 21.00 hours. After a while, René moved from the bed to the sofa. Spuhl was unable to sleep due to the hard pitching of the vessel which he considered to be natural due to the existing wave conditions. Tony Spuhl was lying in his bed listening to the noise when the bow was slamming into the waves and thought spontaneously that they should not proceed at that speed against such heavy seas. He thought at the same time that the arrival at Stockholm would be delayed.«

**Wanda Wachtmeister / Holger Wachtmeister - Enclosure 20.247 / 17.2.232.**

- »Wanda Wachtmeister had dinner with her brother Holger in the A-la-carte Restaurant SeaSide on the 6th deck whilst the vessel was proceeding against exceptionally heavy seas. They sat at a table at starboard side. At one of the neighbouring tables four men were sitting. Two of them were wearing dark blue uniforms with 4 golden stripes and were presumably having a representation dinner with several other persons, one of whom was an elderly man wearing a jacket with a large club ensign, the other one was about 45-50 years of age and wearing a wine-red blazer. The expression on the elderly man's face made him look completely disillusioned. Holger and Wanda had the impression that the four men were not having a pleasant get-together because they hardly said anything to each other. It was more like a penal expedition.«

During a further questioning Holger Wachtmeister stated the following:

- »The witnesses reported that they had dinner in the evening of the accident between ca. 21.30-22.30 hours at the A-la-carte Restaurant. They were sitting near the table where the two vessel masters were performing some sort of representation. The masters were wearing dark blue uniforms with rank symbols in gold. The vessel was labouring heavily all the time and the waves could be heard smashing against the hull. During one of these "wave bangs" the master sitting next to the witnesses stiffened. This was clearly visible, especially on the face of the master. Description of the master: light hair, moustache.«

The above quotations are just a small selection of the many passenger statements available with remarks about the extraordinary behaviour of the ferry in the sea state which was apparently caused by the excessive speed under the prevailing circumstances.

At ca. 23.15 hours ESTONIA met AMBER North of Tahkuna Nina, the Northern tip of the island Hiiumaa and left the shelter of the Estonian coast. This confirms the following statements of the JAIC Report on page 59, item 5.5:

- (1) 19.30 Outside breakwater on full speed to the western exit of the Traffic Separation Scheme NW of Suurupi Lighthouse, which ESTONIA passed at about
- (2) 20.25 i.e. 18.5 nm in 55 minutes, i.e. 20 kn.
- (3) According to the JAIC, ESTONIA passed Osmussaar Lighthouse at a distance of ca. 7.5 nm. The average speed was 20 kn between (2) and (3).
- (4) Further according to the JAIC the vessel passed the Apollo buoy at about 22.55 hours, i.e. the distance of 16.5 nm between (3) and (4) was covered in 55 minutes which corresponds to 18 kn. Note: Assuming that ESTONIA passed the Tallinn breakwater already on full speed at 19.30 hours, which the JAIC does but which is certainly too early, but anyway let's assume it, she covered the 73 nm to the passing of AMBER in 3 hours 45 minutes, which corresponds to an average speed of 19.5 kn.
- (5) Further according to the JAIC the ESTONIA passed the Glotov buoy at about 23.55 hours, i.e. from 23.15 hours. These are 40 minutes in which she passed 10.8 nm, this corresponds to an average speed of 16.2 kn, a speed reduction due to the increasing forward sea, in spite of all 4 main engines running on full power.

Einar Kukk states about this approximate time:

- »I remember that at about 23.00 hours, shortly before the next course alteration towards West, several large single breakers struck the vessel in way of the port bow edge. Captain Andresson came on the bridge about 30 minutes later, stayed there for about 15 minutes and left the bridge at about 15 minutes before the next course alteration. I do remember that the master asked the 3rd mate whether all 4 engines were running and he received, in my opinion, an affirmative reply. In any case, I have heard the order of the master to activate the fins for the stabilisation of the vessel after the next course alteration. According to my recollection at that time our vessel made about 14-15 kn.«

**Note:** If this speed had been true, ESTONIA would never have reached the waypoint in time to reach the visor's and her own final sinking position within the JAIC's available time frame.

- According to SMHI the wind and sea conditions were then as follows:  
Wind: SW 13-17 m/s. Squalls of up to 21 m/s.  
Waves: 3.0-4.0 m, max. 6.0 m.

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At 00.00 hours there was a watch change in the engine room and from then on 3rd engineer Margus Treu and motorman Hannes Kadak were in charge. At ca. 00.25/00.30 hours the vessel reached the waypoint on about 59°20'N; 21°59'E, the course was changed to 287° true towards Söderhamn and the stabilisers were activated a little later at ca. 00.30 hours.

Einar Kukk continues:

- »I do remember that the speed of our vessel decreased after the course alteration, I also remember that the 2nd mate told this to me. At that time it was about 00.00 hours and still heavy sea state.  
- At about 00.30 hours Silver returned from his control round and reported that on board everything was in order, only passengers would be seasick. 5-10 minutes after Silver had returned to the bridge, I left and went straight to my cabin.«

At about this time - 00.00-01.00 hours - the wind and sea conditions according to SMHI were:

Wind: SW 16-20 m/s, squalls of up to 23 m/s.  
Waves: 3.5-4.5 m, max. 7.0 m.

In case the course alteration to starboard of 25° had been carried out, the wind and sea then should have come more from the port beam. Thus the speed should actually have increased since the full engine output remained unchanged, however, since the stabilisers had been activated after the waypoint, which reduced the speed by ca. 1 kn, it has to be assumed that the speed increase was balanced by the speed decrease and thus the speed over ground probably remained at about 15-16 kn, which is rather high under the circumstances prevailing.

According to Einar Kukk, Silver Linde returned to the bridge at ca. 00.30 hours, while actually he should have returned already at about 00.00 hours and started his next round at 00.30 hours. According to the statements of Silver Linde, available to this 'Group of Experts' (in total 8), he allegedly returned to the bridge at about 00.00 hours and started his next (and last) round at 00.30 hours. Based on the apparent fact that Silver Linde has given more different statements than anybody else, this 'Group of Experts' is inclined to believe that Einar Kukk, who was new on board and not a crew member, is much less influenced by the surrounding circumstances than Silver Linde was and still is. In case Silver Linde should have returned to the bridge only at about 00.30 hours he must have left for his next round shortly afterwards and went again down to the car deck. Since it could not have been the water on the car deck which kept him down there, because this was noted already before 22.00 hours when the starboard stern ramp was slightly opened

- See Subchapter 29.7 - while he had taken over the watch only at 22.00 hours. It has rather to be assumed that the crew activities on the car deck, to hold the visor and the bow ramp, were the reason for his delay.

In any event, ESTONIA continued with unchanged full output to force her way against the still increasing seas while most of her passengers had already gone to bed, be it that they were seasick or that they were just tired of always having to hold on to something due to the hard movements of the ferry. Only very few could sleep, most were lying awake listening to the noises created by the vessel when slamming into the waves and feeling the vibrations caused by the 4 main engines running on full power.

As already outlined in the previous chapter, quite a number of passengers were most irritated by the way the vessel was powering against the waves and many truck drivers were thinking of their trucks down on the car deck, especially those knowing that their trucks were not secured.

In particular the passengers in the cabins on 1st-deck, i.e. the deck below the car deck, were alerted from the beginning because they were not only below the car deck, but also below the waterline and not far away from the bow area with the partly loose visor moving up and down within the play created by the indented stempost, the missing rubber packings and the worn out lugs of the locking devices.

In this respect reference is made to the statement of Mikael Öun - attached as [Enclosure 17.2.225](#) - who testified to the Swedish police on 04.10.94, when among other things the following was protocolled:

»While he was sitting in the sauna he continuously heard banging noises which he attributed to the waves smashing against vessel's bow. When he came back to his cabin he still heard the banging noises and continued to hear them, he even woke up from them after having fallen into a light sleep.«

Also passenger Ulla Marianne Tenman in cabin 1098, i.e. below the car deck and located at starboard side in way of the 2nd compartment from forward, was deeply concerned already quite some time before the casualty sequence-of-events commenced. She has testified to the Swedish police on 04.10.94 when among other things the following was protocolled:

»Some time before the casualty Ulla was down in her cabin. She stated to have heard several hard bangs and something that was beating against something. This appeared very strange to her. She spoke to her colleagues, decided to go up to the 8th deck and wait what would happen.  
Her statement is attached as [Enclosure 21.3.1.288](#).

These banging noises - in all probability created by the visor moving within the available play - had already been heard by many passengers on previous voyages, among those was passenger Ivan Petrov who had stayed in cabin 1064 on 22.09.94 and reference is made in this respect to Subchapter 12.4.5 - Other Observations.

The ESTONIA continued all the time on full power against the increasing seas until at about 00.50 hours - after it had been noted or reported that something was wrong with visor and/or bow ramp - the speed was reduced to probably 6 kn until at 01.02 hours the vessel heeled wide to starboard and turned to port. At this moment the farthest point to the West must have been reached, because shortly afterwards at approximately 01.10/12 hours, the main engines stopped and the vessel drifted East or NE and lost the visor about 30 minutes later. It has thus to be assumed that the farthest point to the West has been about 0.5 nm to the West of the alleged visor position, where ESTONIA must have been at about 00.50 hours.

**Note:** After ca. 00.50 hours ESTONIA was first turned to starboard and subsequently to port and was presumably kept on SW course against wind and sea for some time until the sharp port turn commenced, which explains the more southerly Mayday position. The distance from the 23.15 hours-position to the ca. 01.00 hours-position is 30.0 nm which the vessel passed in 1 hour 45 min., of which the last ca. 10 minutes were on reduced speed. This corresponds to an average speed of ca. 17 kn.

As the time of the casualty sequence-of-events commenced at about 00.30 hours and ended at about 01.50 hours with the sinking of the ESTONIA the many statements of the survivors now have to be analysed in the following Chapter 21.

#### 20.1 Further Evidence

There was no further evidence available at the time of closing the Report.

**CHAPTER 21****SUMMARY OF TESTIMONIES BY SURVIVORS**

### **21.1 Introduction**

Officially 137 persons have survived the catastrophe, some are crew members, two are advisors and the others are passengers. Most of them have testified to the police in Finland, Sweden and/or Estonia, some three or more times. Only a few crew members have been questioned directly by the JAIC. They are:

3rd engineer Margus Treu  
motorman Hannes Kadak  
watch A.B. Silver Linde  
system engineer Henrik Sillaste  
trainee officer Einar Kukk  
purser Andres Vihmar (only by Bengt Schager).

The JAIC has also interviewed only very few of the passengers or advisers directly, e.g. Pierre Thiger has been interrogated by Olof Forsberg and the statement is attached as [Enclosure 21.1.248.1](#). The Finnish Commission member Tuomo Karpinen has spoken by telephone to the truck driver Eckard Klug and to the advisors Paula Liikamaa and Peter Järvinen. The respective memo is attached as [Enclosure 21.1.248](#).

Andi Meister's book "*The Unfinished Logbook*" and also the interview which Jutta Rabe held with him and subsequently with Bengt Schager, the psychological expert to the Swedish part of JAIC, reveal however that the Estonian Commission members as well as the Estonian security police and other government bodies have frequently spoken to the crew members, in particular to Margus Treu and Silver Linde. It is unknown whether these questionings were recorded, but at least, recordings are not available. According to Kari Lethola, chairman of the Finnish part of the JAIC, the following survivors have not been interrogated at all:

Igor Gricius from Dobele/Latvia,  
Gull-Britt Payr from Stockholm,  
Arturas Tamasauskas from Paneveöys/Lithuania.

From the latter it is only known that he was the driver of the Lithuanian van, No. CVK 445. He refused to testify at all and left the hospital without permission.

Of the other 133 survivors, however, at least one statement of each is available to this 'Group of Experts'; in total there are 243! Contact was made with some of the key witnesses and additional information was obtained and/or relevant information was confirmed. These interviews - in addition to the statements taken by the police - are also available on video cassettes. The interviews were either carried out by a member of this 'Group of Experts', by the Finnish lawyer Henrik Gahmberg or by the Estonian journalist Juri Liim in close co-operation or in the presence of a member of this 'Group of Experts'.

The relevant parts of some of the statements and all of the interviews have been translated into English and are attached as enclosures.

All the available statements and interviews have been analysed, but only those statements of crew members made on the day of their rescue, or shortly thereafter, were considered to be reliable and thus possibly not influenced by the ESCO/Estline/N&T representatives and/or other interested parties. Similar weight was put on statements and interviews where members of this 'Group of Experts' were present and could talk to the survivor directly.

Several drawings are attached which indicate the layout of the crew and passenger cabins on all decks, the car deck with centre casing and lift arrangements, the 1st deck with passenger accommodation and engine control room (ECR), further the 0-deck with sauna/swimming pool/conference compartments and the sewage treatment area with the vacuum system directly next respectively aft of it and, further aft, the location of the heeling tanks and the stabiliser pockets directly aft of the heeling tanks.

The results of the analyses of all the available statements and interviews with regard to the time up to and including the casualty sequence of events are outlined in the following Subchapters 21.2 - 21.9.

Other relevant observations made by survivors during and after the sinking, while waiting to be rescued and subsequently after their rescue, is explained in Subchapter 21.8 - Other Observations.

### **21.2 Summary of Testimonies by Surviving Crew Members on Duty**

On the bridge there were on duty from 20.00 to 01.00 hours

the 2nd officer (B) Peeter Kannuussaar,  
the 3rd officer Andres Tammas

and since 22.00 hours

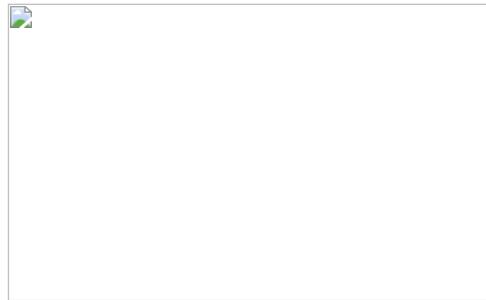
the watch A.B. Silver Linde.

Five or 10 minutes before 01.00 hours the next watch presumably

the 2nd officer (A) Tormi Ainsalu and  
the 4th officer Kaimar Kikas

came to the bridge.

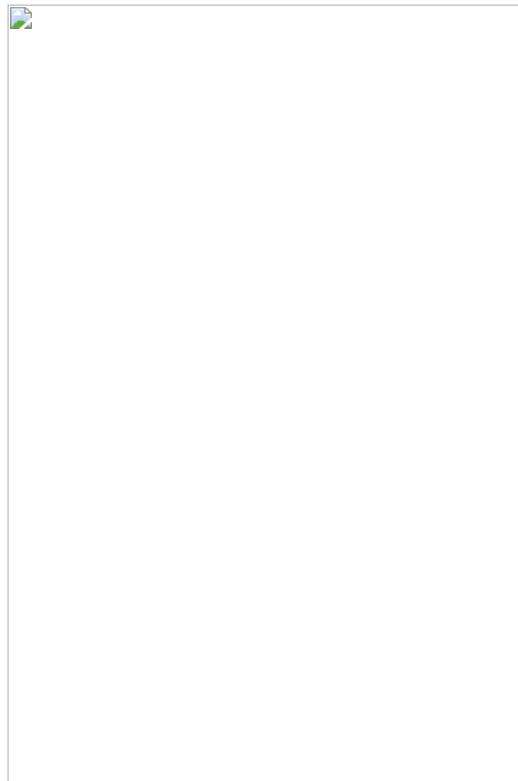
Also the trainee officer Einar Kukk was on the bridge from about 20.20 hours to about 00.30 hours - see [Enclosure 17.2.217](#).



In the engine room there were on duty from 00.00 hours onwards

the 3rd engineer Margus Treu,  
the motorman Hannes Kadak,

and at 00.30 hours the system engineer Henrik Sillaste was called down because there were problems with activating the starboard stabiliser fin (according to the book of Andi Meister "*The Unfinished Logbook*"), and also the vacuum system of the forward sewage installation was causing difficulties.



#### 21.2.1 **Summary of testimonies by trainee officer Einar Kukk - cabin 4103** **- 4th deck, port side outside, 2nd but last cabin**

Einar Kukk has been interrogated five times according to JAIC's Report, of which all statements are available to this 'Group of Experts'. They are attached as:

- (1) on 29.09.94 in Turku - [Enclosure 17.2.217](#)
- (2) on 29.09.94 in Tallinn - [Enclosure 21.2.1.249](#)
- (3) on 07.10.94 in Tallinn - [Enclosure 21.2.1.250](#)
- (4) on 17.10.94 in Tallinn - [Enclosure 21.2.1.251](#)
- (5) on 28.08.96 in Tallinn - [Enclosure 21.2.1.252](#)

- At about 23.00 hours a large wave hit the vessel's port bow.

- The master came to the bridge again about 30 minutes later and asked the 3rd officer whether all 4 engines were running, which was confirmed. The master then ordered that the stabilisers were to be activated **after the next course change** and left the bridge approximately 15 minutes before, i.e. at about 00.05/00.10 hours.

- The wind was coming from SW and veering West, whilst the waves came more from southerly directions. The sea was quite heavy.

- He was apparently still on the bridge **when the vessel changed course around 00.25-00.30 hours**, although he never said so, but he stated that the 2nd officer told him that the vessel would make about 1 knot less speed after the stabilisers had been activated. The speed was then about 14.5-15.0 knots.

- At about 00.30 hours Silver Linde returned to the bridge and Einar Kukk left for his cabin; in his last statement - [Enclosure 21.2.1.252](#) - he said that Linde left the bridge at this time for a new round.
- He went to his cabin, cleared up some matters and then went to Pub Admiral, where also Karaoke was being performed (5th deck, starboard side, aft).
- There he saw Silver Linde in the door at about 00.40 hours. Kukk left after some minutes and went to his cabin. There he arrived at ca. 00.50 hours, went to bed, but could not sleep.
- **After 5-10 minutes** he heard a very strange noise which was very unusual (and alarming) to him, it could have been an impact or strong vibration and the vessel behaved very strangely; he got up and dressed; while he was putting on his shoes the vessel rocked and heeled abruptly to starboard, he cannot say how much, but it was very far.
- He rushed up to the 7th deck and met boatswain Vello Ruben in the central stairway,

**Note:** This means that the boatswain had been somewhere further down when the heel occurred - most probably on the car deck - because his cabin was on deck 7.

- when he was between 6th/7th deck he noted a shock/vibration inside the vessel.

- **He and the boatswain helped each other out of the door on to the open deck 7;**

- the list was then about 45° and the engines had definitely stopped;

- on deck 7 he met Ivan Ziljajev, a crew member with a walkie-talkie, and **further forward in a liferaft, Silver Linde;**

- when the list was 90°, he looked at his watch: it was 01.30 hours and he slid into the water, the stern was then submerged up to the stabiliser fin.

## 21.2.2 Summary of testimonies by watch A.B. Silver Linde

He is the only survivor of those having been on duty on the bridge. His main task was to go security rounds through out the vessel from deck 8 down to deck 0 via three check points on the car deck. One round, which he normally commenced 30 minutes after the full hour, took between 25 and 30 minutes. He carried a walkie-talkie with him.

Of Silver Linde the following statements are available:

- on 29.09.94 in Turku - [Enclosure 21.2.2.253](#)
- on 03.10.94 in Tallinn - [Enclosure 21.2.2.254](#)
- on 17.10.94 in Tallinn - [Enclosure 21.2.2.255](#)
- on 17.11.94 in Tallinn - [Enclosure 21.2.2.256](#)
- on 03.12.94 in Tartu - [Enclosure 21.2.2.257](#)
- on 11.03.95 in Helsinki - [Enclosure 21.2.2.258](#)
- on 31.03.95 at Landvetter Airport - [Enclosure 21.2.2.259](#)
- on 25.01.96 in Tallinn - [Enclosure 21.2.2.260](#)

It was initially the intention of this 'Group of Experts' to ignore the different statements made by **Silver Linde** completely because his "evidence" had obviously been influenced by his ESCO superiors, in particular by Enn Neidre, the head of the Navigation Department of ESCO and safety adviser of Estline and simultaneously member of the Estonian part of the JAIC until April 1996, whereafter he remained to be an expert to JAIC. An example of this is Silver Linde's interview by the JAIC at the so-called "Landvetter meeting" on 31 March 1995, which Enn Neidre, in spite of strong objections by the Swedes and Finns, had insisted on attending by pointing to his membership in the Estonian part of JAIC. He actually attended in a blue captain's uniform, which he had never done before and never did thereafter.

The questions/answers below stated are quoted from the protocol of the meeting.

**Commission:** "Please tell us about your last round."

**Silver Linde:** "I came down to the car deck in the middle, went aft at first, turned the key, walked forward towards the ramp, a couple of meters away from the bow ramp heard strong crashing noise, I told the bridge by walkie-talkie about the noise and got the order to remain and check what it is all about. I stayed there for 5 minutes and controlled in the vicinity, what I could see. After that I opened the doors in front of the panel and all lights were green. I asked for permission from the bridge to go on with my round, which was granted."

**Note:** According to normal procedure this should have been around 00.45-00.50 hours, i.e. at the time when Kadak was in the ECR and saw water penetrating the bow ramp. The communication between Silver Linde/bridge via walkie-talkie should have been overheard by the watch engineer Treu, who has not stated anything in this respect in any of his 12 known statements and interviews. What he stated, however, in all but two of these twelve statements/interviews is that he heard Silver Linde report to the bridge that there was **water on car deck**. Safety officer Ervin Roden also overheard the walkie-talkie communication between Silver Linde and the bridge. Ervin Roden had been sleeping in his cabin with the walkie-talkie on when he suddenly heard Silver Linde shouting to the bridge that there was **quite a lot of water on the car deck** and that they had to abandon the vessel. (See the memos made by Tuomo Karppinen attached as [Enclosure 21.1.248](#) and the statement of Paula Liikamaa - [Enclosure 21.3.4.352](#)) In the spring of 1997 Ervin Roden admitted to the Estonian journalist Heikki Tann that the above is correct.

Parts of the protocol of the "Landvetter" meeting on 31 March 1995 follow below:

**Commission:** "We are showing you a drawing of the control panel with the lamps. Do you know these lamps? Can you please tell us, what is what? Do you remember?"

**Remark:** Silver Linde suddenly becomes very irritated and refuses to look at the drawing.

**Silver Linde:** "I don't remember. Yes, there was some (någon) red. But this was a long time ago. I don't remember if the red one was in the lower or upper row. I have since been on 2 ships and it is hard to remember. The indicator lights of visor and bow ramp were green."

**Commission:** "Where was the red lamp?"

**Silver Linde:** (looking at Neidre) "If the lamp had been red, then something would have been wrong. So all the lamps were green."

**Commission:** (pointing to the protocol) "But you told us a minute before that the lamps ...."

**Neidre:** "He just said that all lamps were green."

**Commission:** (pointing again to the protocol) "But he says here that he saw one red lamp?"

**Silver Linde:** "There was no red lamp."

**Commission:** "O.K."

**Note:** Actually there had to be one red lamp, because at sea the harbour securing of the visor is open, thus the indicator light is red. This would have been the proper reply by Silver Linde, but he had been instructed differently by the security adviser of Estline, Captain Enn Neidre, who obviously was not aware of this respectively not acquainted with the installation. After this 'Group of Experts' had explained in writing to the JAIC the different functions and meanings of the indicator lights, the consultant of the Estonian part of the JAIC, Professor Jaan Metsaveer, tried to correct the already existing impression that the Estonians did not know how their relevant safety installations functioned, by stating at a joint meeting of the JAIC and this 'Group of Experts' that the explanation for "all lights were green" was the fact that the careful boatswain always closed the harbour securing at sea **to avoid any lights being red**. After presentation of the video print below, from one of the underwater videos showing the harbour securing open, the professor remained silent for the rest of the meeting.



In spite of the above the JAIC obviously still considers **Silver Linde** to be a key witness and his (changing) testimony became an important element in their scenario. The readers of this report shall have the benefit of forming their own opinion on the different statements of **Silver Linde** which were made at different times and which are presented as follows:

#### 1.) 29.09.94 - 10.20 hours - criminal police Turku:

- metal to metal noise ca. 00.45 hours;
- reported to watch officer and was instructed to wait some time and find out cause, which he was unable to do and so continued his round since nothing more happened;
- ca. 00.58 hours back on bridge - officers relieved each other and master came to the bridge;
- due to reports about strange noises from car deck he was sent down to investigate (no mention of boatswain);
- when on deck 7 the vessel heeled and people asked him for help, situation calmed down somewhat when the vessel came back to port;
- rushed to Information desk on deck 5 and asked for the car deck doors to be opened when the vessel heeled extremely to starboard and everything slid over to the deep side;
- went to deck 4 but lots of people were streaming against him;
- up to deck 7 and reported by walkie-talkie to the bridge that people were screaming in panic and that **deck 1 was already flooded**.

#### 2.) 03.10.94 - Estonian security police:

- 00.45 hours on car deck - crash behind the ramp - informed officer who asked him to wait for 5 minutes - nothing - all lights were green - down to 1st deck and 0-deck;
- 01.00 hours back on the bridge - bow was still there - order to go down and check, master was on the bridge then;
- no time to see more, there was an immediate list of 10° - could not go down to 4th deck and rushed to deck 7;
- **visor was gone, but ramp seemed to be in place.**

#### 3.) 17.10.94 - questioned by the JAIC:

- 00.35 hours on car deck - car deck doors were locked;
- he started at the stern: 3 check points - stern - garbage container - bow; - he heard a noise (a bit louder) after 00.30 hours, but nothing could be seen - noise sounded metallic;
- reported to the bridge and waited 5 minutes - nothing - all control lights were green;
- down to decks 1 and 0 - nothing;
- 01.00 hours back to bridge - 2nd officer Ainsalu/4th officer Kikas on watch, captain came a bit later;
- officer reported about strange noises from the bow (no talk about water) and sent Linde with boatswain to check;
- could not get down because people came streaming up - there was water on deck 1;
- the vessel heeled and righted itself up;
- on deck 7 people told him that there was water on deck 1;
- visor was gone, the ramp was in place but slightly open - saw flaps at the ramp;
- Linde went to the Information desk to report to them the order to send out the alarm;
- "Mr. Skylight to No. 1 and 2" is the fire alarm.

#### 4.) 17.11.94 - questioned by the Transport Investigation Office in Tallinn:

- 00.35/40 hours on car deck - no water; - heard heavy bang - metal to metal;
- reported to bridge - Peeter Kannussaar;
- continued round since nothing happened and nothing could be seen;
- at 01.00 hours back to the bridge;
- was sent down again by Tormi Ainsalu to check the reported noises together with the boatswain;
- down to the Information desk and asked to have the car deck doors opened;
- sudden heel - continued nevertheless to deck 4 where he met panic stricken passengers;
- together with these people he went up to the 7th deck;
- he was the first one from the crew on deck 7 outside;
- reported by walkie-talkie to the bridge that there was water on deck 1 which was new to them;
- then he lost his walkie-talkie;
- the starboard lifeboats were in the water, but could not be used;**
- he heard about water in the cabins of deck 1 for the first time when he was already on deck 7.

**Note:** According to the available statements only passenger Jaan Stern noted water in his cabin which was the most forward cabin in the centreline on the 1st deck.

#### 5.) 03.12.94 - security police Tallinn:

- ca. 00.40 hours car deck - when he was ca. 1.5 m away from the bow ramp - he heard a bang which he would not have heard had he been 10-20 m away; it was metal on metal;
- the control panel can only be opened by a special key which the boatswain has in his possession;**
- he reported the bang by walkie-talkie to the officer and received the instruction to check and report;
- nothing was found and he was instructed to continue his round;
- time between leaving car deck and reaching the bridge could have been 15-20 minutes;
- at 01.00 hours the officers changed watched on the bridge and that had already taken place when he returned to the bridge;
- he was sent down again to check the ramp together with the boatswain;
- he walked down to the Information desk on deck 5 to ask for the opening of the car deck doors when the vessel heeled to starboard and did not right up again;
- went to deck 4, but could not go further because the alleyways were blocked with people coming up;
- he went up to deck 7 and reported to the bridge by walkie-talkie that there was water on deck 1 which he had heard from a passenger from deck 1, cabin 1064 or 1096 and which surprised the bridge.

#### 6. 11.03.95 (Interview by Jutta Rabe)

- came to the bridge and officer instructed him to go down and check strange noises;
- when on deck 5 vessel heeled to 30°;
- went to deck 4 but could not go further;
- up to deck 7 and reported by walkie-talkie to the bridge that there was water on the decks.

#### 7. 31.03.95 (Neidre present in captain's uniform)

- 00.45 hours heard beating noise on car deck, unusual noise, which he had never heard before or thereafter; - vessel was pitching and rolling;
- reported to watch officer: "Watch A.B. to watch officer: water penetrates through the ventilation grits", and then he explained the noise, was instructed to look around and check for 5 minutes;
- opened control panel and all lights were green; continued his round to decks 1 and 0;
- ca. 01.00, or just after 01.00 hours, back on the bridge;
- put his walkie-talkie into the recharging station and saw the visor to be in position;
- watch officer told him about a phone call from downstairs that strange noises were heard and instructed him to go down with the boatswain and check - it was the new officer Ainsalu since the officers had changed watch;
- he was not told who had phoned the bridge, just that it had been somebody from downstairs; he did not know whether the speed was reduced and/or if rudder manoeuvres were carried out;
- upon being questioned from where wind and waves were came, he said from all directions, the vessel was rolling and it was impossible to feel a heel to one side;
- the master was on the bridge; the previous officers had already left the bridge;
- he called the boatswain but there was no reply, 2nd officer took over to phone him in the cabin and he went down;
- it was possibly 01.05 hours then;

- he never used the lift because the lift doors to the car deck were locked at night;

**Note:** This is wrong according to the statement of Anneli Konrad - see [Enclosure 21.2.4.283](#).

- came down to information on deck 5 and asked that the car deck doors be unlocked, when suddenly the vessel heeled severely to starboard and everything moved to the deep side;
- he continued down to deck 4 where he met many passengers streaming up in panic shouting about **water on deck 1**;
- **he rushed up to deck 7 inside the forward large stairway**;
- he reported by walkie-talkie to the bridge about the water on deck 1 and was instructed to go down and check, whereafter he fell down and lost his walkie-talkie and subsequently commenced distributing lifevests; the heel was then over 30° to starboard;
- at 01.24 hours he looked at his watch when he was already in the liferaft.



(click for full page images)

#### Summary of the seven Statements of Silver Linde

##### a.) Noise heard on car deck:

ca. 00.45, 00.45, 00.35, 00.35/00.40, 00.40, ca. 00.45 and 00.50-00.55;

at first he spoke about an unusual metal/metal noise; then about a crash behind the ramp, then at the hearing by JAIC on 17.10.94 and on 17.11.94 he explained the noise to have been just slightly louder than the normal ones created by wave impact respectively that he could hear the noise only because he was just 1.5 m away from the ramp and he would not have heard it if he would have been 10-20 m away; at the Landvetter hearing on 31.03.95 it became a beating (not a scraping) noise and, finally, in his last testimony on 25.01.96 - the noise was remarkable and not typical for ship/wave contact and he had never heard it before or thereafter, which is actually in agreement with what 3rd engineer Margus Treu had said from the beginning, although had always mentioned at least 2 extraordinary bangs not caused by wave impact. In summary it has to be concluded that

- Silver Linde is the only one just reporting one noise - bang - crash;
- there had most likely been something at about 00.45 hours and that he subsequently changed the time according to the requirements of his principals which becomes very obvious in his last statements when he puts the time at 00.50/00.55 hours because at that time JAIC had already decided to keep the time between the first notification to the bridge and the very late Mayday as short as possible;
- the whole story about his observations on the car deck at this time is fabricated anyway, because at this time several crew members had been working hectically on the car deck for some time already, including the boatswain Vello Ruben, and were trying to hold the visor and the bow ramp.

##### b.) Action thereafter:

- in all statements he reported to the watch officer, which he certainly did at some time before the heel (testimony Margus Treu, Paula Liikaama/ Ervin Roden), but he never mentioned the **water on the car deck** which Margus Treu and Ervin Roden heard him reporting;
- in his first statement on 29.09.94 and in his 4th statement on 17.11.94 he did not mention that he checked the control lights, in the following one - on 03.12.94 - he said that the controls for the bow ramp could only be operated by a special key which was in the possession of the boatswain, (the controls are in the same box as the control lights which should have been locked), thus it has to be assumed that he could not check the control lights. In all the other statements he said that he did so.

##### c.) Back to bridge and persons met on the bridge:

- ca. 00.58, 01.00, 01.00, 01.00, 01.00, ca. 01.00, ca. 01.00 - thus at ca. 01.00 hours he was back on the bridge.
- officers relieved each other, master came to the bridge;
- officers not mentioned - master on the bridge;
- new officers on the bridge - the previous officers had left already, master came a bit later;
- previous and new officers on the bridge, master not mentioned;
- officers had changed watch; master not mentioned;
- previous officers had left, new officers had taken over, master was on the bridge;
- officers had just changed watch, master entered the bridge just before him.

The above variations cover practically all thinkable possibilities apart from one, viz. that there was nobody on the bridge. It has to be concluded that Linde is not telling the truth.

##### d.) After having left the bridge:

- in his first and last statements he helped an elderly couple;
- in the 5 statements in between he did not mention this. Since he said in his first statement that the situation eased somewhat when the vessel rolled back to port, it has to be assumed that it was immediately, i.e. ca. 1 minute, before the big heel which is in agreement with other evidence.

##### e.) At the Information desk

- in all his statements - except for the 2nd and the 3rd - he explained sometimes very detailed, sometimes less detailed, that he went to the Information desk (deck 5) to ask for the unlocking of the car deck doors when suddenly the vessel heeled very severely to starboard;
- in his 2nd statement he did not mention, if at all and in his 3rd one, he said that he was sent down from the bridge to the information, to inform them about the alarm.

Since the car deck doors were never locked at sea according to purser Andres Vihmar and many truck drivers, although it was announced over the loudspeakers after departure that they were, it has to be assumed that he was actually sent down from the bridge to tell the Information girl to alarm the passengers (several minutes before the big heel!).

##### f.) Further action:

- continued to deck 4, met panic stricken people, rushed up to deck 7, fell down inside before he could reach the outer deck, reported to the bridge that deck 1 was under water;
- up to deck 7 and distributed lifevests;

- could not go below deck 4, went up to deck 7, where people told him about water on deck 1;
- down to deck 4 where he met plenty of people, went up to deck 7 together with them, informed the bridge about water on deck 1 which surprised them, heel over 30°;
- the same again;
- to deck 4 and then to deck 7 from where he reported to the bridge about water on deck 1, reached the outside of deck 7 and fell down when he was called from the bridge and instructed to go down to deck 1 and check, lost his walkie-talkie, with him were Aulis Lee and Aldo Metspalu, heel over 30°;
- when the vessel was on the side and the stern was sinking, he went into the water and finally got into a liferaft, the time was then **01.24 hours on his wristwatch**.

#### g.) The finale:

- visor missing and vessel sank stern first, it took about 1 hour from the big heel to vessel's sinking;
- bow was up and down and the bow ramp was in position;
- visor was gone but the ramp was in place, saw the ramp flaps;
- the starboard lifeboats were in the water but could not be used;
- heard all the alarms including "Mr. Skylight to No. 1 and 2" when he was already on the outer deck 7 distributing lifevests; left the vessel when the heel was 90° or more, **looked at his watch when he was in the liferaft and it was 01.24 hours**;
- looked at his watch at 01.24 hours when he was already in the liferaft, **visor was gone but bow ramp in place but slightly open**.

In summary of the above analysis the following conclusions have to be drawn:

(1) There had certainly been bangs/crashes on the car deck at about 00.45 hours, but definitely not just one.

(2) Silver Linde must have noted a lot of water on the car deck at about this time or earlier and certainly reported this to the bridge. It is possible that he looked into the control panel and thereby also looked at the control lights which were certainly not all green because definitely the bow ramp was not properly locked and the harbour securing was open. The control panel must have been open because the boatswain was working on the hydraulic cylinders of the visor and bow ramp. In this connection his remark made on 3 December 1994 has to be understood, that the **controls for the bow ramp could only be operated by a special key which was in the possession of the boatswain**.

(3) If Silver Linde really went back to the bridge it must have been at 01.00 hours or just before because the big heel occurred at 01.02 hours according to the clock of Mikael Öun, and less than 5 minutes later Per-Erik Ehrnsten already saw him coming out of the port inner alleyway on deck 7 walking into the forward central stairway (details later on). It is possible that Linde went down to the Information desk just after 01.00 hours - helped the elderly couple on deck 7, which took about a minute according to his own statement, continued to deck 5 and was at the Information desk when the big heel occurred, whereafter he pushed up to the crew accommodation on deck 7. According to Per-Erik Ehrnsten Linde was talking into his walkie-talkie all the time even when he fell and the other two crew members who were with him - presumably Aulis Lee and Aldo Metspalu - helped him back on to his feet and later out on to the deck. It is doubtful and also unimportant whether he ever went down to deck 4 since it is highly doubtful that he ever got an order from the bridge to go down to the car deck, because since 00.45 hours or earlier it was known to those on watch that there was water on the car deck and it is most probable that 2nd mate Peter Kannuussaar and the nautical advisor Juri Avik were already on the car deck.

(4) This could be the confirmation for a remark made by Linde which he made only once, viz. that **he was sent down to the Information desk to advise them to alarm the passengers**. It is also amazing that he admitted to having looked at his watch at **01.24 hours when he was already in the liferaft and the vessel was on the side bearing in mind that the first "Mayday" was only picked-up at 01.22 hours** and the **3rd mate Andres Tammes was telling SILJA EUROPA at 01.25 that the list was 20°/30° to the right side**. Even if Silver Linde's watch had been wrong by 2-3 minutes the discrepancy is remarkable, i.e. just when the mates had finally decided to transmit the "Mayday" at least A.B. sailor Linde was already in the liferaft.

(5) This means also that some of the AB's had left the vessel already at a stage when more or less all the passengers and other crew members were still on board, because at 01.24 hours the heel was probably between 50°-60°. Also Einar Kukk - who was rather early outside on deck 7 - has testified that Silver Linde was already in the liferaft when he went forward.

### 21.2.3 Summary of testimonies by 3rd engineer Margus Treu

As far as it is known Margus Treu has been interrogated/interviewed 13 times, of which the following statements are available:

- (1) on 28.09.94 at 10.30 hours by the central criminal police, Turku - [Enclosure 21.2.3.261](#)
- (2) on 28.09.94 at 12.00 hours by unknown authority in Turku - [Enclosure 21.2.3.262](#)
- (3) on 29.09.94 at 10.00 hours by central criminal police, Turku - [Enclosure 21.2.3.263](#)
- (4) on 29.09.94 - Notes taken by the Swedish members of the JAIC - [Enclosure 21.2.3.264](#)
- (5) on 29.09.94 at 12.00 hours by the Estonian security police in Turku - [Enclosure 21.2.3.265](#)
- (6) on 03.10.94 by the security police in Tallinn - [Enclosure 21.2.3.266](#)
- (7) on 11.10.94 by Finnish members of the JAIC in Naantali - [Enclosure 21.2.3.267](#)
- (8) on 16.10.94 by JAIC in Tallinn - [Enclosure 21.2.3.268](#)
- (9) on 17.10.94 - Notes taken by Tuomo Karppinen - [Enclosure 21.2.3.269](#)
- (10) on 08.03.95 - Interview by Jutta Rabe - [Enclosure 21.2.3.270](#)
- (11) on 31.03.95 - The Landvetter Hearing - [Enclosure 21.2.3.271](#)
- (12) on 28.02.96 by the Transport Investigation Office, Tallinn - [Enclosure 21.2.3.272](#)
- (13) in May 1998 - Interview by Phillip Wearne - [Enclosure 21.2.3.273](#).

Margus Treu is one of the three survivors considered by the JAIC to be the key witnesses and, thus, was questioned in detail, however, in the presence of the head of the nautical department of ESCO and safety adviser of ESTLINE, Captain Enn Neidre, who was then still a member of the Estonian part of the JAIC and as such insisted on participating despite the urgent requests of the Swedish and Finnish members to stay home. When the psychological expert of the JAIC, the Swede Bengt Schager, was interviewed by Jutta Rabe of Spiegel TV in this connection, he replied the following:

»Q: Hannes Kadak has withdrawn that he saw water coming in at 00.46 hrs, which he withdrew later. He first made a very precise statement and later withdrew it.

A: Oh, yes, you mean that statement, yes. Ah, it was revealed during the Landvetter investigation, when I was asking him and I don't have any explanation to what he said, but I was very curious, because first he said that he had thought about it and wasn't sure anymore and 1 minute later he wasn't sure at all whether he had said so at all. So, I don't know what to believe of that. I am in the hands of the witness, sometimes.

Q: But can it be that confusion was caused, that there were people on behalf of the Shipping Company who were employed there, who were also attending that meeting and Mr. Neidre was more or less like a boss for him, and people do get insecure when being asked.

A: (nodding) Yes, and Mr. Neidre was in full uniform as well for the first time that I have seen it.

Q: But was that very smart?

A: I don't think so, but we had no option, this was the way the Estonians wanted it. Although I had some feelings about it, he was a member of the Commission, I could not say to him, please, I want to talk with him alone. This may have altered some of the responses in the interview, yes.«

This means that Captain Enn Neidre, working ashore in the ESCO administration for many years, had without doubt deliberately put on his captain's uniform to intimidate the crew witnesses and, looking at the answers they have given, he did it successfully.

As a consequence, Treu said less than he had said in his initial statements and stuck to his impossible wrong timing, on which, however, the JAIC has built up their equally impossible casualty scenario. Margus Treu, who is indeed the key witness, because he apparently saw on the monitor how the bow ramp was struck and broke open, because this is what he told motorman Hannes Kadak in explanation of the water ingress on to the car deck according to the first statement of Kadak made on 29 September 1994 to the Finnish criminal police in Turku when he said:

»- suddenly the vessel heeled to starboard, he ran back to the ECR where Treu was watching the monitor and said: "The situation is serious" or "bad" "because the ramp has been struck and became broken." - saw on the monitor that there were high waves on the car deck and that the water level had already reached the height of the personal cars.«

This was not mentioned by any of the JAIC members at the Landvetter meeting, although it concerns one of the topics of the casualty sequence-of-events. The JAIC members instead spent their time with intimidating Kadak to the effect that he withdrew his initial and very precise statement "that at 00.46 hours he saw water penetrating the bow ramp at the upper starboard corner".

In detail:

**(1) on 28.09.94 at 10.03 hours by the Central Criminal Police, Turku:**

- felt 3-4 heavy bangs and when the camera turned to the bow, saw very much water entering from that direction;
- immediate heel of 10°-15° (from previously 1°-2°);
- there was only water on the car deck - not in the engine room;
- the main engines shut off - he managed to start the auxiliaries;
- they tried to pump out the water that was entering the ship.

**Note:** The above short statement implies two circumstances:

- (a) when Treu felt the heavy bangs/blows, the monitor either did not show the bow ramp (because the system was still switched to the rotating mode) or he was somewhere else in the ECR, thus he states: "When the camera turned to the bow, I saw very much water entering from that direction." There might well have been some time between him feeling the impacts and seeing the water penetrate at the bow ramp which does not exclude that at the time of the impacts water was already penetrating the bow ramp.
- (b) Treu states that there was only water on the car deck, not in the engine room, but goes on to say that they tried to pump out the water that was entering the ship. Since it is not possible to pump water from the car deck, water must have been in some compartments in the vessel which were pumpable, i.e. 1st deck and/or 0-deck.

**(2) on 28.09.94 at 12.00 hours by unknown authority in Turku:**

- ca. 01.00 hours felt 2 double, hard bangs from forward;
- 01.15 hours saw on the monitor in the ECR that water was penetrating the car deck via the ramp, at the same time he heard the watch A.B. report about water on car deck;
- ca. 01.20 hours the bridge asked whether it would be possible to create a list to port, which it was not, because the port tank was full and the starboard one empty;
- thereafter he established that the starboard list had already increased by 1 degree and from that moment increased rapidly;
- at a list of 30°-35° the 2 port main engines stopped; an attempt to restart the engines failed;
- "We continued to make 5-6 knots."
- a moment later the 4th engine followed by the 3rd engine also stopped; the auxiliaries continued to produce power;
- ca. 01.30 hours the list was 45° and also the auxiliaries stopped and the emergency generator on deck 8 started;
- the bridge asked whether it would be possible to pump freshwater overboard, which it was not as there was no more power for the pumps;
- left the ECR and reached the 8th deck via emergency exit when the list was practically 90°.

**Note:** This statement was most probably made before anyone from ESCO or the JAIC had spoken to him and can thus be considered uninfluenced. It is the only of the official statements in which he testifies to have felt the two double, hard bangs at about 01.00 hours. At 01.15 hours he certainly saw water entering the car deck via the ramp, but he does not say whether he looked at the monitor straight after the bangs. Actually water had already penetrated the ramp before 01.00 hours. If he saw it for the first time, his timing must be wrong by 13-15 minutes, unless he did not look at the monitor before because he was busy with other matters, e.g. the starboard stabiliser. This is also confirmed by his statement that the list at 01.30 hours was 45°, which it actually was already at ca. 01.15 hours, whilst at 01.30 hours the vessel was on the side or was almost on the side, as confirmed by many survivors, e.g. trainee mate Einar Kukk who looked at his watch.

**(3) on 29.09.94 at 10.00 hours by the Central Criminal Police, Turku:**

- on watch since midnight with motorman Kadak, vessel was making 15 kn;
- at 01.15 hours the vessel was heavily shaken by 2 breakers following shortly one after the other, never before had I experienced such heavy impacts on a vessel;
- I looked at once at the monitor and saw water penetrating at the bow, the water ingress was so strong that the picture became blurred due to water splashing up to the camera;

**Note:** This is not possible. It is more likely that the drencher system became activated by some heat development which was subsequently followed by the fire alarm: the "Mr. Skylight to No. 1 and 2" call over the loudspeaker system.

- the result was felt at once when the vessel heeled 2°-3° to starboard.

- I heard on the walkie-talkie the **watch A.B. Silver Linde**, who was making his rounds and was then on the car deck, **report to the watch officer on the bridge that there was water on the car deck**;
- within a few minutes the list increased to 10°-15° whilst the vessel proceeded onwards with all 4 main engines and 2 auxiliaries running, then the 4th officer asked whether the list could be corrected by means of the port trim tank;
- as there was possibly some space in the port trim tank due to the list, I tried to pump some seawater into it, but the pump was just sucking air;
- after a few more minutes the list reached 20°-25° and the main engines stopped by means of automatic shut-down;
- I sent motorman Kadak, who was about to panic, up together with Henrik Sillaste;
- at about 01.30 hours the list was 40°-45° and also the auxiliaries stopped;
- the officer from the bridge asked whether it would be possible to pump out water from the starboard freshwater tanks, which it was not as there was no more power after the auxiliaries had shut down;
- I went up to the emergency generator on deck 8, which was running until the vessel was on her side and then also shut down.

**Note:**

- Now he declares the 2 impacts to have been **at 01.15 hours** instead of at **ca. 01.00 hours**, but states he looked at the monitor at once and saw water penetrating at the bow.
- **After or when looking at the monitor** he heard Silver Linde report to the bridge that **there was water on the car deck**.
- He repeats that **at 01.30 hours the list was 40°-45° which confirms that his timing is ca. 15 minutes late**.

**(4) on 29.09.94 - Notes taken by the Swedish member of the JAIC (by Börje Stenström)  
Engineer on duty (3rd engineer) (summary of hearing made in Finland):**

- The speed was about 15 knots.
- At 01.15 hours he noted 2 very heavy wave impacts on the ship. Water was observed, heavy water inflow, from the forward ramp, partly drenching the monitor camera.
- Vessel had 1° starboard list from the beginning, caused by the loading. Trimming tanks filled for compensation. List is starting to increase.
- Deck man of the watch reports water on the car deck. List is increasing to 10°-15° within a number of minutes.
- The bridge (4th officer) questions if the list can be compensated by ballast water. Impossible as water intake pipe now above the waterline, pump is only sucking air.
- List increased to 20°-25°. Port side main engines stop due to lube oil pressure failure, number 3 and 4 engines stop subsequently.
- **The motorman on duty is sent to the bridge to report.**
- At 01.30 the list has increased to 40°-45°. The engines driving the generators have stopped, (emergency generator has started).
- The bridge questions if trim could be compensated by emptying the starboard side freshwater tanks, no more possible as no electrical power available.

**(5) on 29.09.94 at 12.00 hours by the Estonian Security Police in Turku:**

- ca. 01.10 hours felt 2-3 heavy impacts at the bow;
- ca. 01.15 hours saw water penetrating the bow ramp at both sides on to the car deck;
- at the same time he heard the watch A.B. report water on the car deck;
- at ca. 01.20 hours the bridge asked whether it would be possible to heel the vessel to port, which it was not; - the heel to starboard increased quickly from this moment;
- tried to pump more water into the port ballast tank which failed;
- sent up the motorman and systems engineer; - at 30°-35° the port engines shut off automatically;
- at this time they were still making 5-6 kn;
- a little later also the 2 starboard engines shut off while the auxiliaries kept producing electricity;
- at about 01.30 hours the heel was ca. 45° and the auxiliaries stopped while the emergency generator started;
- bridge wanted freshwater to be pumped overboard;
- left the ECR when the vessel was practically on the side.

**(6) on 03.10.94 by the Security Police in Tallinn:**

- was in the ECR, all 4 main engines were running and the vessel was making a speed of ca. 14.5 kn;
- on leaving port they were able to balance the ship, but at sea a list of several degrees to starboard developed;
- **heard 2 hard blows one after the other which did not result from wave impact;**
- **saw on the monitor after the impacts that large quantities of water were being pressed through at the sides of the ramp and under the ramp; at the ramp itself, or at its sides, there were no sealings.**
- **Before the impacts he saw also AB Silver Linde on the monitor at about 01.00 hours or 5 minutes later.**
- **At the casualty none of the main engines were running at full revolutions or full ahead.** The officers were fixing the power output.
- He informed the officer that the engines had stopped.
- The car deck cannot be pumped out, but there were 12 scuppers on each side leading the water outboard.
- There were lots of cars. No empty space. At the sides there was ca. 20-25 cm space.

- From the bridge he received two orders:
- to pump more water to the port side, which was impossible,
- to pump freshwater overboard, which failed.

**Note:** In this statement Treu says a lot, viz.

- before the casualty all 4 main engines were running and the vessel was making ca. 14.5 kn (this implies that under the prevailing sea conditions that all 4 main engines were running on full power), however, he says a bit later: "At the casualty none of the main engines were running at full revs. or full ahead. The officers were fixing the power output.", i.e. when the casualty occurred the speed had already been reduced.
- Treu confirms the evidence of Sillaste when he states that after the 2 hard blows he saw water being pressed through on both sides of the ramp and under the ramp, and adds that at the ramp itself and its sides there were no sealings. This means that the ramp was there and visible, but at the sides and underneath water was pressing through as if there were no sealings. This implies that the ramp was open to some extent and it remained open since then, because when Treu looked at the monitor after the bangs, water was already penetrating the ramp and certainly had penetrated the ramp for quite some time already which had not been noted by Treu not looking on the monitor all the time.
- he states only one time that he saw Silver Linde before the 2 impacts at about 01.00 hours or 5 minutes later. This implies that the impacts were after 01.00 hours or even after 01.05 hours, as he has said in previous statements and which, again, proves his error in timing (whereby he was probably following instructions).

**(7) on 11.10.94 by the Finnish members of the JAIC in Naantali:**

*»During the night of the accident the "Estonia" used 4 engines at about 70 - 74% power. The speed was almost 15 knots. Treu left the ECR at about 0130 when the vessel listed 90°. He exited through the emergency exit by the funnel. A wave threw him towards the lee of the ship. At this stage the ship heeled over 90°. The stern sank first. The ship turned towards Treu. The ship sank about 15 minutes after Treu saw water entering the car deck. Water entered from under the ramp and along its sides. Water was thrown on to the video camera which is mounted in the roof of the car deck on the central casing bulkhead.«*

**(8) on 16.10.94 by JAIC in Tallinn:**

*»Treu was employed on board the "Estonia" as 3rd Engineer and had the 00.00-04.00 watch. The speed before the accident was 14.7 knots. The rpm's of the engines before they stopped was 500 rpm, which means 10-11 knots with normal pitch on the propellers. (On the wreck the pitch was found to be about 70%). Normal speed was about 580-600 rpm's. The stabilisers were deployed at 00.30. Treu did not notice the ship turning before or during the heeling over. He saw Silver Linde on the ECR monitor at about 01.00. Treu heard on the walkie-talkie how Silver Linde reported to the bridge at 01.15 that there is water on deck 1. At that stage Linde was on deck 7 distributing lifevests and only 9 minutes later he was already in the liferaft. When Treu selected a view of the bow ramp for the TV monitor, the same picture was also transmitted to the bridge. Did anyone there watch the monitor? He noticed water entering under high pressure along both sides of the ramp. From the monitor he could not see if water also entered over the top of the ramp. "Mr. Skylight" was sounded at 01.20-01.21. The port side engines stopped at about 01.20-01.25. At 01.30 Treu looked at his watch, the aux's stopped, the heel was 70°-75°, he left the ECR and on leaving checked the operation of the emergency generator. Treu got in the water on the starboard side, meaning in practice the funnel side of the heeled ship from which the wind and the waves came, i.e. the south-west side. In the raft he noted that as the ship sank her bows turned toward him, i.e. to the right. The ship sank at 01.45-20.00.«*

**Note:** Now the Silver Linde report "**water on car deck**" at about 00.45 hours has been replaced by Silver Linde reporting "**water on 1st deck**", which he also did, but much later, when he was finally on deck 7 after the big heel, i.e. probably at 01.05 hours.

According to page 175 of the protocol of the hearing on 17.10.94 (only this page is available) Treu stated:

*»Treu: I did not see Linde but I heard his report to the bridge that water was entering at about 01.1 hours.*

**Q: What did he report? Treu: Bridge from watch-keeping seaman, there is water on the car deck.«**

Why should the Estonian A.B. sailor Linde speak in English to the Estonian 2nd officer Kannussaar on an Estonian vessel? This is highly questionable, in particular in the light of the fact that Silver Linde could speak very little English, if at all, in subsequent interviews.

**(9) on 17.10.94 - Notes taken by Tuomo Karppinen:**

*»Watch Estonian time 24.00-04.00. Speed after 2400 was about 14.7-15 knots. Shortly after the accident the speed was reduced. Port ME before the accident was running at 560 rpm's. After the accident it was running at 500 rpm's and the speed was 10-11 knots. Treu did not note any vibrations, indicating that the vessel was turning after the accident. According to the ETA-Pilot the normal speed of the vessel was 580-600 rpm's. Linde was seen on the monitor at 01.00, coming from the pumping station for the visor and ramp. The bridge ordered us to pump ballast when the ship had heeled. When the ME's and Aux's stopped the bridge asked if we could pump out freshwater. 01.20 or 01.21 "Mr. Skylight". 01.20-01.25 ME's stopped due to heel. First Port, then Stbd ME's stopped due to low oil pressure. Treu left the ECR at 01.30-01.32 when the Aux's had stopped. On (=when looking at) the monitor the ramp seemed to be in its correct position when water entered the car deck around the (ramp) edges. The 4th Engineer had the watch 20.00-24.00 on the Estonian coast. He may have information on the vessel's speed. The ship started heeling when water entered the car deck. When Treu left the ECR the list was 70°-75°. Treu did not observe any heel of the vessel first to one and then to the other side, for instance first to Stbd and then P and finally back to Stbd. The ship was thus according to Treu heeling to Stbd at all times. The 3rd Engineer always had the 00.00-04.00 watch. The propeller pitch could be seen from the ECR. Treu did not observe any change in pitch. When the ship's stern sank the vessel came towards Treu. Treu was in the water on the Stbd side by the funnel. When he got into a lifeboat the ship's stern was already deep down. The ship was upright (same Finnish word for upright = stern down / stern up, as for upright = no heel, Peter's note). The lights went out at 01.30. The emergency generator functioned at greater angles of heel than the Aux's. The lube oil level in the engines was higher than normal. The emergency generator stopped when the heel was great, almost 90°. When the emergency generator stopped the accumulator batteries took over. There was light until the vessel sank. Treu did not see Linde except on the monitor, but overheard his report to the bridge. Treu is positive that Linde reported to the bridge. Treu cannot estimate when the vessel sank, maybe at 01.45-02.00. Linde reported water on the car deck at 01.15. He did not say how much or how the water was entering the car deck. Treu kept the camera fixed on the bow ramp. There were no observations of water on the lower passenger deck. When the camera showed the bow ramp the same picture was also displayed on the bridge monitor on the Stbd side of the chart room. Water entered the car deck along the sides of the ramp under great pressure. Water flew all the way on to the video camera lens. Treu did not observe water leaking along the upper edge of the ramp. Partly the upper part of the ramp was visible on the monitor. Treu was not able to say whether he could have observed water entering along the upper edge. The stabilising fins were deployed at 00.30.«*

**(10) on 08.03.95 - Interview by Jutta Rabe:**

**Q: When did you note that something unusual was going on?**

**A: Some minutes before 01.15 hours I heard strong bangs (2-3).**

**Q: Did you note anything before that time?**

**A: No, I did not hear anything unusual. I also saw that the watch A.B. was on the car deck at about 01.00 hours going his usual round. It was Silver Linde.**

**Q: What did you do at the moment of the bangs?**

**A: I went to the monitor to have a look, because I thought that the cars could have moved. From the monitor one can see the car deck from 4 different views.**

**Q: What did you see?**

**A: I saw that water penetrated the bow ramp and was smashing against the camera.**

**Q: How?**

**A: The water smashed with pressure against the camera.**

**Q: Any communication to the bridge?**

**A: I heard on my walkie-talkie that the watch A.B. told the bridge that water had entered the car deck.**

Q: Was Silver Linde then still on the car deck?

A: I heard from the voice that it was Silver Linde, but could not see him anymore.

Q: What communication did you or your colleagues have to the bridge?

A: At this moment I did not take up communication with the bridge. I understood that the bridge was aware of the situation and the bridge did not communicate to me.

Q: Contacted by the bridge at any time?

A: Yes, they did, about 10 minutes later, "Mr. Skylight" alarm had already been announced when they were asking whether ballast could be pumped from one tank to another.

Q: When was the "Skylight" call?

A: That was probably 01.23/25 hours and shortly thereafter they asked for the ballast water pumping. We were unable to do that because the list was that large that we could not do it.

Q: Who asked from the bridge?

A: The 4th officer.

Q: When did you get out of the engine room?

A: I believe it was 01.30 hours. I am pretty sure it was 01.30 hours and the list was 70°-80° because any minute the vessel was on her side.

#### (11) on 31.03.95 - The Landvetter Hearing:

The Estonian Commission member, Captain Enn Neidre, attended against the strong objections of the Finnish and Swedish members in a captain's uniform. Treu:

»At 01.15 I felt 2 strong blows not caused by waves. I was in the ECR and thought it was some truck that had started to move. I went to the monitor and looked at different pictures and then it showed the forward part. There I saw that water was penetrating between ramp and hull at such high pressure that the camera was hit. I realised that the vessel rolled 3° to starboard and 1.5° to port and the next time much more to starboard and upright and then a very heavy heel to starboard. Then I heard Silver Linde's voice on the walkie-talkie that water was entering. I left the bow camera on and then Kadak and Sillaste entered.

Between 01.20-01.25 the bridge asked whether it was possible to pump over ballast, which it was not. The port main engines had shut off already. Tried to restart them, but in vain. This was at about the time of the first "Mr. Skylight" and 1 minute later the lifeboat alarm was given.

Thereafter I ordered Kadak and Sillaste to leave the engine room. This was at 01.30 when also the auxiliaries stopped.

Next the bridge asked whether it would be possible to pump freshwater overboard which it was not because there was no more power for the pumps.

I informed the bridge that I was also going up now to check the emergency generator, which stopped after a short while when the vessel was on the side and the batteries took over the supply of the emergency lights. The main engines shut off at a heel angle of more than 45° and less than 70°.

The auxiliaries stopped at a heel of 70° and the emergency generator at 90°.

It took maximal 10 minutes from the time the auxiliaries stopped to being in the water.

At 01.35/40 I left the engine room.

Apparently the engine output as well as the pitch had been reduced before the big heel.

It is possible that the port engines did not shut off automatically, but were stopped from the bridge.

There has always been maintenance work by the crew to the visor, bow ramp and locking devices as well as hydraulic cylinders for which 2nd engineer Peeter Tüür was responsible.

Elmar Siegel saw the emergency lifeboat No. 1 - starboard side, the first boat - after the heel in the water with lights on driving away without caring for those in the water. «

**Note:** This was also seen by the passenger Thure Palmgren. »The stabilisers are pulled in automatically if the speed is below 4 kn.«

Among other things Treu made some new statements as to the stabilisers:

»**Margus Treu:** Yes, it was so that at 00.30 hours they had activated the stabilisers and it is so that if the speed drops below 4 knots the stabilisers move in automatically.

**Olle Noord:** This was not my question. The speed has in this case never been below 4 knots.

**Margus Treu:** This I cannot say, but I draw your attention to the underwater videos which show that the stabilisers are in.

**Olle Noord:** There is evidence that they had been activated. At port side a fin was seen ...

**Margus Treu:** I do not believe this.«

The above indicates that Treu, who is probably the only one to know exactly what happened, does not believe that the stabilisers were out, at least not during the final stage when the speed had dropped below 4 knots. It is the only indication in one of the official documents that there might have been something wrong with the stabilisers, because N&T/ESCO and the crew remain silent on this, which indicates that there might be some connection with the casualty.

In the book by Andi Meister, the Chairman of the JAIC until July 1996, it is stated in Chapter 7 on page 134:

»At about 00.35 hours the watch engineer went into the engine room in order to get the stabilisers in operation. At 00.30 hours the watch officer on the bridge activated the stabilisers in accordance with the master's instructions, however, one fin did not follow (did not move out).«

It is not stated what was done to rectify the problem, but Margus Treu told the English journalist Phillip Wearne in May 1998 that there had been a "stabiliser alarm" at about 00.30 hours, when the bridge tried to activate the stabilisers. It concerned the starboard fin which did not move out and it took him and Sillaste ca. 5 minutes to activate this fin. Andi Meister told Phillip Wearne subsequently that Henrik Sillaste did not confirm the above and has refused to talk about it. Sillaste told the journalist, however, that there had been major problems with the starboard stabiliser during the installation when the vessel had been in drydock at Naantali the last time, among other things; there had been a fire. The damage caused had to be repaired during the already very short time available and the vessel sailed as planned, however, without everything in way of the starboard stabiliser installation being carried out in accordance with good workmanship as it should have been.

In this connection two remarks have to be made:

1.) At the time of the casualty DIANA II was in the process of being taken over by N&T/ESCO in Rostock. Some Estonian crew members were already on board, also Captain Erik Moik as well as the representative of the Turku Repair Yard responsible for the installation of the stabilisers on the ESTONIA. This man had become very stressed upon hearing about the ESTONIA casualty, but then became very relaxed when it was reported that the visor had broken off.

2.) One of the divers spoke to a member of SEA and indicated that it is known why the casualty really happened, viz. something relevant had been only "spot welded" instead of fully welded and the element could thus not withstand the forces acting on it.

During the analysis of the statements of the survivors from deck 1 the possibility that the starboard stabiliser fin broke off and tore open the empty starboard heeling tank and/or the auxiliary engine room compartment will have to be borne in mind, in particular since recent reports from Tallinn state that there had been a lot of water in the engine room which they had been unable to pump out.

In summary:

- Treu was in the ECR from the beginning of the casualty sequence-of-events up to the end; possibly only interrupted by the time when he was working on the starboard stabiliser. During the time when he was in the ECR he had two clocks in his immediate vicinity in addition to his own wristwatch. Consequently, it has to be assumed that at least his first time statements were relatively exact, whilst the other times, e.g. when the vessel was on her side, were purely guessed. Later he knew from the other survivors that this had been at about 01.30 hours and said it was so when he was interviewed by Jutta Rabe. Therefore in his first statement he stated the time for the two impacts to have been ca. 01.00 hours, which is confirmed by many others, but later moved it back by some 15 minutes, obviously under the influence of his superiors.
- He has, however, repeatedly stated that after having felt those two unusual impacts he immediately went to the monitor and saw water streaming in respectively being pressed through at the sides of the bow ramp, i.e. the bow ramp was slightly but not fully open, because if the bow ramp had been pulled open by the visor broken-off he could not have seen the bow ramp and certainly would not have stated that water was streaming in at the sides. This does not exclude that water had been streaming on to the car deck for some time already because he was not looking to the monitor all the time, probably this was the first time.
- Consequently the following might be concluded:

- Treu heard and felt the impacts, which were not caused by waves, at around 01.00 hours;
- he went straight to the monitor and saw water penetrating the bow ramp at both sides under pressure, i.e. the bow ramp was slightly open because at that time the ramp actuators had already been torn off the ramp and the ramp was being held by the mooring line - see Chapter 19.
- simultaneously or shortly thereafter Silver Linde reported the water ingress to the bridge, i.e. he must have been on the car deck further aft - probably in the door of the centre casing - where the camera did not pick him up and where he saw the water ingress directly. This would mean that it was well before 01.00 hours, because the abrupt heel occurred at 01.02 hours and how else could Linde be in the crew accommodation on 7th deck at ca. 01.05 hours?
- Treu in his statements 2 and 3 has probably deliberately moved the times backwards by some 10 to 15 minutes; this becomes most obvious when he states - in his interview to Jutta Rabe of March 1995 - that the auxiliaries only stopped when the list was about 45° and that then it was 01.30 hours when the vessel was actually on her starboard side and that he, himself, was already on deck.
- The authors of the book 'Katastrofen Kurs', Anders Jörle and Anders Hellberg, who had early access to the initially confidential protocols and working papers of the Swedish part of the JAIC, have revealed that also JAIC had formed the opinion that Treu's timing was impossible. The authors explain this with "Treu's loyalty to Estline which apparently increased all the more as time went on" (last paragraph on page 157).

The authors continue on page 158 top:

*»His time scheme becomes totally impossible when as during the detailed questioning at Landvetter he reconfirms: "... the last time I looked at the clock was at 00.30 hours (note: Swedish time) and then the auxiliaries had just stopped." This, however, is not possible, because Andres Tammes had told the SILJA EUROPA in the course of the distress communication already at 01.25 hours that they had a blackout and therefore could not state their position. But there cannot be a 'blackout' as long as the auxiliaries are running. Even the Estonian Commission admitted that "there has to be something wrong with Treu's statements as to the times, apparently in connection with the alarm clock (in the engine room) ... there is a mistake of between 5 and 8 minutes ..."«*

- The psychologist Bengt Schager, expert to the Swedish part of the JAIC, also stated:

*»Margus Treu's exactness in question of times is questionable ... Margus Treu is about 10 minutes too late in his time statements.«*

- In the opinion of this 'Group of Experts' his timing at least 15 minutes late, and his loyalty towards Estline is also demonstrated by the obvious fact that in none of his statements does he say anything about his observation why the bow ramp was slightly open thus enabling water to penetrate the gaps at both sides from the full visor on to the car deck, viz. just what he told Hannes Kadak after Kadak entered the ECR following the abrupt heeling to starboard: "Tillståndet är allvarligt" eller "dålig", "eftersom rampen har slagit sönder." This translated means: "The situation is dangerous/serious, because the ramp has been struck and become broken."
- It is amazing that the JAIC has ignored this important observation which, fortunately, Kadak testified in his first, obviously uninfluenced, statement. Instead the JAIC has endeavoured, successfully, to weaken Kadak's precise statement (Enclosure 21.2.5.284) that he saw water penetrating the bow ramp at the starboard upper side already at 00.46 hours, which is most likely the truth bearing in mind the full visor and the conditions of the bow ramp (see statement 2nd engineer Peeter Tüür dated 03.10.94 - Enclosure 12.5.183 - and see also Chapter 16).

- The most probable explanation for Treu's observation that the bow ramp was struck and became broken can be found in Chapter 32.

#### (12) on 28.02.96 by the Transport Investigation Office, Tallinn:

- at 01.13 there were 2 bangs which caused him to look at the clock, thereafter he saw water penetrating through the ramp and simultaneously he heard Silver Linde reporting by walkie-talkie that water was penetrating the 1st deck;
- earlier - at 00.55-00.59 hours - he had seen Silver Linde at the ramp, but then there had been no water;
- when the auxiliary engines stopped he decided to leave via the funnel, **at that time the heel was 40°-45°**, it must have been 01.25 hours;
- already earlier he had sent up Hannes Kadak and Henrik Sillaste the same way;
- it took him **2-3 minutes to reach the emergency generator room**;
- when he reached **the open deck the heel was 70°-75°**;
- when he was still in the ECR he heard "Mr. Skylight to No. 1 and 2", thereafter the boat alarm with signals; at that time the vessel was heeling more than 20°;
- he was still in the ECR when the auxiliaries shut off and **the emergency generator started; the vessel's heel was then 40°-45°**;
- he was in the emergency generator room when **the emergency generator stopped** and the batteries took the power supply, the vessel then was heeling about 75°;
- the vessel was on the side when he went into the water.

#### (13) in May 1998 - Interview by Phillip Wearne:

- came already down to engine room at 23.30 and checked everything;
- at 00.30 the stabilisers were activated;
- at 01.13 he felt strong blows, went to the monitor and saw that water was pressing through the sides of the ramp;
- the water came through at both sides of the ramp and then he heard Silver Linde saying on the walkie-talkie that there is **water on the car deck**; the next thing he did was to switch the camera to the fore part of the car deck where he could see the water coming in, he stayed there waiting for orders and advice from the bridge;
- then the big heel came and **he watched the monitor only for a few moments** because he had to concentrate on keeping the engines running as long as possible;
- he did not report to the bridge what he saw on the monitor, because only a few seconds after seeing it he heard Silver Linde report water on the car deck;

- at 01.18 the heel was so big that the main engines stopped, first the port and then the starboard side, thereafter he sent Henrik Sillaste and the motorman up and maybe one or two minutes later also the auxiliaries shut off and he also left for the 8th deck;
- apart from the fact that the port ballast tank was full and the starboard one empty it had just been a normal heavy weather voyage;
- **the heel was 25°-30° when the port main engines stopped** and after half or one minute also the starboard side stopped;
- **at that time the monitor had already fallen down**, with a big crashing noise, and the only and last thing he had seen on it was the water being pressed through along both sides of the bow ramp which was spraying on to the camera, thereafter **he did not look to the monitor anymore**;
- **left the engine room around 01.28/30** when it was already dark and the floor had changed to being the wall;
- **when he looked at the monitor for the last time, i.e. before the main engines shut off, which they did at a heel of 25°-30°, the ramp was still in place.**

In summary of the thirteen statements made by Margus Treu the following can be concluded:

- **The double bangs (impacts)**

1. ca. 01.00 hours.
  2. at 01.13 hours.
  3. at 01.14 hours.
  4. at 01.15 hours.
5. No statement, but "**before the bangs I saw Silver Linde on the car deck, which was at 01.00 hours or 01.05 hours**", thus the bangs were "after 01.00 hours".
6. Some minutes before 01.15 hours I heard strong bangs (2-3).
7. 01.13 strong bangs, looked to the monitor and saw water penetrating along both sides of the bow ramp, did not report to the bridge because seconds later he heard Silver Linde on the walkie-talkie reporting to the bridge that there was water on the car deck.
8. Some time before (the bangs) he saw Linde at the ramp at 00.55-00.59 hours - then there was no water.

- **Water penetrating through bow ramp**

1. At 01.15 hours saw on the monitor that water was penetrating the car deck via the bow ramp,
2. At 01.15 hours the vessel was shaken by 2 breakers .... I looked at once at the monitor and saw water penetrating at the bow ramp which was so strong (under pressure) that water was splashing up against the camera;
3. Saw on the monitor after the impacts that large quantities of water were being pressed through along the sides of the ramp; at the ramp itself or at its sides there were no sealings.
4. Q. *What did you do right after the bangs?*  
A: *I went to the monitor to have a look ... I saw that water was penetrating the bow ramp and was smashing against the camera. The water smashed with pressure against the camera.*

**Note:** The distance between the bow ramp and camera is 25 m, thus the water smashing against the camera did not come from the bow ramp but from the drencher system activated by a possible fire on the car deck.

5. At 01.13 hours after the bangs saw on the monitor that water penetrated through the ramp, simultaneously Silver Linde report water on deck 1.

- **At 01.30 hours when the vessel was more or less on the side 1.**

- About 01.30 hours the list was 45° and then the auxiliary engines stopped;
2. At about 01.30 hours the vessel had a list of 40°-45°. The main engines had shut down already earlier and now also the auxiliaries stopped.
  3. Q: *When did you get out of the engine room?*  
A: *I believe it was 01.30 hours. I am pretty sure it was 01.30 hours and the list was 70°-80° because any minute the vessel was on her side.*
  4. The auxiliaries stopped at a heel of 40°-50° and thereafter the emergency generator started. This was at about 01.25 hours when he left the engine room.
  5. It took him 2-3 minutes to reach the emergency generator room inside the funnel. The heel was then 70°-75°.
  6. He had sent up Hannes Kadak and Henrik Sillaste already before the auxiliaries stopped.

In spite of his loyalty to Estline and ESCO Margus Treu gave a very important indication by stating that the water being pressed through the sides of the bow ramp reached the lens of the video camera fitted at the upper forepart of the centre casing. As the distance between the bow ramp and the centre casing is 27 m this is technically not possible and the water smashing against the camera lens must have come from somewhere else, the drencher system. It has to be assumed that the drencher system on the car deck as well as the fire alarm were activated and the nozzles fitted under deck also between the bow ramp and the centre casing were spraying water under pressure also on the camera lens. As this did definitely happen before 01.00 hours Margus Treu's timing has to be adjusted accordingly.

#### 21.2.4 Summary of testimonies by system engineer Henrik Sillaste

Henrik Sillaste has been interrogated - as far as is known to this 'Group of Experts' - 10 times, viz.

- (1) on 28.09.94 at 10.03 hours by the Finnish criminal police in Turku - Enclosure 21.2.4.274 with office translation.
- (2) on 28.09.94 at 20.30 hours by the criminal police in Turku - Enclosure 21.2.4.275.
- (3) on 29.09.94 by the Estonian police in Turku - Enclosure 21.2.4.276 with office translation.
- (4) on 29.09.94 by members of the JAIC (the statement is not available.)
- (5) on 04.10.94 by the Estonian security police in Tallinn - Enclosure 21.2.4.277.
- (6) on 10.03.95 he was interviewed by Jutta Rabe and a member of this 'Group of Experts' in Stockholm when he also made a very important drawing. The transcript - translated into English - is attached as Enclosure 21.2.4.278. The complete interview which was also attended by motorman Tanel Moosaar is available on 4 video cassettes.
- (7) on 13.01.96 by the Estonian police at Tallinn when he repeated the drawing he had made during the interview on 10.03.95 - Enclosure 21.2.4.279.
- (8) in July 1996 he was again interviewed by a consultant to this 'Group of Experts', this time in Tallinn. The transcript - translated into English - is attached as Enclosure 21.2.4.280. The complete interview is available on video cassette.
- (9) in April 1998 - Interview by the German journalist Christian Jungbluth - Enclosure 21.2.4.281.

(10) in May 1998 - Interview by the English journalist Phillip Wearne - Enclosure 21.2.4.282.

In addition, Henrik Sillaste had made various statements to journalists, viz.

- The first one was published already on 28.09.94 at 15.57 hours Finnish time: »According to an Estonian machine operator, **Henrik Sillaste**, who managed to escape from the ship through a funnel, the **gate of the car deck was for some reason left slightly open and water came to the deck through it**. The body of water, weighing many tons, that got inside the ferry made it very unstable, and the wind and the size of the waves (according to the reports as high as 10 metres) were enough to push the ship to its side.«

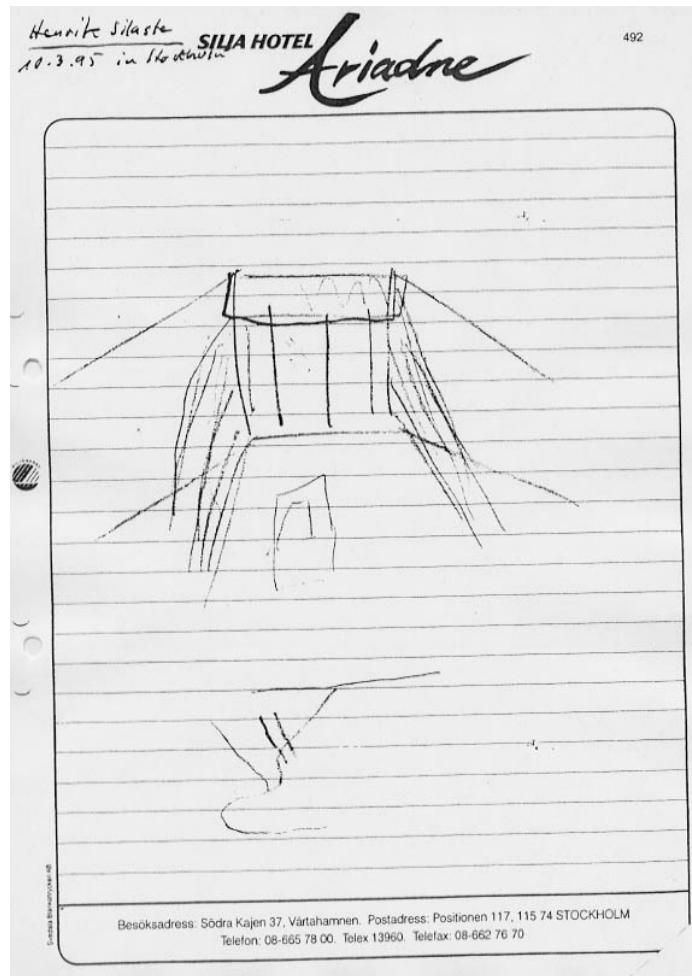
- On 29.09.94 the following was published in a Helsinki newspaper:

Motorman **Henrik Sillaste** (25), translation:

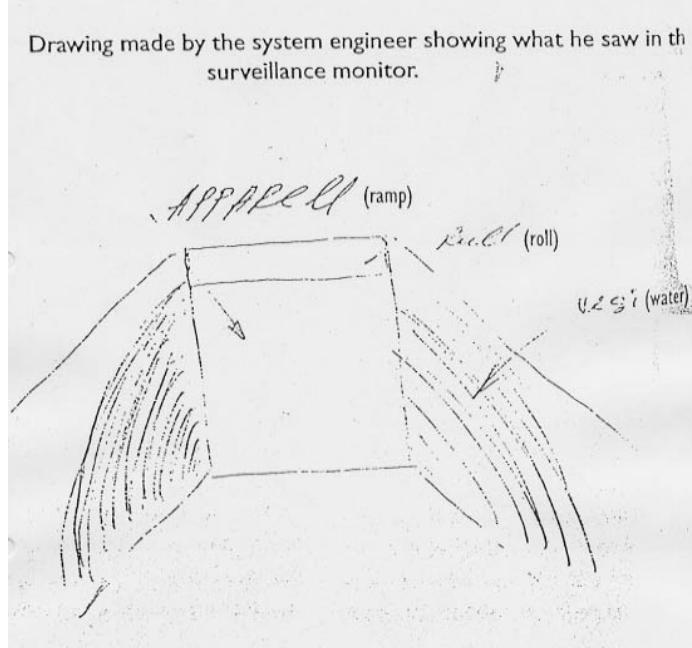
»Soon after midnight "Estonia's" forepart sunk heavily. I watched the car deck via the video control system and saw that water rushed in through the bow door, which earlier has had problems. At this moment the water already stood knee-deep on the car deck. Thereafter "Estonia" rapidly listed over. The 2 main engines stopped soon thereafter, but the auxiliary engines were still running.«

Sillaste has maintained this observation, viz. that the bow ramp was slightly open when he looked at the monitor for the first time in the Engine Control Room (ECR), during all his statements. Although he is expressing himself very carefully and has, after the first three statements taken on 28/29 September 1994 at Turku, obviously been prepared for possible further questioning concerning the visor and its locking devices, however, apparently not in respect of the bow ramp. Also the fact that he was not invited to attend the Landvetter meeting at the end of March 1995 indicates that neither JAIC nor ESCO did consider him to be a key witness. This apparently changed after this 'Group of Experts' had presented his detailed evidence, including the drawing he had made showing the slightly open bow ramp with water pressing through at both sides, to JAIC in the course of the joint meetings held during the second half of 1995.

Already in January 1996 he was again interrogated by the Estonian security police when he made another drawing showing the same condition of the slightly open bow ramp with water pressing through at both sides. Both drawings are shown below.



Drawing made by the system engineer showing what he saw in the surveillance monitor.



In detail Henrik Sillaste has testified concerning his relevant observations:  
**(1) on 28.09.94 at 10.03 hours** by the Finnish criminal police in Turku

- was in the engine control room (ECR) with 3rd engineer and motorman;
- ship turned on the side within 20 minutes;
- saw cars moving on car deck;
- got on deck when the list was 75°-80°;
- lifeboat lashings had been released in advance;
- water was entering through the bow (ramp).

**(2) on 28.09.94 at 20.30 hours** by the criminal police in Turku,

attended by :

- Simo Aarnio
- Finnish Commission and F.B.N.
- Estonian Ambassador as interpreter

- ca. 00.30 hours was called by 3rd engineer Treu to come down to repair the vacuum system;
- went down in the foreship to 0-deck to find out the cause for the problem;
- felt several hard shocks in the hull which he considered to result from wave impact although they were quite heavy;
- he had found the cause of the problem when the vessel heeled to starboard;
- he went to the engine control room (ECR) where Treu and motorman Kadak were;
- looked on the monitor which showed forward, aft and both sides of the car deck;
- saw water penetrating the forward part through the bow ramp, water penetrated in large quantities at both sides of the ramp and we were discussing whether the visor had been lost;
- **there was so much water penetrating that it could not just be a question of damage to the packings, water was streaming in all the time, not just when the bow was diving into a wave;**
- the vessel heeled **then 30°-40°** and the main engines stopped one after the other;
- at a heel of **45°-50°** he and Kadak went up **when the auxiliaries were still running**;
- when he was on **deck 6 the auxiliaries stopped**, the electricity went off and returned after some seconds after the emergency generator had started;
- **Treu had informed the bridge that water was entering the vessel and that the bilge pumps were running and pumping out water;**
- it took 15-20 minutes from the moment he saw water entering the car deck to the sinking of the ferry.

**(3) on 29.09.94** by the Estonian police in Turku:

- ca. **00.30 hours** called down to 0-deck due to the alarm system being out of function;
- went down to 0-deck in the engine room area and found the cause to be lack of vacuum;
- started to work and believes it took him **ca. 20-25 minutes** to find that out while the vessel was labouring and shaking quite heavily in the sea state;

- when he was just about to establish the cause for the vacuum, he felt **2-3 really heavy shocks in the hull** and the panel installation began to shake on the spring suspension;
- **then the vessel heeled slightly** and some drums moved to the side after **one of the heavy bangs**,
- **after the next heavy bang the drums**, which had been standing still, in the meantime moved to the other side;
- he understood that something was wrong and rushed up to the ECR;
- he reached this room after one max. two minutes after he heard the first of the heavy bangs;
- when he asked Treu and Kadak what was going on he heard water rushing on to the car deck;
- he looked at the monitor which showed the bow part and saw large quantities of water penetrating;
- **ca. 1 minute later the watertight doors were closed**;
- **at a heel of 30°-35° the starboard main engines stopped**;
- **at a heel of 40° all main engines had stopped**;
- **at a heel of 45°-50° he went up with Kadak via the emergency exit inside the engine casing**;
- **at deck 6 level the auxiliaries stopped and the emergency generator started**;
- reached deck 8 through the boiler room when the heel was 70°-75°;
- after the whistle signal, the 3rd and 2nd mates left the bridge and climbed down to help opening liferafts.

**(4) on 04.10.94 by the Estonian security police in Tallinn:**

- 00.30 hours got message in his room that the vacuum had disappeared;
- believes to have been in the engine room at 00.45 hours;
- after ca. 25 minutes work, thus after 01.00 hours, he left;
- nothing abnormal in the engine room;
- after the bangs the panel began to shake an the heel occurred which due to following wave impacts increased quickly;
- went to the ECR and asked Treu why water was entering which he could see on the monitor;
- got no answer;
- heel was 45° and the engines stopped, the coded fire alarm "*Mr. Skylight to No. 1 and 2*" was sounded, the watertight doors were closed and boat alarm given;
- upon instructions of Treu I left via the engine casing and on deck 6 level the auxiliaries stopped and the emergency generator started;
- came up to deck 8 when the heel was 80°;
- he would like to make clear, that
  - (a) he left the engine room only after 25 minutes when the vessel did not right up;
  - (b) he did not see water entering the car deck himself, Treu said that to him.

**(5) on 10.03.95 interviewed by Jutta Rabe:**

- 00.30 hours called down;
- **20-25 min. later 2 heavy impacts followed by the heel, this was at 01.00 hours or a little later**;
- rushed to ECR which took **maybe 3-5 minutes**, thus it happened after 01.00 hours;
- looked at the monitor and saw water penetrating at both sides of the bow ramp, thinks more at starboard (made drawing);
- vessel listed more and more like the hand of a watch in steps, main engine stopped;
- up at a heel of 45°/50° and when between decks 5/6 blackout and light back after some seconds (auxiliaries had stopped);
- after the main engines had stopped the Reception girl called "Alarm" several times in a crying voice, thereafter followed the "*Mr. Skylight to No. 1 and 2*" call from the bridge.

**(6) on 13.01.96 by the Transport Investigation Office, Tallinn:**

- ca. 00.45 hours left his cabin for the engine room;
- was told that the control lights of the vacuum system indicated problems and he worked on it for 15-25 minutes when he heard a hard bang which was not caused by wave impact and within less than 1 minute another bang, which until today he cannot fully explain;
- thereafter the vessel heeled and did not right up again;
- he went to the ECR and met Treu and Kadak about 1-2 minutes after the first bang;
- Treu received instructions from the bridge to right the vessel up, which was not possible;
- upon instructions of Treu he checked the car deck via the cameras of the monitor, the trucks were standing in position;
- there was no water except at the bow ramp where the water was pressing through at the sides;

- he was certain that Treu had seen this before himself;
- they did not look at the monitor together;
- he made a drawing to demonstrate what he saw - this drawing is attached to his statement (Note: see pages 476/477);
- tried to phone Leiger (chief engineer), but the telephone fell down, the table had already been torn off its welded foundation and was no more in place;
- when he looked away from the monitor two of the four main engines had shut already off and the other two were about to stop as well, also the secondary consumers shut off due to overload;
- the heel was about 30° and Treu then sent him and Kadak up;
- they reached deck 8 via the boiler room; there they met Arvi Rohumaa, Silver Linde, Victor Psjenitjnyj;
- when he was still in the engine room and the heel was 20°-30° he heard "Mr. Skylight to No. 1 and 2" and the alarm from the Information desk;
- when they were between decks 4 and 6 the emergency generator started, the vessel heeled then 60°-80°;
- at 01.27 hours he was together with Hannes Kadak, Silver Linde and others in the liferafts.

**(7) in July 1996** interviewed in Tallinn:

- was phoned after 12.00 hours to check the vacuum system;
- when he was down on 0-deck **there were 2-3 strong bangs, different to wave bangs**, he was surprised **how strong they were**, they followed more quickly as waves do one after the other;
- then **the ferry heeled and did not right up again** - realised that something was wrong and rushed to the ECR;
- **saw water penetrating the bow ramp at both sides**;
- it could be seen that the bow ramp was closed, but the water penetrated at the sides no matter what the vessel did;
- shortly later the main engines shut off automatically due to the increasing heel;
- also the auxiliaries shut off and the emergency generator took over after only seconds;
- first there was the coded alarm for the crew "Mr. Skylight to No. 1 and 2" and then from the Information desk - very desperate - "Alarm, alarm".

**(8) in April 1998** - Interview by Christian Jungbluth:

- **there were 3 bangs, most of the others forgot the first one, which was the weakest one, there were about 30 seconds between them, and the 3rd one was the strongest**;
- he assumes that the vessel righted up again after the 1st and 2nd bangs (he calls the "bangs" "beats" or "blows" and associates each "bang" with a heeling movement, the bangs came from forward);
- after the 3rd **most heavy bang the vessel heeled excessively to starboard** and the plastic containers slid down to the starboard side and he rushed to the ECR;
- **he did not see water penetrate the bow ramp, saw only the roofs of the cars, never saw water as long as he was in the ECR**;
- when he entered the ECR 2 of the 4 main engines had shut off already;
- the water tight doors were closed;
- tried to phone chief engineer Leiger, but could not reach the telephones which had both fallen down;
- thinks he was there only 5 min. before he went up together with Kadak.

**(9) in May 1998** - Interview by Phillip Wearne:

- **there were 3 strong blows, following one after the other but much quicker than wave blows do and which were different to wave blows**;
- **after the 3rd blow the ship heeled quite heavily** and he knew that something must be wrong;
- rushed towards the ECR;
- **looked at the monitor and saw water rushing in at both sides of the bow ramp**, the first thought was that something was wrong with visor and bow ramp;
- then **2 of the 4 main engines had already stopped**, then there was an attempt to pump the ballast but this was a failure;
- **the heel increased continuously clicking like the second hand of a wrist watch**;
- next also the other 2 main engines stopped while the auxiliaries continued to run;
- **tried to contact the chief engineer but telephone had fallen down**;
- just before the auxiliaries shut off there was the "Mr. Skylight to No. 1 and 2" message followed by the general alarm;
- he refers to what he said right after the accident, he might mix up things now;
- when they were between the 4th/6th deck the electricity went off and 2-3 seconds later the emergency generator started to work and they continued to deck 8, had problems opening the door at the port side because the heel was already some 70° and it was above their heads, managed finally to open the door by pressing their backs against it;
- the emergency exit was well constructed by the yard, it was quite narrow, thus they could lean with their backs against the left wall and climb all the way up, if it had been wider, they would have just fallen down;

- saw 2nd/3rd mates leaving the bridge after the Tyfon signal - did not see them again;
- ran (after the heel) through the auxiliary engine room, the storage room, main engine room and in these 4 rooms there was no water.

In summary of Henrik Sillaste's various statements the following has to be concluded:

Due to his observations and respective statements Henrik Sillaste is one of the key witnesses of the case. His statement: "*that the bow ramp was only slightly open at a time when the vessel had already heeled abruptly to starboard*" is crucial for the cause consideration, because obviously the big heel had not been caused "by large quantities of water flooding onto car deck through the bow ramp having been pulled open by the forward tumbling visor" as alleged by the JAIC.

Also his timing was quite good in the first statements but was changed possibly as consequence of influence of his principals, as evidenced by his statement taken by the Estonian security police on 04.10.1994.

**As a matter of fact, it was Henrik Sillaste who told a member of this 'Group of Experts' in March 1995 that all the crew survivors had been threatened to be immediately sacked by ESCO if they said anything against ESCO's interests to Commission members, journalists or other interested parties and this had scared all the crew survivors considerably.**

Nevertheless, in addition to the aforementioned statements about the slightly open bow ramp he has made a number of interesting remarks:

- The lifeboat lashings had been released in advance, which means that the vessel's command had been aware for some time before the big heel at 01.02 hours that the ferry was in danger of sinking.

- The heavy impacts - three in total, of which not everyone had felt the first one, but which he had, having been so close - were not caused by waves

- When he came to the ECR two of the four main engines had already stopped, i.e. at ca. 01.03/04 hours, and the other two followed shortly afterwards, the watertight doors were closed and the bilge pumps were running. (Since bilge pumps can only pump from sections below the car deck, i.e. 1st deck or 0-deck, they must have pumped from one or both of these decks.)

- He could not phone the chief engineer since the telephone had fallen down which - according to Treu - also the monitor showing the bow ramp had done at some stage.

- He and Kadak left the ECR upstairs already after having been there for only 5 minutes. Then all four main engines had stopped already, but the diesel generators were still running, possibly for another 1 or 2 minutes. This means that the main engines had stopped already at about 01.10 hours or earlier and the diesel generators stopped at about 01.12 hours, whereafter the emergency generator in the funnel had started automatically, which among other things was also supplying power to the bilge pumps.

- Just before the diesel generators stopped he heard the "*Mr. Skylight to No. 1 and 2*" alarm, which consequently must have been at about 01.10/01.11 hours.

The testimony of Henrik Sillaste further proves that the visor was full of water and remained full, respectively refilled time and again, **because water continued to stream on to the car deck no matter whether the bow was diving into waves or not.**

The apparent fact that there was something wrong with the vacuum system at about 00.30 hours is confirmed by the statement of Anneli Konrad, one of the dancing girls, who has testified, inter alia:

*"At about 00.30 hours my performance was over and I was on my way to my cabin. I went wrong and ended up on the 2nd car deck where I heard a crash. I found my cabin finally feeling very sick. There was no water in the toilet."*

The complete statement is attached as Enclosure 21.2.4.283.

## 21.2.5 Summary of testimonies by motorman Hannes Kadak

Kadak, who made his first voyage on ESTONIA and who went on his first (and last) watch on ESTONIA on 28 September 1994 at 00.00 hours, has been interrogated 3 times, viz.:

- (1) on 29.09.94 by the Estonian security police in Turku - Enclosure 21.2.5.284.
- (2) on 29.09.94 by the JAIC members in Turku (transcript not available).
- (3) on 31.03.95 by the JAIC members in Gothenburg - Enclosure 21.2.5.285.

In detail:

(1) on 29.09.94 by the Estonian security police in Turku:

- commenced his first watch ever in the engine room of ESTONIA at 00.00 hours, made an inspection round of the engine room and returned to the ECR, whereafter Margus Treu made his round;
- sometime later the bridge ordered to activate the stabilisers;
- at 00.46 hours he saw a jet of water penetrating the right side of the bow ramp, and thought it was rain water, did not report it to anybody;
- when Margus Treu returned to the ECR Kadak went to the workshop next to the ECR and on same deck, and did some work;
- suddenly the vessel sank down and fell to starboard, he ran back to the ECR, where Treu was watching the monitor and said:

**"The situation is serious" or "bad" "because the ramp has been struck and became broken."**

- saw on the monitor that there were high waves on the car deck and the water level had already reached the height of the personal cars;
- thereafter the light began to blink which meant "boat alarm";
- then Henrik Sillaste came in and the watertight doors closed again;

**Note:** This means that the watertight doors were already closed when Henrik Sillaste arrived 1-2 minutes after the sharp heel to starboard. Since a sharp heel to starboard is no reason to close the watertight door in the engine room, there must have been something else and earlier which caused Margus Treu to close the watertight doors, apparently without instructions from the bridge, because he has testified that he had only had two communications with the bridge subsequently in relation to pumping water to the high port side.

(2) on 29.09.94 by the JAIC members in Turku:  
This statement is not available.

(3) on 31.03.95 by the JAIC members in Gothenburg:

Main subject of the questioning of Hannes Kadak was his statement - obviously uninfluenced - made on 29.09.94 ([Enclosure 20.2.5.284](#)) in Turku that at 00.46 hours he had seen water penetrating on the right side of the bow ramp.

On pages 162 ff. of the book "Katastrofen Kurs" by Anders Jörle and Anders Hellberg, who had early access to the confidential protocol of the meeting, the Questions/Answers quoted below developed:

»JAIC: Are these statements correct?

Kadak: I have thought a lot about it in hindsight, but I cannot say if it was exactly that way.

JAIC: You say here that you saw water before midnight (Swedish time)?

Kadak: I have thought it over and it can be totally wrong.

JAIC: We may consequently consider it to be uncertain?

Kadak: Uncertain.

JAIC: Uncertain. This can mean that it might have been so or it might not have been so. In the statement it is written down that "... at 23.46 hours I saw on the monitor that water penetrated at the right side of the ramp". Is it correct that you said so to the officer in charge of the interrogation?

Kadak: It is so that, after coming home, I have thought it over and it is so that I am not so sure about it, and I have considered whether it could be wrong and why could I say so.

JAIC: But you did say so to the interpreter during the questioning on the 29th?

Kadak: After I came ashore I have testified so many times.«

At this stage Enn Neidre, member of the Estonian part of JAIC and in a captain's full dress uniform, interrupted the discussion:

»Neidre: I made notes at the hearing on 29 September and in these notes nowhere can the time 23.46 hours be found.«

**Note:** It is clear that Neidre never wrote down 23.46 hours as Kadak never said 23.46, because he was talking in Estonian time and in his respective statement 00.46 hours is stated as the time when he saw the water penetrating.

The psychological expert to the JAIC, Bengt Schager, commented on the Kadak testimony as follows:

»... that Kadak probably saw a water stream, but that he is afraid that this information can be relevant. We have no evidence that he has more information than he has told us and today he might be unwilling to give more information, because he might correctly assume that in such a case he would be partly blamed for the catastrophe ...., the water stream could hardly have been there, rather small or thin, because then it would hardly be visible on a small monitor.«

The further statement of Hannes Kadak, viz. that Margus Treu had told him: "**The situation is dangerous or bad, because the ramp was struck and became broken.**" is much more important, but was apparently not questioned by the JAIC.

In summary it has to be concluded that the JAIC changed the initial statement of Kadak, that he saw - expressed carefully and already under intimidation - a jet of water penetrating the bow ramp, into a "trickle" of water. Of course, a "trickle" would certainly have been difficult to observe on the small monitor, so what Kadak must have seen was much more, viz. almost the same picture that all three of them saw subsequently and of which Sillaste made two drawings. The reason why Kadak did not react differently was most likely because he was on his first watch ever on ESTONIA and simply did not know any better.

Due to the statements made by Treu and Sillaste in 1996 and subsequently - as is now known - that all three - Treu, Kadak and Sillaste - had left the engine control room much earlier, i.e. Kadak and Sillaste when the heel was 30°-35° and Treu when the heel was 40°-45°. It also explains how 2nd engineer Peeter Tüür saw Kadak on the open deck 7 as he left his cabin on the forward port side of deck 7 through the window. Since Sillaste and Kadak were together with Silver Linde in the same liferaft, which they all boarded in the forward part below the bridge and Linde has testified that he was in the liferaft already at 01.23 hours, it has to be assumed that they were out on the open deck 7 at a rather early stage, earlier than many crew members from cabins on decks 7 and 8, not to speak of the passengers from the lower decks!

## 21.2.6

### Further Evidence

This and the following pages were left empty for possible new evidence and are thus used for additional testimony received from survivors during the November 1999 hearings and which shall be quoted as follows:

Carl-Erik Raintamm - cabin 1094 - 1st deck:

- He couldn't sleep well and suddenly he heard a sound like the vessel was proceeding through ice, it was "a scraping noise", after he had realised that it couldn't be ice during that time of the year, he finally thought that the vessel ran over something, ca. half a minute later the vessel heeled to starboard.
- he ran out into the alleyway, but he didn't look at his watch, in the alleyway he saw water in the angle between the wall and the floor streaming along the wall with considerable speed,
- it was a considerable quantity of water, about 40 centimetres high, which was not running down the stairs from the above car deck, but was rushing very quickly through the centre alleyway in the angle between wall and floor, which made him run even faster into the stairway and up;
- he did not note any water coming through the car deck doors but heard an alarm signal which sounded like an old fashioned alarm clock which was ringing all the time without interruption,
- when he came up to Deck 7 he saw two officers from the crew wearing white shirts with epaulettes, but he doesn't recall the number of stripes, at least one of them had a walkie-talkie in his hand,
- he informed them that the vessel was taking water into deck 1, whereupon one officer instructed the other one to go down and check the situation when quite suddenly the ship heeled over again; and the two officers fell to the deck, where after both got back on their feet and went down, probably to investigate;
- he went out on deck through the left door on Deck 7 (that was the door on the part which was down) and saw two ferries far away from the "Estonia";
- the lamps went off and on and the vessel heeled more and more,
- probably when he tried to release a life boat, he saw a huge thing floating along the vessel, but he cannot exactly say when he saw it, the thing looked square and at first he thought that it was a part of the vessel the waves were washing over it and it was then on one level with the sea surface, he says it was so "quite some time" and others should have also seen it,
- in the official protocol he was wrongly quoted since it was stated there that he had seen "many items", but he underlines that it was only one item, several metres long each side, like a steel plate it was white and/or light and it was big and still very close and that moment he thought that this item was "the reason for everything",
- it floated away with small waves coming over it and then it disappeared.

Pierre Thiger - Admiral's Pub - 5th deck, starboard aft :

- when he was on the port side of the hull and looked forward, he saw something looking like a stabiliser fin, it was at least 5 metres long and standing completely in the air, but it could not have been a stabiliser fin which was much further aft, the object moved transverse and it was 50 % higher than wide
- he was sitting above the stabiliser fin, but the thing he saw was far forward of the vessel

- he was subsequently washed into the water by a wave, and when he finally had time to look from in the water, he saw that the visor was no more there.  
 Note: The "thing" Pierre Thiger saw far forward must have been the port aft part of the visor bulwark sticking up and extending the port hull side of the ferry. See page 1091.

## 21.3 Testimonies by Passengers and Off-Duty Crew Members

### 21.3.1 Reports from Deck 1 - Passenger Area

Deck 1 is located below the car deck, which is the bulkhead deck, and is - forward to aft - divided into watertight compartments:

- forepeak tank
- bow thruster room
- water ballast tank
- 6 compartments passenger cabins
- 2 compartments engine control room (ECR) workshop, etc., main engine casing
- 4 compartments provision/store area.

For details reference is made to the drawing showing the forward part of 0-deck and 1st deck which is attached to the end of this Subchapter as well as to the GA plan.

The passenger accommodation was accessible by 2 personal lifts and 6 stairways inside the centre casing. The forward lift and the stairway in the 4th compartment continued down to 0-deck level (swimming pool, saunas), the other lift ended on 1st deck level. Both lifts had only non-watertight doors to starboard with 100 mm sills on the car deck, while the doors on 1st deck opened to port only and on 0-deck to both sides.

The store area was accessible by 3 large lifts and 1 stairway. The first store lift had a door to starboard, while the second one had doors to both sides. Both store lifts had no sills at all and led down to the 1st deck in way of the engine room. At the aft end of the centre casing a container lift of 10' x 8' x 8' was installed which led down to the 1st deck only. The doors opened to the aft and also had no sill.

The sliding doors on car deck level leading from car deck into the centre casing above the 1st deck had sills of 130 mm above the 100 mm sill running around the entire centre casing just interrupted in way of the 2 store lifts, i.e. the sills of the sliding doors had a total height of 230 mm. None of the lift doors were watertight. All 4 lifts went up to the 8th deck.

As the 1st deck was located below the bulkhead deck the compartments were separated by watertight bulkheads which, in way of the passenger accommodations, were only interrupted by the longitudinal alleyway. The openings could be closed by watertight doors operated hydraulically either from a panel on the bridge or manually on site.

The doors were sliding doors, closing from port to starboard. The hydraulic station for these doors was located about midships in the centre casing on 2nd car deck (B-deck) level. Before and during the closing of the doors yellow flashlights went on.

The passenger accommodation was divided into 6 watertight compartments of which the first compartment was located directly behind the empty ballast water tank No. 2 and above the three freshwater tanks 4A, 4B, 5 which were all said to be full with in total 291 ts.

The 2nd and 3rd compartments were directly above the sauna/ swimming pool area, the 4th compartment was at starboard side above the sewage plant belong to the engine room and at port side above 2 conference rooms. The 5th and 6th compartments were located above the heeling tanks, two centre heavy fuel tanks and the stabiliser fin spaces. The void spaces in between were connected to the engine room area.

In the following statements of survivors from the 1st deck shall be quoted commencing with the survivors in the cabins in the most forward compartment - the 1st compartment, followed by the 2nd compartment and so on.

**The 1st compartment** - located above 3 full freshwater tanks and behind 1 empty water ballast tank.

• **Jaan Stern** - cabin 1120 - 53 years old (Estonian) - [Enclosure 21.3.1.286](#):

- most forward cabin in the centre line directly behind the water ballast tanks with the door opening to aft;
- was in cabin which he had to leave because water was already entering the cabin;
- heard immediately before casualty that waves were beating very hard against the vessel, then silence, then the vessel fell on the side.

• **Neemi Künno Kalk** - cabin 1122 - [Enclosure 21.3.1.287](#):

- woke up from loud rushing noise and saw from the angle at which his coat was hanging on the wall that the vessel was heeling about 45°, ran up and saw water on car deck.

**Note:** This cabin is located at starboard outside. The door opens athwart-ships to port. There is only one cabin between his and the cabin of Jaan Stern which is located in the centre line. Both cabins are in the same alleyway. Since both men left their cabins after the starboard heel and at this time water was entering the cabin of Jaan Stern already above the 60 mm high sill, it has to be assumed that there must have been water also outside of the cabin door of Neemi Künno Kalk.

**The 2nd compartment** - located above the sauna compartment.

• **Ulla Marianne Tenman** - cabin 1098 - 30 years old - [Enclosure 21.3.1.288](#):

- was in her cabin before the casualty;
- some time before the casualty heard several hard bangs and something beating against something which she considered to be strange and dangerous, therefore she decided to go up to deck 7 and wait to see what would happen;
- after she had been sometime on deck 7 she heard a heavy bang and subsequently the vessel heeled to starboard.

**Note:** It is uncertain when she went up. Possibly the "something beating against something" could have been the 'sledge-hammer noises' heard by Carl Övberg in his cabin starboard side in the 4th compartment. He had heard these noises about 15-20 minutes before the heel. At this time most probably there was no water on the 1st deck.

**The 3rd compartment-** located above the swimming pool compartment.

- **Carl-Erik Reintamm - cabin 1094 - Enclosure 21.3.1.289:**

- went to bed at 23.00-23.30 hours (probably Swedish time);
- woke up when shortly afterwards he suddenly heard 2 strong, strange noises, scraping noises which came from below as if the vessel proceeded through ice (which he had heard many times before);
- he realised that it could not be ice but had to be something different below water and jumped out of the bed while the vessel heeled about 10° to starboard;
- he also realised that there was something definitely wrong and that he had to get up to the lifeboat deck as soon as possible
- he left his cabin at once and found a lot of water in the alleyway;
- when he passed the shower/WC area on his way into the stairway he saw water about 0.4 m high which was rushing along the longitudinal wall with speed;
- he rushed up the stairs while the ferry heeled more over and reached the open deck 7 where he met two officers in white shirts with epaulettes on the shoulders with unknown numbers of stripes, whom he told about the water in deck 1 whereafter one of the officers send the other one downstairs;

**Note:** It has only been possible to talk to this key witness directly in November 1999 and the respective statement is attached as Enclosure 21.3.1.289.1. It has to be assumed that the two officers he met were the 2nd officer Peeter Kannuusaar and the 3rd officer Andres Tammes. It has to be further assumed that the ferry had already made the big heel to starboard and was back to 10° starboard heel when Reintamm woke up because he does not recall the big heel.

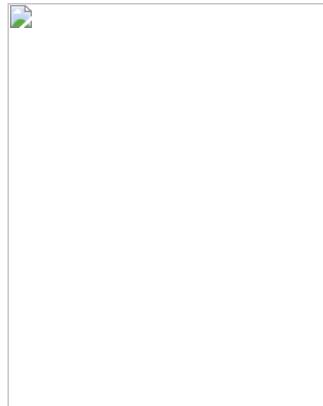
**The 4th compartment-** located starboard side above two conference rooms and port side above the forward sewage treatment installation.

- Carl Övberg - cabin 1049:

Övberg has made statements on 29.09.94 and on 10.10.94, he was interviewed by Jutta Rabe of Spiegel TV on 13.03.96 and frequently by members of this 'Group of Experts' in the course of 1997, the results of which are summarised in his statement dated 09.09.97 - attached as Enclosure 12.4.2.151. The most relevant parts of this statement in connection with the casualty scenario shall be quoted as follows:

- at about 22.30 hours (Swedish time) down to the cabin and to bed;
- he woke up suddenly from the strong noise of rushing water which he could hear from both sides, but loudest from starboard side; these noises alarmed him;
- in addition he heard quite strong metallic banging noises which definitely had not been there before; he sat up in bed and put his feet on the floor, since the bed was athwartships he was facing the door looking aft;
- he lit a cigarette and listened intently to the strange and frightening noise scenario;
- after a little while he suddenly heard the starting up noise of an hydraulic pump or pumps followed by the clicking of valves and then the typical noise created by an hydraulic system under load;
- simultaneously he heard the banging of sledge hammers;
- the noises came probably from forward;
- the hydraulic under load noise faded away and came back again whilst the sledge-hammer banging noise more or less continued. Both the hydraulic noise and the sledge-hammer banging noise continued for ca. 10-15 minutes whilst the other banging noises, then heard already for some 20-25 minutes, also continued;
- the hydraulic noise and the sledge-hammer noise stopped with a short, sharp metallic crash which gave him the impression that something heavy, metallic had broken;
- after a 'silence' of 30-40 seconds the next really extreme crash followed in connection with an abrupt stopping of the ferry which was so 'sudden' that he was thrown against the front wall of his bed; it was a short, sharp intense crash as if the ship had struck against something;
- he jumped out of his bed and put his clothes on very quickly when he realised that all the engine noises had stopped and that the ferry was now making much softer pitch movements; this must have been at about 01.00 hours.
- he rushed out of his cabin, turned right towards the stairway, around the aft part of it, through the open WT-door (watertight) towards aft, but turned around after some meters and headed forward, by now the vessel had started making sideway movements (rolling), the door at the port side of the stairway was either open or missing, and he rushed through it;
- he turned right up the stairs when his coat got caught at the beginning of the right handrail, he turned round to his right and looked over his right shoulder out through the door opening into the alleyway;
- he saw 2 goosenecks next to the cabin wall, as indicated on the drawing on the pages 517/518;
- out of these goosenecks water was streaming under great pressure, he also saw water penetrating the door forward of these goosenecks in the 3rd compartment which belonged to a cleaning room;
- he saw the water running over the floors;
- he had freed his jacket and he rushed up the stairs;
- when he was about half way up to the car deck the vessel heeled suddenly and abruptly more than 45°, probably 50° or 60°;

**Note:** The reason for Övberg estimating this large angle of heel is the fact that he was standing on the wall, as shown by the drawing below to his statement and on the following paragraph.





- the ferry quickly came back to almost upright position but then heeled about 10° to 15° to starboard and thereafter slowly heeled in steps further to starboard, which each rolling movement a little bit more. Övberg continued upwards, i.e. when the ferry rolled back to almost upright condition, he rushed upwards as far and as fast as he could and when the ferry subsequently heeled wide to starboard, he stood waiting and holding fast to the rails of the stairs, etc., his way up is demonstrated by a further drawing above;

- he reached the 7th deck and managed to get out through the open door whereafter he saw at once the lights of one ferry at port side;

**Note:** This means that the vessel was then already on a south-easterly heading. - there was one light shining from the port bridge wing, otherwise the bridge was dark. Note: This is a key statement which gives a great deal of explanation because Carl Övberg could be questioned in detail and because he was very co-operative. There can be no doubt that many of the survivors could give considerably more details if they would have been asked properly by the JAIC. Another unforgivable mistake of the JAIC who had the authority and the means of carrying out a detailed interrogation of all the survivors, however, did not make use of it.

- **Holger Wachtmeister** - cabin 1047 - 41 years old - [Enclosure 17.2.232](#):

- he was awakened **by a scraping noise and a hard bang - the scraping noise continued**;  
- he got up and dressed and left the cabin when the vessel heeled;  
- **saw water when he passed the car deck possibly already below in front of his cabin.**

**Note:** His cabin was adjacent to the cabin of Carl Övberg who rushed up before the heel and saw water. Since Holger Wachtmeister followed Övberg after the heel, he must certainly have seen even more water when he left his cabin and subsequently entered the door to the stairway, which he indicated in an addendum (attached to his statement).

- **Antti Arak** - cabin 1056 - 21 years old - [Enclosure 21.3.1.290](#):

- "At first I heard screaming and then I saw water running in the alleyway. I heard no engine noises when we were pulling us up the stairs. The lights were normal until we reached the railing on deck 7, when it began to blink."

- **Ain-Alar Juhanson** - cabin 1056 - 18 years old - [Enclosure 21.3.1.291](#).

Statement made at Turku on 29.09.94:

- "Whilst I was asleep I heard a heavier bang which I had heard before already, but not so heavy. After that bang the vessel suddenly heeled to starboard. All 4 of us woke up, grabbed our clothes and jumped into the alleyway, where we noted water."  
Statement made at Tallinn on 29.09.94 - [Enclosure 21.3.1.291.1](#):

- "We were one of the last to enter the car deck with our Mercedes bus. We were all sleeping in our cabin when we woke up from heavy metallic bangs. Due to these noises it was impossible to hear any engine noises. After the mentioned metallic bangs the vessel heeled to starboard."

- **Taavi Raba** - Reefer engineer assistant - cabin 1070 - [Enclosures 21.3.1.292 / 21.3.1.293](#):

- was in bed half sleeping, became alarmed when the vessel did not roll evenly any more and suddenly heeled to starboard so that he fell against the wall;  
- **had to jump through a water wall to reach the stairway leading from 1st deck upwards**;  
- saw water penetrating the car deck doors.

**Note:** Raba left his cabin shortly after the heel when the vessel had righted up and then took a list of 10°/15° which was increasing when Övberg was in the stairway between the 1st deck and car deck during the wide heel and Wachtmeister was about to leave his cabin, i.e. both left before Raba. It is thus logical that Raba met much more water than they had which was rushing around the corner and against him.

**The 5th compartment** - located directly above the heeling tanks. At starboard side there were 13 cabins and at port side there were the WC/showers for ladies and gents.

- **Martin Nilsson** - cabin 1028 - 22 years - [Enclosure 21.3.1.294](#).

Martin had told the police that his cabin no. was 1027, however, according to the drawing he made showing his way up, it was cabin no. 1028. The drawing is attached to his statement, which can be summarized as follows: - He went to bed at 23.00-23.30 hours, noticed heavy movements of the vessel and lots of cracking noises. He also heard that something was frequently heavily beating against the vessel;

- About 10-15 minutes before the accident became a fact, i.e. before the big heel, he woke up from the heavy movements of the vessel, heard a scraping noise, i.e. it was cracking and scraping very close to him on the deck above him. This was (for him) the introduction to the developments which ended in the catastrophe;  
- A little later Martin felt that the noises were connected to the shaking of the vessel, and then the vessel began to heel noticeably. He and his bed moved upwards while the others in their beds on the opposite side of the cabin moved downwards. He is unable to explain this in more detail. Simultaneously the strong scraping noise was being continuously heard and then Jan Gustavsson said: "Now we have run aground." So clear and distinct was this noise;

**Note:** Since noises associated with "running aground" cannot originate from above but must have come from below, this was probably a wrong description or memory of Martin Nilsson. Below him were the starboard heeling tank and the pocket of the starboard stabiliser.

- He left the cabin and jumped up one flight of stairs to the next deck (car deck), where he noted several centimetres of water on the floor;  
- When he had reached the boat deck he observed two crew members talking into walkie-talkies;  
- A search light was shining from vessel's side into the water; the lights went out/on several times;  
- He saw the lights of a ferry far away.

- **Daniel Svensson** - cabin 1027 - [Enclosure 21.3.1.295](#):

- was in this cabin with Jasmina Waidinger, but has mixed up port/ starboard, forward/aft and decks 6/7;
- vessel was pitching and rolling, at each pitch movement something was beating against the hull - "**as if someone were hammering with a big stone**".

**Note:** This is probably what Carl Övberg has identified as "**sledge-hammer banging**".

- suddenly the vessel heeled - what he believes was to port - ca. 20°-30° but continued to heel deeper;
- he jumped into the alleyway and rushed upwards;
- when he passed the car deck he saw water penetrating the car deck doors, on the floor there were ca. 10 cm of water;
- he heard crashing and squeaking noises and a car alarm from the car deck.

- **Jasmina Waidinger** - cabin 1027 - statement made on 29.09.94 - [Enclosure 21.3.1.296](#):

- went to bed ca. 23.30 hours (Swedish time) and changed beds shortly afterwards with Daniel Svensson;
- both heard strange noises "**as if the sea was striking against the vessel's bow**";
- they discussed the situation when **Daniel's alarm clock rang at midnight**;
- **she dozed for some minutes - she believes ca. 5 - when there was a "hard bang" from the car deck**;
- **at the same time the vessel heeled over to starboard** and Daniel Svensson rushed out of the cabin while she dressed and followed;
- **when she jumped out of her cabin door she saw water in the alleyway which trickled from somewhere**;
- she estimates the time from hearing the "hard bang" to being washed overboard when the vessel was on the side at about 1/2 hour.

Statement made on 04.10.94 - [Enclosure 21.3.1.297](#):

- went to the cabin ca. 23.15 - 23.20 hours (Swedish time);
- at ca. 23.30 hours went to another cabin to ask for pills, noticed nothing abnormal then;
- when she was in her bed she heard banging noises which she and Daniel Svensson did not consider to be normal; - they discussed this and she thought of the stabilisers, how they might function, etc. when **she heard a rushing sound, which was low in its intensity and which she had not heard before**;
- it seemed to her that **the rushing sound came from above and appeared to her like water running rather slowly**;
- they heard the sound of Daniel's clock indicating **midnight** which was confirmed when she looked at her watch;
- she was lying in her bed dozing a bit, but did not sleep **when she suddenly heard the strong noise above her cabin ceiling** which appeared to her to be "**something big and strong moving from one place to another**";
- immediately after this noise the vessel heeled over and Daniel shouted that they had to get out at once;
- at the same time when Daniel jumped out of the cabin door he **shouted that "there was water in the alleyway"**;
- outside the cabin she was able to lean against a wall and pull up her jeans **when she saw water penetrating the floor in front of the cabin**.

**Note:** This area was directly above the allegedly empty starboard heeling tank which apparently was now full. This could have been affected by the opened cross-flooding valve between the full port and the allegedly empty starboard heeling tank. On the other hand the starboard heeling tank could have been full all the time. - See Subchapter 17.1 and 29.5.

- **Bengt Nilsson** - cabin 1026 - 35 years old - [Enclosure 20.238](#):

- **the vessel left the berth when they entered the restaurant, i.e. at 19.30 hours board time or later (because restaurant only opens at 19.30 hours)**;
- went at 22.00 hours on deck also to forward of deck 7 - could not see anything abnormal - **it was very dark**;
- was there twice again later - no change except increasing storm and higher seas;
- at ca. 23.00 hours - must be Swedish time - he went to bed, but could not sleep due to heavy labouring of the vessel **and something beating frequently against the hull very heavily**;
- he noted after an hour or so **that it began to roar (scream, howl), squeak, shriek, scrape and finally he heard a sharp metallic breaking noise at the starboard side and aft of him**, and formed the opinion that something was wrong;

**Note:** His cabin was next to the cabin of Martin Nilsson, i.e. also above the starboard heeling tanks/starboard stabiliser space. He was lying in his bed with his head aft. The noises came from starboard aft of abeam.

- when he had reached that conclusion the vessel started to heel to starboard;
- he opened his door and saw Martin Nilsson jumping past him;
- he rushed upwards and heard strange noises.
- when he reached the deck above (**car deck**) **he saw water penetrating the lower part of the car deck door and when he was holding his hand to the wall aft of the door he noted that the wall was covered with white powder and foam which was slowly running down the wall**.
- he continued upwards and saw no more water in the stairways.

**Note:** The car deck door was at the starboard side of the centre casing. The apparent fact that water penetrated the door, although the vessel heeled to starboard, demonstrates that the water level on the car deck must have been high.

- **Ants Nadar** - cabin 1025 - 46 years old - [Enclosure 21.3.1.298](#):

- was in bed - woke up due to **hard banging noises**, started to climb up to deck **when the vessel suddenly heeled to starboard**.

**The 6th compartment** - located above the stabiliser compartments and in front of the engine room area.

- **Andrus Maidre** - cabin 1022 - [Enclosure 21.3.1.299](#):

- was in the cabin when he heard, just before or almost at the same time when the vessel started to heel, metallic scraping noises and the moving/falling of a heavy object;
- also the ringing of a clock began with the heeling. In addition, **Andrus Maidre** is quoted on page 80 in the Estonian book "*Mayday Estonia*".

*»I had just gone down to my cabin on the 1st deck and undressed when I heard crashing and banging noises, something like a truck toppling over. Then the ferry heeled so much that already from the beginning I did not believe that she would right herself up again, which she did however. I rushed up very quickly. When I passed the car deck I saw through the door gaps that really a lot of water was flowing onto the car deck. I moved on quickly because inside at this time there was only little water.«*

**Note:** Maidre left the cabin shortly after the big heel and apparently did not note water outside the cabin in the alleyway but some water inside the centre casing on car deck level and a lot of water on the car deck. According to Maidre's observation the car deck door in way of his staircase, which was the most aft one of the 1st deck passenger accommodation, was partly open.

- **Tambet Herbert Lausma** - cabin 1023 - [Enclosure 17.2.222](#):

- was in bed and asleep, woke up from **loud rumbling noises and the vessel heeling heavily to starboard**;
- on the way up he saw **water running on car deck level** around the corners.

- **Ints Klavins** - cabin 1024 - [Enclosure 21.3.1.300](#):

- was in bed and woke up from a **dangerous (evil) noise, such as metal scraping the vessel's bottom**.

**Note:** No further information are available.

- Gennadi Mikhail Pärson - cabin 1013 - Enclosure 21.3.1.301:

- was in bed but could not sleep - **before the catastrophe heard an unusual, strange noise** - cannot say exactly from where the noise came, but he had the impression **that something like a barrel was rolling against something**;  
 - when he felt the heeling he jumped up, put on his trousers and left the cabin;  
 - the heel was very noticeable;  
 - when he left the cabin **there was light in the alleyway**.

- Dainis Steiners - cabin 1015 - Enclosure 21.3.1.302:

- went to the cabin at 22.00 hours, there was no water in the alleyway;  
 - was in bed and woke up, **a heavy bang followed by the heeling**, the whole vessel was shaking - he believes it was 01.30 hours - **he did not hear the engines anymore** - which he had done before;  
 - he remembers having heard **low indefinable strange noises** when he was still dozing before he was awakened by the heavy bang;  
 - on his way up he passed the 2nd deck, i.e. the first car deck and saw water in the alleyway.

- Nikolajs Andrejev - cabin 1016 - Enclosure 21.3.1.303:

- was asleep in the lower bunk **when the vessel heeled so much that he fell out of his bunk on to the floor**;  
 - at the same time he heard and felt **an extremely hard bang which was so hard that he was thrown against the cabin wall**;  
 - he was unable to identify from where the bang came, but it felt as if the vessel had collided with something and at the same time was heeling over extremely;  
 - **they rushed upwards and when they passed the 2nd deck (car deck) cold water came from the vessel's side**, he cannot say exactly where it came from and it was not in big quantities.

- Mats Finnanger - cabin 1002 - Enclosure 21.3.1.304:

(Cabin was located in front of the engine room bulkhead at port side - Mats Finnanger (12 years old) is the only survivor from a port side cabin on the 1st deck in addition to Antti Arak and Ain-Alar Juhanson from cabin 1056.):

- **was asleep in his bed and only woke up when he was thrown out of it by the vessel's extreme heeling**;  
 - before he had not noted anything unusual;  
 - also his father was thrown out of his bed.

In summary of these statements of the survivors from the passenger accommodation on the 1st deck, the following can be concluded:

(a) 21 passengers from the 1st deck survived. This is a comparatively high number, bearing in mind that from all the six accommodation decks only 137 persons (official number) had survived, because the survivors from deck 1 had by far the longest and most difficult way to deck 7. Presumably because they had been warned early through their proximity to the noise scenario, they had therefore left their cabins earlier and faster than many of those from the upper decks had done.

(b) 9 reported water on the 1st deck, of which two noted the water already **before** the big heel, but the others only one minute or more thereafter. 4 reported a lot of water up to 0.4 m high which was rushing very quickly respectively under pressure. Thus water has been on the 1st and consequently also on 0-deck **before** the big heel.

(c) 9 reported water on car deck level inside the centre casing and/or penetrating the car deck, of which one saw water directly on the car deck through a partly open car deck door (most aft stairway for passengers).

(d) 14 reported the abrupt wide heel (45°-60°), were thrown out of their beds and/or against the walls etc., but only three reported that the ferry more or less righted up thereafter, although it is absolutely clear that if the ferry had not righted from a heel of 45°-60°, nobody would have been able to escape from the 1st deck or would have been able to reach the outside of deck 7 from any other deck.

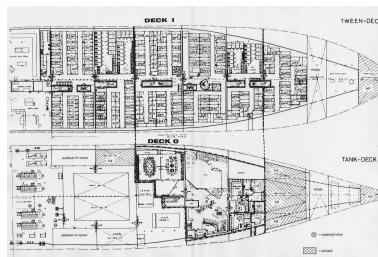
(e) Water was reported from the 1st, the 3rd, the 4th and the 5th compartments. In cabin 1120 located in the first compartment in the centre line, on top of a full freshwater tank the water penetrated the door from the alleyway, i.e. the water height in the alleyway exceeded the height of the door sill. In the 3rd compartment water was noted in the alleyway, probably originating from either the spiral staircase or the lift casing. In the 4th compartment water was seen to escape from 2 ventilation openings under high pressure. In the 5th compartment water was reported to have penetrated the floor. All observations were made either in the longitudinal alleyway in the centre line or in athwartships alleyways at the starboard side only.

(f) The time for the big heel was stated only by few survivors to have been just after 01.00 hours.

(g) **The noise scenario:**

Most of the survivors reported **at least one very heavy bang, crash, impact combined with an abrupt stopping of the vessel as if the vessel had collided with something**, which was so strong that they were thrown against the walls, etc. Before this very dramatic crash/impact noise, which apparently caused the vessel to stop abruptly and which was clearly before the sharp and wide heels to starboard, there had been other noise scenarios heard by survivors, which were different. While Carl Övberg was in his cabin in the 4th compartment he heard hydraulic and sledge-hammer type banging noises. The others further forward and aft heard howling, squeaking and, most dominantly, scraping noises which were combined with the shaking of the vessel and which sounded as if the vessel proceeded through ice.

(n) This noise scenario has been explained in detail to the diving and underwater explosives expert Brian Braidwood, who has excluded, with a high degree of certainty, that any of the noises heard by the survivors could have been caused by explosions. See also Chapter 32.



(click for full page images)

### 21.3.2 Reports from Deck 4



This deck is located directly above the car deck and approximately the forward two-thirds are arranged for passenger accommodation. In the aft one-third there are conference rooms and the Estonia Club on port side.  
The persons having been on this deck - located above the car deck and being on same level with the forecastle deck - have made most important observations as summarized below:

In the **forward** part there were among others:

port outside:

Anders Ericson  
trainee officer  
Einar Kukk A.B. sailor Aulis Lee with his wife Aina Lee

port inner side:

Mikael Öun  
Stephan Duijndam  
Eckard Klug

starboard outside:

Tony Spuhl

**Anders Ericson** - cabin 4131 - 45 years old - port outside (3rd cabin from forward) statement is attached as [Enclosure 20.239](#):

- went to cabin at 22.15 hours (Swedish time), but impossible to sleep, each time the vessel met a wave it was shaking/vibrating severely;
- ca. 24.00 hours (Swedish time) **came suddenly two heavy bangs, one straight after the other** which almost threw him out of his athwartships bed, he realised that something must be wrong, thus got up and dressed himself
  - he had the feeling that the noises came from nearby his cabin (2nd cabin port outside from forward);
- he opened the cabin door, looked out and saw nobody, he went along the alleyway to midships and then followed the alleyway aft. **When he had made about 2/3 of the way to the large centre stairway the vessel suddenly heeled to starboard** (he had walked ca. 32 m, i.e. incl. opening door, looking out and walking ca. 32 m it should have taken ca. 1 minute);
- he waited a short while for the ferry to right up again, which she did not. He continued to the centre stairway and went up the stairs. The list increased.
- **When he reached the 6th deck the listing stopped at about 30°.**
- **On deck 7 he opened the door to the outside with two other persons.**

**Note:** Anders Ericson and the two other persons were the first ones to reach the open deck 7.

**Aulis & Aina Lee** - A.B. sailor in cabin 4125 (because his wife was on board) - [Enclosure 21.3.2.305.1](#):

- woke up from the heavy heel, no observations or noises heard before or after, up to deck 7 and into liferaft.

**Note:** Actually Aulis Lee had left the cabin time before the big heel and was most probably one of those working on the car deck while his wife stayed back in the cabin and was later - after the big heel - brought up to the 7th deck either by him or another sailor (statement Elmar Siegel!).

**Einar Kukk** - Trainee officer - cabin 4103 - port outside - 2nd last cabin - Statement of 29.09.94 - [Enclosure 17.2.217](#):

- at about 00.30 hours Silver Linde returned from his safety round to the bridge and said everything was o.k.
- 5-10 minutes later he left the bridge and went to his cabin, cleared up some matters and went to the Pub (where also Karaoke was performed).

**Note:** Pub Admiral is located on the 5th deck starboard side, aft.

- There he saw Silver Linde in the door at about 00.40 hours. Kukk left after some minutes and went to his cabin, where he arrived at **00.50 hours**, went to bed, but could not sleep.
- **After 5-10 minutes** he heard a **strange noise which was very unusual** (and alarming) to him; got up and dressed; **whilst he was putting on his shoes the vessel heeled to starboard**, he cannot say how much,
- he rushed up to the 7th deck,
- when he was between 6th/7th deck he noted a shock/vibration inside the vessel.

**Note:** It has to be assumed that Einar Kukk went first to the bridge and subsequently to deck 7.

**Mikael Öun** - cabin 4217 - port inside, middle.  
Statement of 29.09.94 - [Enclosure 17.2.224](#):

- was in bed but could not sleep;
- close to 01.00 hours he noted that the vessel's movements changed, i.e. whilst the vessel had so far been pitching, she now started to roll 3°-5°;

- after a heavy wave **impact he heard 2-3 severe scraping noises from forward** - this was at **01.01 hours** - followed by a slight listing to starboard and some things fell down;
- directly thereafter followed a very severe heeling and now everything loose was sliding to starboard. Statement of 04.10.94 - [Enclosure 17.2.225](#):
- was in bed and continuously heard banging noises which he believed to be caused by the waves hitting against the bow;
- he slept a bit and **woke up again and finally was fully awake when he heard a particularly loud bang and because the vessel started to behave differently in the sea state**;
- he noticed that **the vessel started to roll from side to side** instead of pitching against the sea;
- **he also heard 3 heavy scraping noises which followed straight one after the other with some seconds in between and after these scraping noises the vessel heeled severely to starboard**;
- **at first there was heavy movement of the vessel and a slight list remained and the vessel remained with that list for a while**;
- **a little later the heel suddenly increased severely and everything loose moved toward the cabin door whereafter the vessel righted again**;
- he got out of his bed, put on some clothes and removed the loose objects from the door in order to open it, thereby he put his camera and the alarm clock in his pocket;
- after his survival he realised that the **alarm clock had stopped at 00.02 hours (Swedish time)** because the moment it fell from the table, due to the sudden heeling, the batteries had become disengaged and the clock stopped.
- **Consequently the time of the 1st heavy heeling to starboard was 00.02 hours Swedish time = 01.02 hours ship's time.**

**Eckard Klug** - cabin 4214 - 54 years old - port inside middle - [Enclosure 17.2.221](#):

- was in bed, heard many bangs which he had never heard on his many previous voyages, in his opinion these were cars floating on the car deck;
- **in his opinion the unsecured cars and trucks had moved forward against the bow ramp due to the hard setting in of vessel's bow and forced the bow ramp open and this is the cause of the casualty**;
- Klug heard in addition to the above explained bangs a bang which was heavy as if breaking of a thick plate;
- they got up and by the time he had reached the cabin door the starboard heel started;
- when he reached the boat-deck the list was about 30°.

**Note:** When being questioned in October 1999 Eckard Klug stated to have information that the bow ramp had not been secured at all.

**Stephan Duijndam** - cabin 4221 - port inside middle - [Enclosure 17.2.220](#):

- at 23.00 hours to bed;
- woke up at 01.00 hours from a noise as if the vessel had collided with something, heard several cracking/crashing noises thereafter;
- a little later the vessel heeled to starboard to such an extent that he was thrown out of his bed;
- met chaos everywhere on his way up;
- on 7th deck was an officer with white shirt and walkie-talkie.

**Jaak Mollo** - cabin 4214 - port inside, middle (cabin mate of Eckard Klug) - [Enclosure 17.2.223](#):

- woke up when he was thrown out of his bed by the abrupt heel to starboard;
- visor fell off after 5-10 minutes, bow ramp looked as if it had fallen backwards.

**Jukka Pekka Ihlainen** - cabin 4212 - port inside - (cabin mate of truck driver Leo Sillanpää ((( )) - [Enclosure 21.3.2.305](#)):

- truck driver who had previously been with the Coast Guard/Navy at Russarö;
- to bed at 22.30 hours, woke up due to radio music at 00.32 hours, turned down the sound and slept again;
- woke up again shortly afterwards from 3 very hard bangs/crashes;
- realised that engines were reduced and stopped;
- then the vessel heeled and drifted with wind and sea;
- saw the other two ferries at port side (could not believe that ESTONIA had changed course so much after the heel);
- the other two ferries continued their course and speed;
- met Per-Erik Ehrnsten in the liferaft.

**Margus Karmet** - cabin 4224 - starboard inside - [Enclosure 21.3.2.306](#):

- was one of the first trucks to drive on board - trucks and trailers were secured by belts;
- to bed ca. 23.30 hours, heard strange cracking noises in the structure, woke up from some unusual noise and that he heard flower pots and other things smashing against the wall due to the abrupt and wide heel;
- noted later from the liferaft that the ramp was missing.

**Ainus Toobal** - cabin 4224 - starboard inside - [Enclosure 17.2.229](#):

- heard at 00.30 hours strange bangs and metal bearing against metal - heavy heel to starboard and vessel did not right up;
- heard subsequently from crew members that water had penetrated the bow ramp.

**Tony Spuhl** - cabin 4313 - 2nd cabin starboard forward outside -- statement taken on 06.10.94 - [Enclosure 17.2.228](#):

- could not sleep due to labouring of vessel;
- looked frequently out of the window;
- listened for the noises which the bow created when smashing into the waves and thought spontaneously that the vessel should not be going so fast against such waves;
- he noted after a while that the engine noises became different and he got the impression that the vessel reduced the speed;
- he was lying there and continued to listen to the noises and the roaring was quite severe when the waves slammed against the bow;
- after a while he heard an enormous crash and the whole vessel was shaking/vibrating;
- he looked out of the window and is not really sure whether the vessel was proceeding ahead or was lying still (did not move);

- the normal roaring noises remained when the bow was slamming into the waves, **but then came "2 metallic noises"**, which sounded like "klonk-klonk" directly after the bow was setting into the sea;
- when the next wave hit the bow Tony Spuhl heard something which sounded like "klonk-klonk-klonk", 3 times. Directly thereafter he heard a rushing noise below his cabin. The noise came from the car deck.
- he was still lying in his bed and heard this **rushing sound once more**;
- his partner René by then was also awake and he said: "Something is wrong, we must get out of the cabin."
- Whilst Spuhl was jumping out of his bed, he saw René opening the door, at this very moment the vessel heeled suddenly to starboard.

**Pär Andersson** - cabin 4319 - starboard outside - Enclosure 21.3.2.307:

- nothing special until midnight - made outside/inside walk around the vessel after midnight and also looked down on the forecastle deck, saw wet carpet and water on stairs between decks 5/6;
- heard and felt between 0.00-01.00 hours heavy metallic banging;
- estimates that the engines stopped between 01.05-01.10 hours;
- reported the severe starboard heel only when they were already on the 7th deck together with other people.

In the aft part of deck 4 behind the reception area several passengers have survived. Some of them made the following observations:

port outside : Morten BojeJensen  
 port inner side : Anneli Konrad :  
 Wanda Wachtmeister :  
 Magnus Lindström  
 starboard outside : Tom Olav Jonsson  
 starboard inner side : Raivo Tönisson  
 aft part : Kerim Nisancioglu :  
 Yngve Lien :  
 Kalvet Maiko :  
 Marek Kaasik  
 Estonia Club : Janno Aser

**Morten Boje Jensen** - 28 years old - cabin 4603 - port outside, 2nd cabin behind the Reception - Enclosure 21.3.2.308.  
 (Danish) Statement taken by the Copenhagen police 06.10.94:

- ca. 22.40 hours Swedish time in bed - 23.00 hours switched off the light, but could not sleep, he heard continuous "small banging noises" which did not appear to him to be natural.
- after a certain time, cannot say how much later, **he heard 3 "bangs" one after the other. Between the first and the 2nd a car alarm sounded below him, but not after the 3rd one which came from port side**;
- shortly afterwards the ferry heeled to (he said port) must be starboard side and simultaneously he heard below himself the noise of a large object moving from port to starboard. After some seconds he jumped out of bed and left the cabin;
- could not reach the centre stairway directly because his alleyway was blocked by iron bars to forward, had to go back and then over to the starboard alleyway which was clear.

**Anneli Konrad** - cabin 4620 - dance girl - port inside, 3rd last cabin - Enclosure 21.2.4.283:

- shared cabin with Hannely Veide, both were making first trip, thus were not yet acquainted with the vessel;
- last performance ended at ca. 00.30 hours, whereafter she made her way to her cabin;
- **she got lost and ended up by the lift on the 2nd car deck, where she heard a "crash";**
- came finally to her cabin, felt sick, no water in toilet;

**Note:** Henrik Sillaste was working on the non-functioning vacuum system in the engine room on 0-deck level at that time.

- she switched off the light in her cabin to sleep, but it continued to blink (on/off);
- apparently must have slept, because she stated having woken up due to a "crash" and the vessel was shaking whereafter she felt that the vessel heeled over.

**Wanda Wachtmeister** - cabin 4618 - 4th deck - next cabin further aft. Statement taken on 29.09.94 - Enclosure 20.247:

- in bed - could not sleep - suddenly she heard "ett brak" = one crash - this was a loud bang and thereafter the vessel started to heel to starboard.

Statement taken on 01.10.94 - Enclosure 21.3.2.309:

- in bed - heard a heavy loud noise - "bom" - a noise of the type that makes you realise at once that something is wrong;
- the vessel heeled substantially to starboard and maintained the list;
- upon being questioned with what she could associate the noise "bom" she said it came from the bottom of the vessel, from the same hull, a clear, distinct "bom" - not rattle;
- when she reached the deck above, i.e. 7th deck, she looked at her watch and it was **00.05 hours Swedish time = 01.05 hours ship's time**.

**Tom Olav Jonsson** - cabin 4405 - starboard outside, 3rd cabin after the Reception - Enclosure 21.3.2.310:

- he was in his cabin and had just completed his toilet/washroom matters when the vessel suddenly heeled to starboard and did not right up again.
- he looked out of his window straight into the sea and saw the waves smashing against the window.

**Note:** In upright position the windows on 4th deck are 8.8 m above waterline, at a starboard heel of about 45° the windows were touching the water level which created the impression that waves were smashing against the window.

**Marek Kaasik** - deck passenger in some room in the aft part of deck 4 - Enclosure 21.3.2.311:

- about one hour before the vessel fell on the side he felt that the vessel's whole construction was suddenly shaking;
- at some time they heard metallic noises from upper decks and became aware of the heeling.

**Magnus Lindström** - cabin 4429 - starboard outside aft part - Enclosure 21.3.2.312:

- Magnus and his wife went to bed at about midnight, but due to the heavy movements of the vessel it was difficult to sleep;
- at 01.00 hours he heard strange noises, the tooth brush jumped out of the glass and other things fell down, he noted noises from the car deck, it appeared as if something was rolling over the car deck;
- after the rolling he heard one heavy metal bang and then the vessel heeled 10°-15° to starboard. It is difficult to state that more exactly as the vessel was still pitching and rolling.

**Kerim Nisancioglu** - in the cinema - aft part of deck 4 - Enclosure 21.3.2.313:

- shortly before the heeling started the vessel began to roll equally in the waves from side to side and he believes that then the waves did not come from ahead anymore. **At that time he did not feel the engines;**
- in connection with this rolling, the vessel heeled to starboard and he heard something below them sliding over to starboard. According to the noise this came from some place below them and must have been some large object;
- shortly after this noise he felt that the vessel heeled more to starboard;
- they came to the Information desk, there were two girls who refused to talk to them - they were totally helpless.

**Yngve Lien** - deck passenger in cinema in the aft part of deck 4 - Enclosure 21.3.2.314:

- ca. 23.00 hours to sleep;
- heard a heavy noise and the vessel heeled to starboard.

**Kalvet Maiko** - deck passenger on deck 4 - Enclosure 21.3.2.315:

- woke up when the vessel heeled to starboard;
- water splashed against the window.

**Raivo Tönisson** - cabin 4426 - starboard inside - Enclosure 17.2.230:

- heard and felt hard blows/bangs between 00.00-01.00 hours;
- at 01.00 hours heavy bang and shortly later the vessel heeled wide to starboard, everything slid over to the deep side.

**Janno Aser** - Estonia Club - port aft - Enclosure 21.3.2.316:

- the vessel was shaking/vibrating when he suddenly felt the heel to starboard, saw furniture moving to the deep side;
- the heel was 45° when he had reached deck 7 outside.

**Summary of observations made / noises heard / times realised by passengers/ crew members in the area of the 4th deck Before and after the starboard heel:**

- a.) First noises / extraordinary shaking / vibrating of vessel / crash.
- b.) Speed reduced / engines reduced / engines stopped.
- c.) Movements on car deck.
- d.) Several bangs and starboard heel.
- e.) Time of starboard heel.
- f.) The righting up after the big heel.

**as to a.)**

**First noises / extraordinary shaking / vibrating of vessel / CRASH.**

(1) Ca. 23.45 hours (Swedish time) = 00.45 hours ship's time a dull bang and ca. 1/2 minute later a similar bang were heard, these were really sharp and short sounds which were clearly heard despite the music, the vessel was shaking somewhat, the noises were not created by waves striking against the bow;

(2) after a while there was an enormous crash and the whole vessel was shaking / vibrating;

(3) 23.45/50 hours (Swedish time) 3 metal to metal bangs with 15-20 seconds in-between were heard and the vessel was shaking/vibrating differently than before;

(4) got lost and ended up on the 2nd car deck, where a CRASH was heard (probably the same as under (2));

(5) time before the vessel fell on the side it was felt that the vessel's whole construction was suddenly shaking (probably the same as under (2));

(6) unusual shaking/vibrating of the vessel's hull were felt, these shocks were really shaking the vessel and the truck drivers felt uneasy wondering whether the trucks were really secured.

In summary of the above item a.) it has to be concluded that the survivors from the 4th deck heard and felt at about 00.45 hours a dull bang and 30 seconds later another similar dull bang. These were sharp and short sounds. A moment later there was an enormous crash and the vessel's structure was shaking/vibrating. Again a little later there were 3 metallic bangs after which the vessel was shaking/vibrating differently than before.

**as to b.)****Speed reduced / engines reduced / engines stopped.**

(1) It was noted after a while that the engine noises became different and that the vessel's speed might have been reduced;

(2) a little later a deep/slow pitch movement and vibrations in the aftship like from astern-pitch and/or stern turned into the wind were realised - glasses were clinking;

(3) shortly before the list started the vessel began to roll equally in the waves from side to side and it felt as if the vessel did not have the sea from ahead. At that time the engines were not felt;

(4) there was uncertainty whether the vessel was proceeding ahead or was lying still (did not move).

In summary of the above item b.) it has to be concluded that at some short time after the noise scenario summarised under item a.) the engines/pitch were reduced and/or put to 0 and/or to astern. It has further to be concluded that the course was changed to port or to starboard to the effect that wind/waves came either from port or starboard and caused the vessel to roll.

**as to c.)****Movements on car deck.**

(1) Many bangs were heard, which in such intensity had never been heard before on previous voyages and which were considered to be cars floating on the car deck;

(2) at 01.00 hours strange noises were heard and it was noted that the noises came from the car deck, it appeared as if something was rolling over the car deck.

In summary of the above item c.) it has to be concluded that doubtless there were movements of cars and in all probability also of trucks. The inside of the bow ramp shows damage from inside to outside which could have been caused by a truck. On the other hand what many explained as "movements" on the car deck could also have been the scraping noises deeper below.

**as to d.)**

Several bangs, etc. and starboard heel.

(1) At ca. 01.00 hours suddenly 2 heavy bangs, one straight after the other, then suddenly a very low noise was heard and the pitch movements stopped, thereafter pitching and rolling and then only rolling - 2 full swings, i.e. less to port/more to starboard; at the 3rd swing the vessel heeled deep to starboard, righted almost and then fell abruptly to ca. 15°, this was just before 01.00 hours;

(2) other survivors identified the bangs to be more like 3 scraping noises which followed one straight after the other with some seconds in between and after these scraping noises the vessel took the severe heel;

(3) the heel caused the alarm clock to fall from the table, the batteries became dislodged and the clock stopped at 00.02 hours Swedish time = 01.02 hours ship's time which has to be considered the exact time of the big heel;

(4) in a starboard forward cabin a rushing noise was heard from below after the bangs but before the big heel;

(5) another survivor reported that 3 "bangs" were heard one after the other; between the first and the second a car alarm sounded below, but not after the third one which came from port side. Shortly afterwards the ferry heeled to starboard side and simultaneously below the noise of a large object moving from port to starboard was heard.

In summary of the above item d.) it has to be concluded that there had been 2-3, probably 3, bangs, crashes, shocks at about 01.00 hours which were followed by the big heel shortly later. The time of the big heel was 01.02 hours when the alarm clock stopped because the batteries had become disengaged.

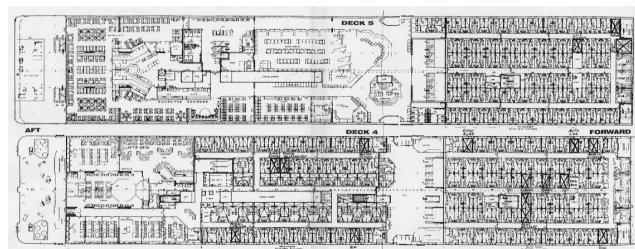
**as to e.)****Time of starboard heeling.**

- Anders Ericson - at ca. 24.00 hours Swedish time = 01.00 hours ship's time suddenly felt two heavy bangs, got up and dressed and had walked ca. 32 m in the alleyway when the vessel heeled to starboard ~ 2-3 minutes after 01.00 - 01.02/03.
- Einar Kukk - at 00.50 hours back in cabin and to bed, could not sleep, after 5-10 minutes strange noise, got up and dressed when vessel heeled to starboard, thus at ca. 01.00 hours.
- Mikael Öun - alarm clock fell from table when vessel heeled to starboard and stopped at 00.02 hours Swedish time = 01.02 hours ship's time.
- Stephan Duijndam - 01.00 hours woke up from noise as if vessel had collided with something, heard several crashing, cracking noises - thereafter heel to starboard, which threw him out of his (upper) bed.
- Magnus Lindström - heard rolling (scraping) noise from below, at ca. 01.00 hours tooth-brush fell out of glass and other things fell from the shelf, heavy metal bang followed by the heeling.
- Juri Pekka Purilävi - awakened at ca. 01.00 hours by an enormous crash followed by the big heel, two men from the upper beds were thrown to the floor.
- Wanda Wachtmeister - after she had reached the 7th deck she looked at her watch - it was 01.05 hours, i.e. the heeling must have been some minutes before, say at ca. 01.00 or 01.02 hours.

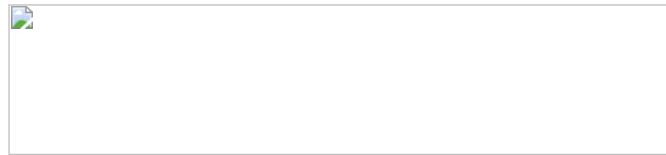
In summary of the above item e.) it has to be concluded that according to the survivors of the 4th deck the time for the big heel was 01.02 hours.

**as to f.)****The righting up after the big heel.**

- Mikael Öun - he thought that they were turning the vessel, it appeared as if the waves were then coming from the starboard side, the vessel suddenly heeled wide over, the alarm clock fell from the table and the vessel righted up and heeled again to ca. 10°-15°.
- There is no other known statement from the 4th deck survivors about the righting up of the ferry.



### 21.3.3 Reports from Deck 5



Only in the forward third of this deck passenger cabins were arranged. In the middle was the large Tax-Free Shop, the Boutiques were at starboard side as well as the Pub Admiral, also called the Karaoke Bar. On port side there was the Arcade, with the Playroom and in the aft part Café Neptunus. Considerable modifications had been carried out on this deck in comparison to the newbuilding condition. The drawing attached after this page shows the location of the cabins of the survivors from this deck:

**Birgit Eriksson** - cabin 5229 - 1st cabin on port side in front of accommodation (overlooking forecastle) [Enclosure 21.3.3.317](#):

- at about 23.00 hours the vessel began to move and labour heavily in the seas;
- woke up from **noises like that of steel plates knocking against steel plates**;
- **after these steel-to-steel noises the vessel heeled heavily to starboard**, her husband caught her from falling out of bed.
- the direction where the noises came from was forward.

**Sten Jolind** - cabin 5135 - first outside cabin, port side, forward - [Enclosure 21.3.3.318](#):

- was on deck 7 several times and looked over the foreship; heard heavy bangs and thought that the vessel was going much too fast;
- at 00.00 hours to bed;
- before 01.00 hours 2-3 really heavy bangs from forward; got up and dressed;
- when he had just opened the door the vessel heeled abruptly and widely to starboard and everything slid against the door;
- at first no one was in the alleyways;
- the vessel heeled stepwise.

**Leif Bogren** - cabin 5128 - port inside, 4th cabin from forward - Protocol 01.10.94 - [Enclosure 20.242](#):

- **to bed at 23.30 hours** (Swedish time);
  - vessel behaved like a small boat also does when slamming over the waves - explains the many noises created by a vessel proceeding against heavy seas;
  - so he was lying there and listened and suddenly there was the bom-bom, which was no more the same noise, it was not a good noise;
  - he continued lying still and listening, and was fascinated about why they were proceeding so fast?
  - **from the time he went to bed** to the first unusual noise bom-bom to when the engines stopped **maybe 10-15 minutes had passed**, i.e. it was 23.40/23.45 hours Swedish time;
  - at first there was an additional sound with this bom - an enormous bom-bom - then came bom;
  - he was lying awake and then came the next BOM.
- This was definitely a different noise, now the sea was higher and they were proceeding slowly against it and then came the next VROM BOM, now they were smashing in the hull plates of the vessel and then there was also a CRASH.
- **Now they must go down to half speed was his next thought, and the engines stopped.**
  - Had they reduced to half ahead he would not have felt uneasy, but to stop the engines? Engines are not stopped from full ahead and **at that time the vessel had not yet started to heel to starboard**.
  - **Ca. 1 minute after the engines had stopped the vessel heeled to starboard (20°).**
  - It took him ca. 5 min. to reach deck 7 (2 decks up) and then the vessel had a list of already ca. 45°.

**Note:** The vessel was fitted with 2 pitch propellers which could be controlled either directly or via the combinator. - See Subchapter 2.5.3 - In all probability the engines and the pitch propellers were working in the combinator mode, i.e. in case the speed was reduced from full to slow ahead the pitch and the propeller revolutions were reduced simultaneously. Based on experience a passenger in a cabin or in some restaurant could normally notice a pitch change only by a change of vibration. If, for example, the pitch was reduced to maintain a speed of 6 kn, the vibration level would more or less totally disappear in the passenger cabin and the passenger had the impression that the engines did stop.

**Additional Protocol of 02.10.94 (is attached to his statement):**

- Bogren has in the course of his working life also worked at a shipyard and is therefore acquainted with metallic noises. He is also to a certain extent acquainted with the sea as he has a pleasure boat.
- Bogren described the sound like someone beating with a sledge hammer against vessel's shell plating or hull. **He noticed the noise three times within 2 minutes.**
- He had the impression that the noises came from forward, port side and from below.
- Bogren stated that the vessel did not roll, but was pitching against the waves.

**Summary of the reports in his book: "Therefore I Survived the 'Estonia' Catastrophe"**

- normal cracking/banging noises of a vessel in heavy weather.
- at 00.00 hours was on the 8th deck and looked onto the forecastle, saw fantastic water cascades, speed was too high under the circumstances.
- at 00.30 hours to bed. \* at ca. 00.40/45 hours suddenly heard low metallic banging noises.
- 30-60 seconds later one bang; after another 40-60 seconds a tremendously loud metallic bang (hull plate smashed in).
- 1-2 minutes later engines stopped.
- 1-2 minutes later sudden heel to starboard -ca. 00.55 hours - when he was already on way up to deck 7.
- it took him about 5 minutes to reach deck 7, then the heel was already 45°.

**Håkan Ekstedt** - cabin 5205 - port inside, aft - [Enclosure 21.3.3.320](#):

- went to bed before 01.00 hours when the vessel was heavily pitching;
- woke up at ca. 01.20 hours when the vessel heeled to starboard and everything moved to the deep side.

**Leja Kozareva** - in toilet near Pub Admiral - [Enclosure 21.3.3.321](#):

**Hannu Seppänen** - deck 5, Tax Free Shop area - [Enclosure 17.2.227](#):

- at ca. 24.00 ship's time he went to the Night Club on deck 4, but sat outside watching the sea/storm;
- some time later he felt an unusual shaking/vibrating in the vessel's hull, these shocks were really shaking the vessel and he felt uneasy thinking about whether the trucks were really well secured;
- he decided to go to his cabin and walked up to deck 5, had a brief look into the Karaoke Bar and continued to his cabin;
- when he was in the area of the tax-free shop the vessel suddenly heeled to (port) to 15°, 10 seconds later the listing continued and stopped and continued immediately thereafter further to 40°.

**Rein Vaaske** - deck 5 - Sleeping Room - [Enclosure 17.2.231](#):

- after 00.00 hours hard bang from the middle of the ferry;
- after 5-7 minutes heel to starboard to 15°-20°;
- crew member showed up who was under shock.

**Siegfried Wolf** - 5th deck - near Tax Free Shop - [Enclosure 21.3.3.322](#):

- ca. 10 minutes before the big heel there was a first shock through the vessel;
- next came the main shock and everything flew/slid to the deep side - the engines stopped.

**Georg Sörensen** - 5th deck, starboard cabin - [Enclosure 21.3.3.323](#):

- saw through the window and felt that the vessel had heeled;
- there were two major shocks in the vessel and the big heel to starboard occurred.

**Paul Siht** - 5th deck, near the slot machines - [Enclosure 21.3.3.324](#):

- vessel heeled suddenly to starboard and he rushed to the 7th deck.

**Paul Barney** - in the Café Neptunus - [Enclosure 21.3.3.325](#):

- woke up from a bang/shock and thought there had been a collision;
- then he heard cracking and scraping noises and something was gliding along the vessel's hull side;
- he got up to look what was going on when the vessel suddenly heeled very widely to starboard and the furniture moved to the deep side.

**Sarah Hedrenius** - in the Café Neptunus - [Enclosure 21.3.3.326](#):

- asleep since ca. 21.30 hours, but felt the hard movements;
- woke up from two heavy bangs which made the vessel shake (she thought they had hit a rock), vessel moved up and down;
- she fell almost back to sleep, but not for long when the big heel occurred and she knew that it was very serious now;
- made it to the 7th deck where she met Kent Härstedt;
- at first the stern appeared to be higher than the bow and they started to walk aft, when the situation changed and the bow went up and the stern down.

The now following summaries of statements refer to the survivors from the "Pub Admiral", also called the "Karaoke Bar" since Karaoke was performed there.

**Pierre Thiger** - Admiral's Pub on deck 5 - together with Altti Hakapää - Statement taken on 03.10.94 - [Enclosure 21.3.3.327](#):

- ca. 23.45 hours (Swedish time) = 00.45 hours ship's time he heard a dull bang and ca. 1/2 minute later a similar bang, these were really sharp and short sounds which he clearly heard in spite of the music. The vessel was shaking somewhat. The noises were not created by waves striking against the bow;
- ca. 3 minutes after he had heard the mentioned noises he felt that the vessel was swinging/rocking athwartships not just from side to side. He was very surprised about the behaviour of the vessel.
- these swinging movements repeated themselves 3-4 times, simultaneously the vessel was shaking somewhat;
- Pierre Thiger has spent some time at sea and has experience with the behaviour of large vessels, therefore he observed rather closely the behaviour of ESTONIA.
- ca. 10 minutes after he had heard the before mentioned noises the vessel began to roll from side to side, and thereafter remained with a starboard list of 10°-15°;
- the vessel did not return to normal;
- he is of the opinion that it was some minutes before 24.00 hours (Swedish time) when the vessel took the first heavy starboard list;
- they left the bar immediately and when they reached the exit the vessel heeled further to ca. 30°, at which she steadied;
- the only crew member they saw was carrying a walkie-talkie or the like;
- when he reached deck 7 the heel was ca. 35°, increasing;
- at ca. 45° the lights went out, but returned.

In June 1997 it was finally possible for a member of this 'Group of Experts' to talk to Pierre Thiger personally.  
The result is stated below:

*»On the night of the casualty he had not been out on deck, but watched the sea state through the windows, the speed of the "Estonia" was highly excessive under the circumstances, as a matter of fact Pierre Thiger has never before or thereafter experienced that a vessel was smashed so hard into heavy headseas, each time the bow smashed into the sea, the vessel almost stopped, was shaking and vibrating and then accelerated again until it smashed into the next wave and so on, in addition to this very hard pitching, she was rolling, always more to starboard than to port, because he remembers having to continuously hold himself to the bar with one hand (for the last hour or so he was sitting together with Altti Hakapää in the Admiral's Pub on 5th deck) to avoid his bar stool tilting over to starboard. According to his observations the sequence-of-events started 10-15 minutes before midnight (Swedish time) when he heard 3 bangs with 15-20 seconds in between, metal to metal and thought it was a collision, the ship was shaking and vibrating differently than before, shortly afterwards he noted that she was pitching more, but made much slower and deeper movements, there were no more bangs but suddenly he felt vibrations in the aft ship which made him think that they had turned the stern into the sea and the pitch was on astern, he could not see anything out of the window, he felt the vibrations from the propeller (glasses were clinking) and then he heard the strange noise: A very low noise and simultaneously the pitch movements stopped as if a wave had struck under the stern, then all vibrations stopped and in the same second she continued to pitch again, however, without any engine noise, for about one minute she was only pitching, then pitching and rolling, and then only rolling - she made two full swings - more to starboard, less to port, and the third time she heeled over deep to starboard, did not right up again and then fell abruptly to about 40°/45°, this was just before midnight (Swedish time), she came back to almost upright position and then heeled to about 10°/15° and further heeled to about 40°/45° when she stabilised herself for at least 10 probably 12 minutes, whereafter she continued to heel from 45° to 90° relatively quickly before she was fully on the side, the funnel smashed a couple of times on the waves; when he had reached the outside of the 7th deck, the list was about 40°, wind and sea were coming abeam from starboard and at port side, 5-6 points aft of abeam there were lights, after they had been on deck for sometime already and the list had slowly increased to about 45°, the lights went out, but immediately thereafter came back, all this was within the ca. 10-12 minute phase, when the ferry had stabilised herself at a heel of 40°-45°.*

*He was subsequently picked-up by SILJA SYMPHONY and came ashore at Helsinki, where he was interrogated for the first time but does not have a copy of the protocol. In Stockholm he was subsequently questioned again by the Swedish police and by Olof Forsberg from the JAIC. «*

The respective memo is attached as Enclosure 21.3.3.319. Only recently the statement of Pierre Thiger taken by Olof Forsberg on 14.10.94 was received and is attached as Enclosure 21.3.3.319.1. See also Subchapter 21.8 - Other Observations.

**Juuse Veljo - Enclosure 20.245:**

- at 22.30 hours felt some roll movements although vessel had been pitching all the time;
- at the same time - not long - before the big heel to starboard - glasses suddenly toppled over in the bar;
- then the vessel heeled widely to starboard and he rushed up to deck 7;
- when he was on the outside of the hull on the way to the water **he heard pumping noises inside**.

**Note:** At that time the emergency generator must still have been running which was providing power to the following installations:

- navigation apparatuses, navigating lights, day light, radar, gyro- and autopilot, typhoon
- emergency lighting
- alarm system
- gyro compass
- radio
- CO2-fan (engine room evac. fan)
- lift motors
- certain fans
- one steering gear pump
- fire pump
- sprinkler pump
- emergency bilge pump
- intercommunication
- loudspeaker system
- one hydraulic pump for stem ramp

Consequently it has to be assumed that Juuse Veljo heard the running fire-, sprinkler- or emergency bilge pumps.

**Ronnie Bergqvist - Policeman ST Section - Enclosure 21.3.3.328:**

- vessel started to shake and vibrate;
- bar personnel took down the bottles from the shelves;
- just after 01.00 hours the vessel heeled first to port, then followed a very hard push combined with a bang/crash and then the vessel heeled very severely to starboard.
- all loose objects flew over to the deep side.

**Karin Bergqvist - Enclosure 21.3.3.329:**

- made no comments in connection with the movements of the vessel.

**Maria Fägersten - Policewoman ST Section - Enclosure 21.3.3.330:**

- heavy pitching all the time;
- at about midnight the vessel ran against something and she and all the others were looking out of the windows but could see nothing;
- then the vessel started to shake/vibrate;
- at 00.45 hours the casualty sequence-of-events began, glasses above the bar fell out of their holdings;
- suddenly everything flew over to one side when the vessel heeled over very rapidly, people were thrown against the wall - she was able to hold on to the bar: "The ship came over me!" - The clock above the bar showed 01.05 hours.

**Tomas Grunde - Statoil - Enclosure 21.3.3.331:**

- at ca. 01.15 hours first bang from forward and the vessel heeled;
- then more heavy bangs from forward and the vessel heeled more.

**Kent Härstedt - member of a social team - Enclosure 21.3.3.332:**

- was sleeping in his cabin on deck 4;
- ca. 00.00 hours woke up from a "muffled" sound which was nevertheless "heavy" - like something moving from side to side and then crashing against the hull with force;
- felt uneasy and joined his colleagues in the "Pub Admiral";
- after he had been there for ca. 30 minutes the vessel started to shake and roll from side to side, lots of bottles fell out of the shelves;
- the vessel came back to upright position and then heeled again to starboard;
- 45° heel when he reached the 7th deck, where he met Sara Hedrenius.

**Altti Hakunpää - private businessman - Enclosure 21.3.3.333:**

- when he was still in the restaurant Poseidon - the vessel was twice shaken heavily and the dancing girls fell to the floor;
- a bit later he was in the Karaoke Bar when the vessel suddenly heeled ca. 45° and came back to almost upright condition and then heeled stepwise more and more to starboard;
- he believes that this was at about 01.25 hours.

**Lars-Torsten Österberg - Statoil - Enclosure 21.3.3.334:**

- rough sea state - it was difficult to walk and it was necessary to always hold on to something;
- at about 01.00 hours the vessel rolled 2-3 times, then heeled wide over to starboard and came back to almost upright condition; \* thereafter heeled stepwise relatively quickly to about 30°;
- when he reached deck 7 the heel angle was still about 30°, which subsequently increased to 45° and steadied for quite some time;
- the vessel sank stern first and the last thing he saw was white.

**Rolf Sörman - member of social team - Enclosure 21.3.3.335:**

- at 19.45 hours they were still in their meeting in a conference room in the starboard aft part of deck 4 when suddenly some sort of pump started below them which made such a noise that they were unable to continue;
- he still heard the rather high noise later on also in other parts of the vessel;
- as from 00.30/00.40 hours he was in Admiral's Pub;
- at about 01.05 hours the vessel heeled slightly to port (as if altering course), came back and a little later heeled very deeply to starboard and water smashed against the window;
- when he was on deck 7 and the heel was already 70-80° he saw two people coming out of some sort of emergency exit in the funnel, the big one of them shouted: "... water is coming up from the car deck", they were either Finnish or Estonian crew members;

- it took 35 minutes from the big heel until the vessel was on her side.

On 13.11.1999 Rolf Sörman was heard by a member of this 'Group of Experts' and stated, among others, the following (see Enclosure [21.3.3.335.1](#)):

- The conference began only at 17.00 hours Swedish time (ST) and the room was at the starboard side aft.
- He had to give a speech and simultaneously show 7-8 overheads. At some time, when he was still showing overheads, a high whining noise started which apparently came somewhere from below. It was loud but constant at the beginning and he just had to speak in a louder voice.
- He thinks that they had another break after his presentation when the conference hostess was asked to have the machine or pump, creating the disturbing noises, turned off, however, she came back stating that nothing could be done about it.
- The noise changed to on/off, which was even more disturbing and we closed down the conference about 15-20 minutes earlier than planned, i.e. at 20.40/20.45 hours ST. This means that the noise did presumably start at about 20.30 hours ST.
- Dinner at restaurant "SEASIDE" on deck 6, starboard side, was ordered for 21.00 hours ST, but they had to wait some 5-10 minutes before their tables were ready.
- Dinner took probably 11/2 hours and the time was then about 22.30/22.40 hours ST. He still heard the "noise" in the distance.
- After having walked around for some time he met four ladies of his group and they went up to deck 7, port side where the door to the outside was slamming open/closed and the carpet was soaking wet up to the stairs.
- Thereafter they decided to visit the Admiral's Pub which they entered probably 23.40/23.45 hours ST. Also here he heard the "noise".
- Shortly afterwards Sörman felt the change in the vessel's movements because she was now pitching softly and started to roll more. It was much more comfortable than the very hard pitching before and he hoped it would remain like this for the rest of the night.
- After a while near the stage he walked to a sofa in the starboard forward corner. It was then that he felt 2-3 shocks in his feet. These were like blows in the forward/aft direction, somehow like pitching, but different.
- The girls sat on the sofa and he sat on a chair and they continued their discussion when Anita suddenly rose saying she would go to her cabin now. They tried in vain to persuade her to stay and Sörman looked at his watch. It was 23.55 hours ST.
- They continued to discuss a particular course when suddenly the vessel heeled very slowly, but much deeper to starboard. She heeled so far over that they could see water splashing against the windows next to them. Behind the bar all the glasses hanging underneath the ceiling fell on top of the bar lady.
- The vessel came back to more or less upright condition, maybe even a bit to port, but subsequently heeled again and even deeper to starboard. This time all the tables, chairs and whatever else was not solidly fixed rushed to the starboard side.
- The saw again water on the window but the vessel came back again to almost upright condition and they took the chance and rushed to the exit which they managed.
- It was then that he realised that there were no more engine noises, but the lights were on.
- The vessel heeled again to starboard, now stepwise with stable periods in between.
- They rushed up to deck 6 and further to deck 7 where they reached the aft door and managed to get out to the open deck with difficulties.
- They could still walk on the deck, the heel was then probably 30°.

**Tåge Hellgren** - Policeman from ST Section - [Enclosure 21.3.3.336](#):

- 1st heel to ca. 20°, did not right up, thereafter step by step heel until on the side after 2 minutes;
- light went out after 5-10 minutes and came back;
- after 20 minutes blackout.

**Jan Grafström** - Policeman from ST Section - [Enclosure 21.3.3.337](#):

- just after 01.00 hrs. severe heel and up to deck 7, 30° heel when he arrived outside.

**Urban Lambertsson** - Estline employee (booking manager) - [Enclosure 21.3.3.338](#):

- Karaoke Bar;
- had been together with marketing manager Tomas Persson visiting Estline, Tallinn (Marja Brannbrück);
- ca. 01.00 hours strange high noise and vessel heeled slightly to starboard, some glasses fell down;
- ca. 1 minutes later severe heel to starboard.

#### Summary of observations made / noises heard / times realised by passengers/ crew members in the area of the 5th deck

##### Before and after the starboard heel:

- a.) First noises / extraordinary shaking / vibrating of vessel / crash.
- b.) Speed reduced / engines reduced / engines stopped.
- c.) Several bangs and starboard heel.
- d.) Time of starboard heel.
- e.) The righting up after the big heel.

##### as to a.) First noises / extraordinary shaking / vibrating of vessel / CRASH.

- (1) Heavy bangs believed to result from too fast speed in heavy weather;
- (2) vessel behaved like a small boat slamming over the waves;
- (3) at about 00.00 hours vessel started to roll, although it had been pitching all the time and a shock was felt like running aground;
- (4) after 00.00 hours "muffled" sound which was nevertheless heavy - like something moving from side to side and then crashing against the hull;
- (5) at about 00.40/45 hours heavy banging noises - metal-to-metal and the vessel was shaking;
- (6) some time before the big heel unusual shaking/vibrating in vessel's hull;
- (7) ca. 10 minutes before the big heel the first shock ran through the vessel;
- (8) at ca. 00.45 hours one dull bang and ca. 1/2 minute later another one of the sharp, short sounds and the vessel was somewhat shaking;
- (9) at 00.45 hours the casualty sequence-of-events began with shocks in the vessel and the glasses hanging in holdings above the bar fell down;
- (10) the vessel was twice shaken very heavily and the dancing girls in the Restaurant Poseidon fell to the floor.

In summary of the above item a.) it has to be concluded that

- at about 00.00 hours the vessel was rolling for a while instead of pitching and seemed to strike against something like running aground;
- at 00.40/45 hours there were three heavy banging noises heard and shocks/vibrations felt, it was - metal-to-metal - the vessel was shaking / vibrating;
- ca. 00.45 hours there were two dull, sharp bangs;
- it was generally felt that the casualty sequence-of-events commenced at ca. 00.45 hours.

**as to b.) Speed reduced / engines reduced / engines stopped.**

- (1) After the three heavy banging noises the engines stopped;
- (2) after the three heavy banging noises she was pitching much slower and more deeply - feeling as if the vessel turned - propeller vibrations were still being felt - but 0-pitch;
- (3) after the big heels the engines were not heard or felt anymore.

**as to c.) Several bangs and starboard heel.**

- (1) Noises like steel plates knocking against steel plates and the vessel heeled heavily to starboard;
- (2) before 01.00 hours 2-3 really heavy bangs; the vessel heeled wide to starboard;
- (3) two heavy bangs and one CRASH and about 1 minute later the vessel heeled to starboard;
- (4) at about 01.00 hours hard bangs from the middle of the ferry, after 5-7 minutes starboard heel;
- (5) there were two major shocks in the vessel and the big heel occurred;
- (6) there was a bang/shock as if there had been a collision, then cracking and scraping noises were heard and then the vessel suddenly heeled very wide to starboard;
- (7) two heavy bangs made the vessel shake as if hit by a rock, vessel moved up and down (pitching), shortly afterwards the big heel occurred;
- (8) vibrations in the aftship and from the propeller - very strange, low noise, pitching movements and all vibrations stopped and in the same second pitching started again but without engine noises - ca. 1 minute pitching - then pitching and rolling and then only rolling - 2 full swings - deeper to starboard, less to port, then deep to starboard - no righting up - then abruptly to 40°-50°, came back to almost upright condition and subsequently heel 10°-15° to starboard;
- (9) the vessel started to shake and vibrate and the bar personnel took the bottles down from the shelves, just after 01.00 hours the vessel heeled first to port, then followed a very hard push connected with a bang/crash and the vessel heeled very wide to starboard.

In summary of the above item c.) it has to be concluded that

- before the big heel at about 01.00 hours there were heavy knocking noises, bangs, a CRASH followed by cracking/scraping along vessel's hull, possibly bottom, vibrating and shaking of the vessel;
- it felt like a collision or hitting a rock;
- vessel's movements changed from pitching, to pitching/rolling and to rolling, whereafter the two big heels occurred and the vessel righted up again but subsequently fell again to starboard.

**as to d.) Time of starboard heel.**

- (1) just after 01.00 hours.
- (2) ca. 00.55 hours (twice)
- (3) about 01.20 hours/01.25 hours
- (4) about 01.07/10 hours
- (5) just after 01.00 hours
- (6) ca. 01.15 hours
- (7) at about 01.00 hours
- (8) at about 01.00 hours
- (9) at about 01.05 hours
- (10) just after 01.00 hours
- (11) ca. 01.00 hours.

In summary of item d.) it has to be concluded that the majority of survivors from deck 5 put the time for the big heel at just before or just after 01.00 hours.

**as to e.) The righting up after the big heel.**

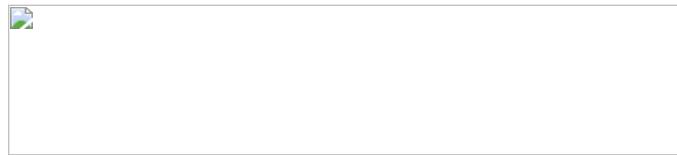
- (1) The vessel heeled deep to starboard and righted up, whereafter she heeled again to starboard;
- (2) the ferry fell abruptly to about 40°/50° - this was just before 01.00 hours - she came back to almost upright condition and then heeled to about 10°/15° to starboard;
- (3) the vessel heeled suddenly ca. 45° to starboard and came back to almost upright condition and then heeled stepwise more and more to starboard;

(4) at about 01.00 hours the vessel rolled 2-3 times, then heeled wide over to starboard and came back to almost upright condition.

(5) the vessel heeled twice very deeply to starboard and back to almost upright condition.

In summary of item e.) it has to be concluded that although only 5 survivors have directly testified that the ferry righted up after the big heel, it is certain that many more had noted it but have not testify respectively because they were not asked.

### 21.3.4 Reports from Deck 6



Only in the forward third of this deck there were passenger cabins, the luxury cabins equipped with mobile phones. In the larger part, there were the A-la-carte Restaurants SeaSide and Poseidon, the Baltic Bar and the Casino. Also this area had been changed considerably in comparison to the newbuilding layout. The above drawing shows the latest condition. Before referring to the testimony of passengers and crew members having been on this deck, the summary of the statement of Mats Hillerström shall be outlined. He was actually sharing cabin 1026 below car deck with 3 others but felt unwell and scared and thus moved up to the aft and open part of deck 6 already after midnight, ship's time, ca. 00.30 hours! See also Chapter 20.

With reference to the photo on the next page here are his observations in short:

*»He stayed in a sheltered place on starboard side best protected against the storm and heard nothing but the noises of the storm. The air was full of spray. At some time he saw a large vessel on starboard side apparently on same course and speed. Also on starboard side, but far away and astern, there was another vessel which was slower because the distance appeared to increase. He looked at his watch and it was 01.05 hours. Suddenly and without any previous indication the vessel heeled to starboard. He saw the tables and chairs inside the restaurant moving to starboard. Within a very short time the vessel took such a list that he could not walk anymore on the deck, but had to pull himself along the railing on the aft part to the higher port side.*



*When he had reached the port side, he looked over the side and got the impression that the vessel had reduced speed and was turning to port.*

**Per-Erik Ehrnsten** - cabin 6304, starboard, aft inside - statement taken on 28.09.94 - Enclosure 20.243:

- tried to sleep, but was kept awake by hard noises created by the ferry's slamming into high seas, however what kept him awake, in particular, were the indefinable shocks, which deviated from the normal noises of the ferry;
- the shocks and the noises repeated themselves indefinitely, regularly 4-5 times. "tong-tong, tong, tong"; noise, short pause and the same again;
- he got up and started to dress when the ferry suddenly heeled to starboard and, his suitcase fell from the sofa and together with the furniture slid against the door;
- the mentioned noise came from below and from forward;
- the noise was not caused by the sea and also was not a sudden sound like an explosion but it was regular, each unit - tong, tong - was equally strong, a little pause and the same regularity;
- it was not an impact noise (collision, grounding);
- when he reached the 7th deck after less than 5 minutes he saw three crew members - one of them was Silver Linde whom he later recognised on photos - coming out of the port inner alleyway from the aft crew accommodation, Silver Linde was talking into his walkie-talkie.
- In his opinion the list remained for quite some time at 30°-50°.
- The funnel was pointing in the direction from where the wind came.

**Note:** In subsequent tests he found out that it requires an angle of at least 30° to make the suitcase slide down from the sofa. He has further ascertained that it took him a maximum of 5 minutes, probably less, to reach the inside of the 7th deck where he met Silver Linde and the other two crew members. This means that Silver Linde had never been at the Information desk on deck 5 when the big heel occurred and also never went down to deck 4 thereafter.

**Marianne Ehn** - cabin 6222 - 59 years old - Enclosure 21.3.4.340.

- was asleep in her cabin with her husband - woke up from lots of noises in the vessel - it was so terrible - she asked her husband for the time and he looked at his watch - **it was 01.00 hours;**

- shortly afterwards the vessel was diving into a deep wave trough, there was a heavy bang - the vessel heeled severely and the engines stopped;
- before this she had already noticed that something was beating heavily against the vessel.

**Vassili Vorodin** - cabin 6320 or cabin 6230 - [Enclosure 21.3.4.341](#):

- cabin 6320 together with cousin Alexander and uncle Vasili Krjut'kov;
- ca. 24.00 hours went to bed - at ca. 01.00 hours felt that the vessel heeled to starboard and was thrown out of bed - does not remember having heard particular noises;
- saw through the window that the vessel was heeling heavily to starboard;
- was thrown from the stairs against the wall and broke his hand.

**Alexander Vorodin** - cabin 6320 or cabin 6230 - [Enclosure 21.3.4.342](#):

- cabin 6320 together with cousin Vassili and uncle Vasili Krjut'kov;
- ca. 00.30 hours very hard bang;
- slight heel to starboard, some minutes later another much stronger bang, more heeling;
- another bang and vessel heeled further;
- aft part was under water when he went overboard.

**Vasili Krjut'kov** - cabin 6320 or cabin 6230 - [Enclosures 14.196/197](#):

- woke up from vessel's shaking violently and slight heel, then another shock, shaking and heeling.

**Lars-Olof Lamke** - cabin 6223 - [Enclosure 21.3.4.343](#)

- ca. 24.00 hours went to bed - at ca. 01.00 hours was awakened by his wife because the vessel had taken a list to port, which he tried to explain to her by the weather. Immediately thereafter the vessel listed very severely to starboard and everything loose moved to starboard side, blocking the door.
- It took them about 5 minutes to open the door, at that time the list was already so large that they had to walk in the angle between the wall and floor on their way up to 7th deck, i.e. 45°.
- Lamke stood outside at port when the vessel was already lying on the side and he was washed off the vessel by the sea; the glass of his wristwatch was thereby smashed in and the watch stopped at 00.31 hours Swedish time = 01.31 hours. This is the time when the list had reached or exceeded 90°.

**Vihio Itäranta** - port side aft, inside - 60 years old - statement taken on 30.09.94. - [Enclosure 21.3.4.344](#):

- had been at sea when he was young;
- went to bed early but could not sleep, heard strange noises from below as if the propeller were rising out of the water, time and again;
- became alarmed by strange noises - unusual noises, was just about to get dressed when the vessel heeled to starboard;
- saw later that the searchlight on top of the bridge was on and that water was splashing down from the highest point of the bridge.

**Erik Gemheden** - cabin 1026 - [Enclosure 21.3.4.345](#):

- was in the corridor on his way aft on deck 6;
- the vessel was heavily labouring and suddenly heeled, more and more quickly, vessel was shaking;
- was thrown against the bulkhead - starboard side;
- was walking one foot on the deck, the other on the wall.

**Christer Eklöf** - cabin 4219 - [Enclosure 21.3.4.346](#)

- On the evening of the 27.09.94 he was sitting in the Baltic Bar at port side, deck 6, until the performance of the dance group from Pörnu was ended due to violent movements of the vessel. This was about 00.00 hours Estonian time. The vessel was pitching extremely hard which caused the hull to shake and vibrate almost continuously.
- He had also been out in the open forepart of deck 8 when he saw the whole bow diving into waves and spray all over the vessel. There was some light and he could see the anchor windlasses. He does not recall to have seen any other vessel.
- Then he went to pub Admiral where Karaoke was performed and Jasmina Waidinger was first singing.
- It was very crowded and he went back to deck 6 where he sat down near the entrance at the port side.
- After a while, he believes it was ca. 24.00 hours ST / 01.00 hours ET, the first of three very heavy bangs was felt and the foreship was rising and fell back and there was another heavy bang, the foreship rose again and the third bang - metal - was heard and felt, followed by the heel to starboard.
- There was less than one minute between the last bang and the heel to starboard.
- The third most wide heel was followed by tremendous crashes, e.g. from the tax-free shop, when everything loose moved to the deep starboard side.
- He quickly made his way of the deck 7 and got out to the open deck when he heard "Haire, haire" from the loudspeakers.
- When he looked around he saw the bow turning towards the moon, which he believes, was in the Southeast. He did not see any other vessel.

**Note:** Calculations revealed that on 27.09.94 at about 23.00 hours UTC = 28.09.94 - 01.00 hours Estonian time - from position 59°23' N; 21°39' E the moon was visible in a bearing of ca. 90°. This means that the ferry was turning to port when Christer Eklöf reached the outside of deck 7, i.e. approximately two or three minutes after the heel at about 01.05 hours ET and that the heading of the ferry was ca. 90° at about 01.30 hours ET, when she was on the side. - See memo with calculations attached as [Enclosure 21.3.4.346.2](#).

- He reached the open deck 7 through the forward door which was then still closed.

**Jürgen Korjas** - cabin 1022 - [Enclosure 21.3.4.347](#):

- was in the toilet near the Night Club when suddenly the vessel fell to one side;
- came out of the toilet door and saw crack in ceiling out of which water was spraying;
- saw two vessels, one to the left, the other one astern;
- after ca. 30 minutes the vessel was on the side.

**Nebosja Grkovic** - cabin 6217 - (cabin mate of Rolf Sörman) - [Enclosure 21.3.4.348](#):

- was on outer deck at 22.00-23.00 hours and also looked onto the forecastle;
- was alone in cabin, heel came without any warning, left to starboard side;
- vessel heeled, righted up and heeled again;
- jumped into the sea from starboard side, an Estonian sailor stayed on board.

**Ülo Kikas** - deck passenger - [Enclosure 21.3.4.349](#):

- in Night Club on deck 6 at time of heel;
- ca. 01.15 hours vessel rolled from port to starboard;
- when on deck 7 - 30° heel, engines stopped.

**Ewa Askerup** - cabin 6129 - Police ST Section - Enclosure 21.3.4.350:

- in bed - water smashed against windows;
- could not sleep due to hard movements of vessel;
- just after 01.00 hours heel to starboard, then to port and again heavily to starboard.

**Peter Järvinen** - croupier - Enclosure 21.3.4.351:

- in Casino on deck 6 - did not hear bangs or crashes;
- vessel heeled and tables were crashing to the deeper side;
- vessel was shaking;
- speed reduced and pitch movement;
- vessel was shaking again and the heel increased;
- 2-3 "alarms" in Estonian, then "Mr. Skylight" for fire alarm.

**Paula Liikamaa** - croupier - Enclosure 21.3.4.352:

- in Casino on deck 6 - at ca. 01.05 hours heavy heel without any warning;
- after the big heel no more engine noises;
- she had never been trained in the use of the lifesaving equipment.

#### **Summary of observations made / noises heard / times realised by passengers/ crew members in the area of the 6th deck**

**Before and after the starboard heel:**

- a.) Before the starboard heel.
- b.) After the initial starboard heel.
- c.) Time of starboard heel.
- d.) The righting up after the starboard heel.
- e.) Vessel on the side (ca. 90°).

**as to a.) Before the starboard heel.**

- (1) One vessel on starboard side abeam, the other one starboard astern.
- (2) Something was beating heavily against the vessel.
- (3) Vessel was diving into a deep trough - heavy bang - starboard heel - engines stopped.
- (4) One crash - starboard heel; heavy, loud noise.
- (5) Indefinable shocks and noises which were repeated regularly 4-5 times "tong-tong-tong-tong", which came from forward and below and were not created by wave impact.

**as to b.) After the initial starboard heel.**

- (1) Ca. 2-3 minutes after heel something far forward out of the water, which looked like a fin.
- (2) Vessel in port turn with reduced speed.
- (3) Vessel stabilised for quite some time with a list between 30°-50°.
- (4) Funnel was pointing in the direction where the wind came from.
- (5) At 01.31 hours vessel on her side with 90° or more list.

**as to c.) Time of starboard heel.**

- (1) **Mats Hillerström:** looked at watch: 01.05 hours, thereafter vessel heeled to starboard.
- (2) **Marianne Ehn:** something was beating heavily against the vessel - asked husband for the time and got the reply: **00.00 hours** (Swedish time) - 01.00 hours ship's time, shortly thereafter vessel was diving into a wave trough - heavy bang - **heeled to starboard** - engines stopped.
- (3) **Vassili Vorodin:** ca. **01.00 hours** he felt that the vessel heeled to starboard.
- (4) **Lars-Olof Lamke:** was woken up by his wife, it was ca. **01.00 hours**, immediately thereafter vessel heeled to starboard.

**as to d.) The righting up after the starboard heel.**

- (1) Vessel heeled wide to starboard, righted up and then heeled again to starboard.
- (2) Vessel heeled wide to starboard, righted not fully and continued to heel to starboard.

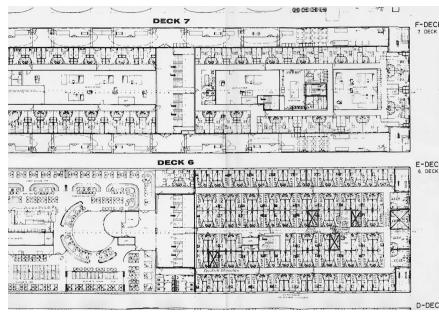
**as to e.) The vessel on her side - ca. 90°.**

- (1) Lamke was washed overboard when the vessel was on her side, thereby his arm with the wristwatch was smashed against a rail and the watch stopped at 01.31 hours.

In summary of items a.) - e.) the following can be concluded:

- (a) The noise scenario was partly different, partly more or less the same as heard on the lower decks which can probably be explained by the longer distance from deck 6 to the casualty areas.
- (b) The observations stated under (1) and (2) were made by passengers Mats Hillerström and Christer Eklöf. Hillerström was out on deck in the aft part of deck 6, starboard, when the big heel occurred. He saw the vessel still turning to port when he looked over the port side which was confirmed by Christer Eklöf when he reached the outside of deck 7 only two or three minutes after the heel. It was not confirmed by Per-Erik Ehrnsten who reached the open deck 7 probably four to five minute after the heel.

- (c) The time for the big heel was about 01.00 hours as confirmed by most of the survivors who have stated this time.
- (d) As on the other decks the righting up after the big heel has been reported by only few survivors.
- (e) Vessel was at 01.31 hours on her side.



### 21.3.5 Reports from Deck 7

This is the main accommodation deck for the crew with four cabins in front of the superstructure, cabins on each side up to the stern, and officers' and crew's messrooms with pantries in the aft part. The four forward cabins were used as follows (from starboard to port):

- 1st cabin : economy superintendent Jan Bergendahl ()
- 2nd cabin : technical superintendent Tomas Rasmusson (not on board)
- 3rd cabin : chief officer Juhan Herma ()
- 4th cabin : 1st engineer Arvo Tulvik ().

The windows of these cabins overlooked the foreship and it can reasonably be assumed that the chief officer and the 1st engineer did look out of their windows when hearing the crashing and/or banging noises from the bow area, which alarmed so many persons.

Whilst Jan Bergendahl is not mentioned in any of the statements available to this 'Group of Experts', the voice of chief officer Juhan Herma has been identified with a high degree of probability in the Distress Communication through his shouting of the position to Andres Tamme - see Subchapter 22.1 - thus during the final stage he was on the bridge. According to the statements of 2nd engineer Peeter Tüür and reefer engineer Andres Verro they had met 1st engineer Arvo Tulvik shortly after the big starboard heel in the alleyway in front of their cabin doors.

The statements of those having survived from deck 7 are summarised in respect of the casualty scenario as stated below. The complete statements with translations are attached as enclosures.

**2nd engineer Peeter Tüür** - 1st cabin port side (statement of 29.09.94 - [Enclosure 7.3.2.128](#) and statement of 03.10.94 - [Enclosure 12.5.183](#)):

- *woke up by things moving around in his cabin - before that had heard metallic bangs apparently caused by objects hitting against each other - thought the noises came from a badly secured lifeboat or that the visor had become loose;*
- *felt that the speed was reduced and that there was a starboard heel of about 30°;*
- *opened the cabin door and met the 1st engineer Arvo Tulvik who said: "Apparently the visor broke up, would be good if the vessel would be beached."*

**Note:** As stated above, the cabin of 1st engineer Arvo Tulvik is on deck 7, port side, in front of the accommodation. From his window he could overlook the foreship with visor. - See Subchapter 7.2.3.

- next he heard "Mr. Skylight to No. 1 and 2", which according to Peeter Tüür's understanding means: "Fire Alarm." The two fire-fighting teams had to go to their stations - he was number one of team No. 1 and his station was on deck 8 - port side - below the bridge, i.e. directly above him;

**Note:** According to Supplement 226 to the JAIC Final Report the 2nd engineer is also number 1 of the fire-fighting team 2. - See Subchapter 7.2.3.

- *he went back to his cabin, picked up his walkie-talkie and flashlight, left via the window and saw motorman Hannes Kadak outside on deck 7;*
- *at that time he was convinced that there was the risk that the vessel might sink;*
- *heard on his walkie-talkie that the Information desk was trying to reach the bridge but was not getting any answer;*
- *he tried it himself but also got no answer;*
- *the lights went out but came back on again (diesel generators shut off and emergency generator started, i.e. the heel was then in the range of 30° - 40°);*
- *after 4-5 minutes also this generator stopped - vessel on the side and thereafter only emergency lights fed by batteries.*

**Andres Verro** - reefer engineer - cabin 710 - 35 years old - statement taken on 29.09.94 attached as [Enclosure 21.3.5.353](#):

- *was in his cabin;*
- *at ca. 01.00 hours was in bed reading a book when the vessel suddenly heeled to starboard and everything rushed to the deep side;*
- *believes that before the heel he heard some completely strange metallic sounds;*
- *when he left his cabin he met the 1st and 2nd engineers, one of them said: "Visor went away" (or something like that);*
- *heard by radio "Mr. Skylight to No. 1 and 2", which means actually "Fire Alarm" spoken by a male voice, when he was already in the stairway in the aft part;*
- *he got the impression that possibly the locking devices of the bow ramp had failed and through them water came in;*
- *he walked aft towards the stern.*

**Aarne Koppel** - car deck worker - cabin 7011 - statement taken on 29.09.94 in Turku attached as [Enclosure 21.3.5.354](#):

- 5°-10° starboard list, felt it was an abnormal situation and woke up - heard a low breaking sound;
- at 01.00 hours - when we got dressed - the vessel suddenly heeled to ca. 30°;
- when I was still in the cabin putting on warm clothes the light went out/on several times, **that was when the main engines stopped**;
- it took ca. 5 minutes from the moment I woke up from the 5° list to my leaving the cabin through the window, which was at the high port side.

**Elmar Siegel** - motorman - cabin 7007 - 43 years old. Statement taken on 28.09.94 in Mariehamn - [Enclosure 21.3.5.355](#):

- was in cabin on deck 7 aft;
- 3-5 minutes before heel started heard noise like somebody beating against vessel's hull with a large hammer which came from car deck direction.
- from the liferaft he saw the emergency lifeboat proceeding away from the sinking vessel without caring for anybody in the water (see also statement of Thure Palmgren - [Enclosure 21.3.5.356](#)).

Statement taken on 30.09.94 in Tallinn - [Enclosure 21.3.5.357](#):

- It sounded as if the vessel had hit something with the bow.

Interview by Jutta Rabe on 08.03.95 - [Enclosure 21.3.5.357.1](#):

- Aulis Lee went on the way down from deck 7 to his cabin on deck 4, picked up his wife and both returned to deck 7 and survived.

**Note:** According to Aulis Lee's own statement he was in the cabin together with his wife when the vessel heeled and they both left together to deck 7. - See [Enclosure 21.3.2.305.1](#).

**Andres Vihmar** - purser - cabin 713 - port side - cabin located 20 m aft from front bulkhead:

Statements taken on 29./30.09.94 - [Enclosures 21.3.5.358 / 21.3.5.359](#):

- the starboard heel occurred at just after 01.00 hours.
- 5-7 minutes after the first listing, the list was already 45°;
- when he came to the boat area on deck 7, port side, **Aulis Lee and Aarne Koppel were already there**;
- people were streaming up to deck 7 through the open doors for another ca. 5 minutes, thereafter it was no longer possible due to the list and no one escaped anymore from the inside of the vessel.

**Note:** This means that already after ca. 01.15 hours it was no longer possible to get out of the inside of the accommodation.

**Ivan Ziljajev** - motorman - cabin 7009, port side (his room-mate was Vassili Märtsen, who also survived). Statement taken in July 1996 - [Enclosure 13.193](#):

"After I woke up due to the heel I also heard the engines running. It appeared as if the pitch propellers were running in 0 position. I must say that I react rather sensitively in these matters. When I do not hear the engines anymore I wake up immediately, even if the pitch is changed I wake up already. I heard the engines running, I cannot say how many, but I heard the noise of the running engines. I got the impression that the vessel had stopped in spite of the engine noise. I want to make this quite clear, it appeared to me that the vessel was still making headway due to the momentum it still had, but without propulsion. I assumed it was a manoeuvre. They tried to change the condition of the vessel. I also realised that the ship was turning to port and simultaneously I felt a strong wind blow. The waves were so high that water spray came up to deck 7."

**Jerzy Florysiak** - member of band - cabin 770 - starboard side - [Enclosure 21.3.5.360](#):

- should have played until 01.00 hours, but due to heavy movements of the vessel they finished already at 23.40 hours, he went to his cabin on deck 7 at around 00.00 hours;
- vessel rolled to starboard slightly - heeled further - heeled further abruptly;
- everything slid to the deep side, heard two short bell signals (alarm);
- ca. 20° heel when he reached the outside of deck 7.

**Maiga Järvi** - shop girl - cabin 7005 - statement taken on 20.12.95 - [Enclosure 21.3.5.361](#):

- went to bed at 00.50 hours; \* ca. 01.05/10 hours sudden heel and she was thrown to the end of her bed;
- left her cabin through the window to outer deck 7, the heel was then ca. 45°;
- met Aarne Koppel

**Sirje Juhanson** - service girl - cabin 753 - [Enclosure 21.3.5.362](#):

- to bed about 00.00 hours;
- the vessel made a big movement followed by the big heel to 30°;
- left cabin through window;
- met Arvi Rohumaa/Capt. Avo Piht.

**Orumaa Malle** - cook - cabin 7th deck starboard side - [Enclosure 21.3.5.363](#):

- no pre-casualty observations;
- had been warned that heavy weather had to be expected;
- at 00.30 hours to cabin and to bed, was just about to fall asleep;
- mirror fell off the wall and broke to pieces due to the heavy heel.

**Vassili Märtsen** - welding motorman - cabin 7008 - (room-mate Tanel Moosaar) - [Enclosure 21.3.5.364](#):

- no pre-casualty observations;
- to bed at 23.00-23.15 hours;
- heel to 30°/35°, engines stopped;
- together with Moosaar out of window to deck 7.

**Valdur Matt** - cabin 7004 - [Enclosure 17.2.219](#):

- secured trailers, distance between trucks 10 cm, behind the bow ramp were two personal cars;
- guarantees that the visor was closed and the locks were closed hydraulically;

- was asleep when the heel occurred, before 01.20 hours, heel more than 45°;
- heard "Mr. Skylight to No. 1 and 2" fire alarm and went forward to fire station 1;
- visor was gone, forward was open, did not see the ramp.

**Tanel Moosaar** - motorman - cabin 7008 - aft port side [Enclosure 21.3.5.366](#):

- 23.00 hours to cabin, hard bangs, vessel's doors were banging, thought vessel had run aground, 01.20 or 01.15 hours;
- heavy heel to starboard which woke him up;
- while getting dressed heard a female voice calling "alarm, alarm";
- before that he had heard "Mr. Skylight to No. 1 and 2".

**Peeter Palgunov** - galley personnel - cabin 7026 - starboard side - [Enclosure 21.3.5.367](#):

- 23.45 to bed, woke up when the mirror on the opposite wall smashed to pieces;
- looked out of cabin door and heard "Mr. Skylight to No. 1 and 2", engines had stopped;
- looked out of window and saw water already at 7th deck level.

**Victor Psjenitjnyj** - sailor - cabin 7201 - [Enclosure 21.3.5.368](#):

- no pre-casualty observations;
- woke up from rumbling noise due to heel.

**Arvi Rohumaa** - cabin 753 - port side - [Enclosure 21.3.5.369](#):

- at 22.30 hours to bed;
- heavy heel to starboard;
- went to fire station underneath bridge after hearing "Mr. Skylight to No. 1 and 2".

**Ervin Roden** - safety officer - cabin 7013 - [Enclosure 21.3.5.370](#):

- to bed at 21.00 hours, had been on car deck before;
- felt one bang and the vessel was shaking, after some time another bang, the vessel rocked;
- heavy heel to starboard, which caused him to slide to the foot end of his bed;
- took 10 minutes to reach the outside of deck 7, 45°.

**Note:** According to the statement of Paula Liikamaa - See [Enclosure 21.3.4.352](#) - Roden had overheard the walkie-talkie report of Silver Linde to the bridge about water on the car deck.

**Raivo Sinimi** - cabin 754 - [Enclosure 21.3.5.371](#):

- some minutes after 01.00 hours he felt a heavy shock (push/blow) in the vessel, ca. 01.03 hours heel;
- everything fell down;
- heard "alarm" and subsequently "Mr. Skylight to No. 1 and 2".

**Elmar Siegel** - motorman - cabin 7007, port side - [Enclosure 13.192](#):

- 20.00-24.00 hours watch in engine control room (ECR);
- full speed on all 4 main engines all the time plus 2 auxiliary diesels;
- chief engineer Leiger asked to correct the 1°-2° starboard list before departure, which was not possible since the starboard heeling tank was empty and the port one full;
- to bed before 01.00 (ca. 00.30), heard and felt banging and vibrating;
- ca. 30 minutes after he was in bed felt as if vessel had hit/truck something with the bow combined with a hard shock and heel to starboard;
- 20°-30° starboard heel, left cabin through window, 4th deck starboard windows at that time were already in the water;
- heard the engines at the beginning, which stopped one after the other a little later;
- Aulis Lee went back to deck 4 (after having been on deck 7) and got his wife up;
- saw the lifeboat No. 1 (man overboard boat) proceeding away from the vessel.

**Ulla Marianne Tenman** - outside on deck 7 - starboard side - [Enclosure 21.3.1.288](#):

- from her cabin 1098 she went up to deck 7 and waited, suddenly heavy bang and the vessel heeled;
- some time before casually heard heavy bangs and something beating against the hull.

**Valters Kikust** - deck passenger in the stairway, port forward of deck 7:

- at 22.00 hours the vessel was pitching and rolling;
- at 23.00 hours he went into the port forward stairway of deck 7 behind the stairs and the windows;
- soon he felt strange knocks against the ship's side while the pitching and rolling continued, he had never felt anything like this before;
- the structure of the ship was cracking all the time;
- he looked down on the bow of the ferry through the window and saw that the search light was on;
- the visor was seen to be in some raised position and water was seen flowing through the gap between visor and forecastle deck;
- the bow was diving into the waves all the time;
- soon the search light went out and the ship heeled heavily to starboard.

**Summary of observations made / noises heard on deck 7****a.) Before the starboard heel:**

(1) Various crew members heard metallic noises as if somebody was beating with a large hammer against vessel's hull or as if the vessel's bow was hitting something.

**b.) After the starboard heel:**

(1) There was a vessel about abeam at starboard side - probably SILJA EUROPA.

**c.) After the starboard heel:**

(1) Speed was reduced.

(2) Vessel turning to port and the engine room did something to change the condition of the vessel.

(3) Pitch probably 0, although vessel was still making some headway, the engines shut off automatically after the heel was 30° or more.

(4) According to 2nd engineer Tüür, the 1st engineer Arvo Tulvik (()) had told him in the alleyway after the big heel that the visor was open, broken open, gone.

(5) The Information desk as well as 2nd engineer Tüür tried to reach the bridge by walkie-talkie - ca. 01.07/01.10 hours - both got no reply.

(6) Already after ca. 01.15 hours it was no longer possible for anybody to get out of the central stairways due to the excessive list.

**c) Timing**

(1) At ca. 01.00 hours was in bed reading a book when the vessel suddenly heeled to starboard.

(2) At 01.00 hours - when we got dressed - the vessel suddenly heeled to starboard.

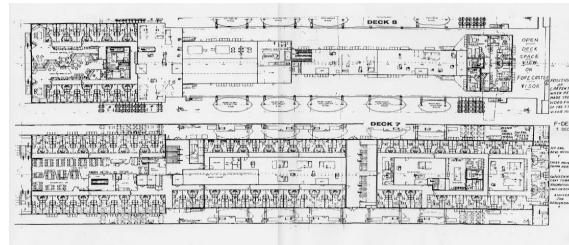
(3) The starboard heel occurred just after 01.00 hours, 01.15 or 01.20 hours.

**d.) Righting up after the big starboard heel:**

(1) There are no reliable reports about the righting up after the big heel, although many experienced it without directly reporting it.

**In summary of the aforementioned items a.) - d.) the following has to be concluded:**

- The time and noise scenarios are basically in agreement with the observations from the other decks, although it has to be borne in mind that only the crew members were accommodated on deck 7 and their statements have to be considered with particular care.
- This refers also to the statement of 2nd engineer Peeter Tüür who has testified in his second statement taken on 29.09.94 by the criminal police Tallinn - Enclosure 7.3.2.128 - that he met the 1st engineer Arvo Tulvik (()) in front of his cabin door, who then said: "Apparently the visor broke up, would be good if the vessel would be taken ashore." In his first statement taken by the Finnish police on 28 September 1994, while he was still on board the ISABELLA (the ferry that rescued him), he specifically said that he had not discussed anything with Arvo Tulvik.
- The observations of Elmar Siegel that the man overboard boat (lifeboat No. 1) proceeded away from the vessel without caring for the people in the water and which is confirmed by the surviving passenger Thure Palmgren is of considerable importance, although the consequences cannot be overlooked.
- - See also Subchapter 23.1.



(click for full page image)

### 21.3.6 Reports from Deck 8

In the fore part were the accommodations of the master, the chief engineer and the radio officer as well as the radio room located more or less directly below the bridge. At port side behind the chief engineer's accommodation the owners' cabin was located which was occupied by one of the senior pilots from Stockholm and his lady.

The master, the chief engineer and the Stockholm pilots with their ladies are missing. Whilst Captain Arvo Andresson according to Silver Linde's doubtful statements was said to be on the bridge at ca. 01.00 hours, chief engineer Lembit Leiger was seen by safety officer Ervin Roden and others when stepping into a liferaft together with captain Avo Piht and the Veide twins (dance girls). All 4 are considered to be missing.

In the aft part there were several crew cabins and the day-rooms of the officers and crew. During the first heavy heel to starboard one crew member looked out of one of the windows at starboard side of the dayroom and saw "another ship in the sky".

### 21.3.7 Further Evidence

This space was left empty for possible new evidence received in the year 2000. Below parts of the statement of the survivor Christer Eklöf are quoted. The statement was taken early December 1999 by the Finnish lawyer of Meyer Werft, Henrik Gahmberg, but the translated version was only available in March 2000.

Only those parts of the statement are quoted which have not been covered already:

- when he was crawling along the vessel's hull he saw something like a stick coming out of the hull below the fender bar,
- he first thought it would be the stabiliser fin and he wanted to hold on to that thing, however
- it was too far in the fore part of the vessel and too small to be the stabiliser fin,
- the "thing" was about 1 to 1.5 metres long and only 10 or 20 centimetres thick,
- it had the same colour as the bottom,
- it was not a bilge keel,
- he does not believe that it was a damaged propeller blade of the bow thruster because those do not have the colour of the bottom,

- when he was underneath the bridge, he heard a muffled sound from there and compares it with an imploding TV-set,
- when he was down in the sea he saw that the visor was missing,
- the police did not show any interest in the fact that he had seen this thing when they were interrogating him.

Per-Erik Ehrnsten - interviewed by Peter Jansson on 1 May 2000 :

- ESTONIA left somewhat delayed at about 19.15/20 hours. At 19.00 hours vehicles were still boarding, he could hear the sounds.
- Vessel started pitching noticeably after 21.00 hours and at about 23.00 hours he went to his cabin 6304 on deck 6 which was an inside cabin without windows, the bed was athwartships.
- He cannot recall significant rolling, just pitching.
- he woke up several times by vibrations in the hull when the bow was diving into the waves,
- at a certain time these vibrations were replaced by new sounds which were regular 4-5 tong, tong sounds, a short pause and the same again, which appeared to be transmitted through the ship's structure as vibrations from somewhere forward and below; the tong, tong sounds came in such short intervals that they could not have been caused by wave movements; there was no change in the ship's movements that he could associate with the tong, tong sounds.
- There were 4-5 "tongs", then a pause of 4-5 seconds and then again 4-5 "tongs", the interval between the "tongs" remained the same, ice floes crashing against the hull in the winter cause less heavy sounds than these tongs did;
- he does not recall having noted change of engine revolutions at that time;
- there were 2 "tong" sequences before the big heel to starboard occurred.
- There was first one smaller and then a bigger heel to starboard when he just had his trousers on and everything flew against the door; - he removed these things from the door, went out, turned into the central (forward) stairway, rushed up the stairs to deck 7, where he was helped out on deck by Silver Linde and two other sailors, Silver Linde was talking into his walkie-talkie and refused to follow some order, he was very irritated (P.E. Ehrnsten understands Estonian):
- The heel was about 30° when he came out on deck and the wind and waves came in from the aft port quarter (30° to 60° from aft of abeam, port side).
- With his back to the wall (longitudinal bulkhead on deck7) he could see the two ferries 20-30° aft of abeam at port side; at the same time he could see the moon and the bow simultaneously;
- the ferry stabilised at a heel of 30-50° for quite a while;
- the waves came from port aft and the ship was drifting with the wind, he and other people were eventually washed overboard by waves approaching from aft and washing oblique about the bottom, ended up in the water on the same side as funnel and bridge were, i.e. in the lee.
- He saw the stabiliser fin sticking out about below the forward door, it was not moving.
- When he was washed overboard he was slightly forward of the bridge.
- From the water he could see the unbroken silhouette of the vessel against the moonlight.

## 21.4 Summaries of All Available Statements of Passengers and Crew

### 21.4.1 Summaries of Passengers Statements

Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel	
				time/0°	righting up ?
Ewa Askerup (Stockholm) Police-ST Section	cabin 6129 in bed	water smashed against windows could not sleep due to hard movements of vessel	just after 01.00 hrs. heel to starboard then to port and again heavily to starboard	just after 01.00 hrs.	no comment
Nikolajs Andrejew from Latvia	cabin 1016	in bed very hard movements of vessel		no	no comment
Antti Arak (Tallinn)	cabin 1056	last car to roll on board, they were a party of 5, one stayed in the car	no comment	no	no comment
Pär Andersson (Granges/Sweden)	cabin 4319	nothing special until midnight, took outside/inside walk around after midnight, also looked down on forecastle, saw wet carpet and water on stairs between decks 5/6	1) between 24.00-01.00 hrs. heavy metallic banging noises; 2) at 01.05-01.10 hrs. engine stopped (estimate).	no	no comment
Janno Aser (Tallinn)	Night Club deck 4 (port, aft)	vessel was shaking/vibrating	no comment	no	no comment
Karin Bergqvist (Söder/Sweden)	cabin on deck 4 and Karaoke Bar (deck 5)				

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Jonne Bergqvist (Johaneskov/ Sweden) Policeman ST Section	cabin 6119 Pub on deck 5 (Pub Admiral) mid-ships, starboard side	vessel was pitching very hard	shaking/vibrating, bar personnel took bottles from the shelves	just after 01.00 hrs.		vi a s a fl
<b>Name</b>	<b>Location at heel</b>	<b>Pre-casualty observations</b>	<b>Noise scenario times/observations</b>	<b>Heel</b> time/0°	<b>righting up ?</b>	<b>o</b>
Leif Bogren (Fässberg/Sweden) Mazda bus with trailer	cabin 5128 (4th cabin from forward port, inside)	normal cracking, banging noises of vessel in heavy weather, at 24.00 hrs. was on foredeck (7), saw fantastic cascades of water, speed was too high under the circumstances, 23.30 hrs. (?) to bed	1) suddenly low banging noise, metallic; 2) 30-60 seconds later bang; 3) after 40-60 seconds loud bang (metallic), appeared to him as if a hull plate was smashed in; 4) 1-2 minutes later engines stopped; 5) 1-2 minutes later sudden heel to starboard (was already on way up).	ca. 00.40 /45 hrs.	had been working at shipyard before and is thus sure that the heavy metallic noise he heard two or three times within ca. 2 minutes was as if something was beating with a huge hammer against vessel's hull	5 4
Stephan Duijndam (Ablasserdam/ Holland)	cabin 4221	high sea state 23.00 hrs. to bed	01.00 hrs. woke up from noise as if vessel had collided with something, heard several crashing/ cracking noises there-after	ca. 01.00 hrs.		vi s o fl
Per-Erik Ehrnsten	cabin 6304		woke up from hard bang, and heard thereafter in regular intervals 4-5 times "tong-tong, etc.", pause and again, got up and dressed		no	vi d
Håkan Ekstedt (Karlstad/Sweden) Statoil employee	cabin 5205	felt the sea state already at 21.30 hrs. at dinner	to bed before 01.00 hrs., heavy pitching	ca. 01.20 hrs.		w h e si
Marianne Ehn (Uppsala/Sweden)	cabin 6222	21.30 hrs. to bed	woke up from beating noises, called husband who said it was 01.00 hrs.	ca. 01.00 hrs.		vi w a si ..
Christer Eklöf (Sollefteå/Sweden)	cabin 4219	truck driver in restaurant on 6th deck (presumably Restaurant Poseidon) trucks were so close that the mirrors had been bent inside, no securings	wind and sea from port side, was sitting after 00.30 hrs. at the exit port side, some minutes after 01.00 hrs. bow rose/sank 2-3 times, vessel behaved differently and a fatal minute later fell to starboard	ca. 01.02/03 hrs.	yes	
<b>Name</b>	<b>Location at heel</b>	<b>Pre-casualty observations</b>	<b>Noise scenario times/observations</b>	<b>Heel</b> time/0°	<b>righting up ?</b>	<b>o</b>
Brigitte Eriksson (Södersbyn/ Sweden)	cabin 5229	ca. 24.00 hrs. vessel began to labour, husband wanted to make round, but returned silently after some minutes and also went to bed	heard noises of metal beating against metal, directly thereafter the vessel heeled to star-board			h fr ci h h
Anders Ericson (Karlskoga/ Sweden)	cabin 4131 port side forward	23.15 hrs. to bed, high sea state, vessel shaking/vibrating, impossible to sleep 21.00 hrs. on bridge course 262° wind: 20 m/sea	ca. 01.00 hrs. suddenly two heavy bangs, one after the other, got up and dressed, noises came close to his cabin	ca. 01.00 hrs.		
Mats Finnanger (Foslandsen/ Norway) 12 years old	cabin 1002					w s fe
Maria Fägersten (Huddinge/Sweden) Stockholm Police ST-Section	cabin 6107 but was in Karaoke Bar (5th deck)		heavy pitching, shaking/vibrating of vessel, at 00.45 hrs. the casualty sequence began, glasses above the bar fell out of their holdings, suddenly everything slid to one side - clock above the bar showed 01.05 hrs.	01.05 hrs.	yes	vi re a h c

Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel		
				time/0°	righting up ?	o
Tomas Grunde (Stockholm)Manager Statoil	Karaoke Bar		1st bang from forward and vessel heeled, more heavy banging from forward, vessel heeled heavily to port	ca. 01.15 hrs.		
Erik Gemheden (Tuskvarna/ Sweden)member of Bible School	cabin 1026but was in corridor on way aft on deck 6		vessel was labouring heavily and suddenly heeled, more and more quickly, vessel was shaking			h b
Jan Grafström (Djursholm/Sweden) Policeman ST-Section	cabin on 6th deck Karaoke Bar			just after 01.00 hrs.		s 7
Nebosja Grkovic	cabin 6217(with Rolf Sörman)	was on outer deck at 22.00-23.00 hrs.and looked onto forecastle	was alone in cabin, heel came without any warning, left to starboard side	ca. 01.00 hrs.	yes	v a
Täg Heilig Policerian ST-Section	cabin 6126Karaoke Bar		reported nothing		no	1: ri si 2
Kent Härstedt	cabin 4316until 24.00 hrs.		at 24.00 hrs. woke up from a muffled sound which was nevertheless "heavy", as if something moved from side to side and crashed with force against the hull - he felt uneasy and joined his colleagues in the Pub Admiral		yes	a v o th a s
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel		
				time/0°	righting up ?	o
Altti Hakanpää	cabin 1047 Karaoke Bar		at about 24.00 hrs. when he was in Restaurant Poseidon the vessel was twice shaken heavily, dancing girls in the Karaoke Bar fell, etc., the vessel heeled ca. 45°	ca. 01.25 hrs.		s R
Sara Hedrenius	Café Neptunus (near Paul Barney)	asleep since ca. 21.30 hrs. but felt the hard movements	woke up from 2 heavy bangs which made the vessel shake (thought they had hit a rock), vessel moved up and down, she fell back (half) to sleep, but not for long, then the heel	no	no	s
Mats Hillerström	cabin 1027on 6th deck in the open, aft of Restaurant Poseidon	hard movements, pitching and rolling, 2-3 times on forepart deck 7 and looked down onto forecastle, last time ca. 22.30 hrs., search light was on	nothing heard, "SILJA EUROPA" abeam, "MARIELLA" aft of abeam, vessel had been slamming since 00.30 hrs., on deck 6 aft	01.20 hrs. (est.)	yes	v s c
Jukka Pekka Ihälainen truck driver (had previously been with Coast Guard/Navy at Russarö)	cabin 4212 4th deck shared cab-in with Leo Sillanpää ((	to bed 22.30 hrs., woke up from radio music at 00.32 hrs., turned it down and slept again	woke up again shortly afterwards from three bangs, that engines were reduced and then stopped			v
Vilho Itäranta	aft part of 6th deck, possibly cabin 6334	early to bed (upper bed), heard strange propeller noise (as if propeller rising above water level at each pitch movement)	climbed down from his upper bed and was about to put back the ladder when the big heel occurred			th
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel		
				time/0°	righting up ?	o
Sten Jolind	cabin 5135	was up on deck 7 and overlooking forecastle several times, heard heavy bangs, thought vessel was too fast	at 24.00 hrs. to bed. between 00.00-01.00 hrs. 2 or 3 really heavy bangs from forward (heavier and louder than before), got up and dressed			w t e d
Ain-Alar Juhanson small Mercedes bus - one of the last cars	cabin 1056		was sleeping and heard frequent hard bangs			h vi
Tom Jonsson one of the 68 policemen	cabin 4405			just after 01.00 hrs.	no	c vi w ci si
Morten Boje Jensen (Copenhagen)	cabin 4603	vessel was labouring more and more	ca. 23.40 hrs. in bed , ca. 00.00 put out light, no sleep, small banging noise combined with pitching, then 3 bangs, very hard, after the 2nd one car alarm went off		no	si si b si
Ülo Kikas	deck passenger Night Club			ca. 01.15 hrs.		v si
Jürgen Korjas	cabin 1022 toilet near Night Club	hard movements			no	si o
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel		
				time/0°	righting up ?	o
Neemi Künno Kalk	cabin 1122	went to cabin at 21.00 hrs. and was reading until 23.30 hrs.				a s h t
Margus Karmet truck driver	cabin 4224	trucks and trailers were secured by belts, was one	to bed ca. 23.30 hrs., heard strange cracking noises in the structure, woke up from some unusual noise			w si d

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		of the first trucks to drive on board				
Marek Kaasik	deck passenger	heavy movements	about 1 hour before, heavy bangs and vessel shaking in whole structure, heard metallic noises from above		no	v
Ints Klavins	cabin 1024		in bed			w n s b
Leja Kozareva	in alleyway near toilets deck 5					
Vasili Krjutjikov	cabin 6230 or 6320 together with son-in-law/nephew		woke up from vessel shaking violently and slight heel, then another shock, shaking and heeling			
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel		
Eckard Klug truck driver	cabin 4214		23.45 hrs. to bed heard metallic knocking noises		no	p u t
Lars-Olof Lamke	cabin 6223		00.00 hrs. to bed			o h h
Tambet Herbert Lausma - truck driver	cabin 1023					w a
Magnus Lindström	cabin 4429	early to bed, difficult to sleep due to movements	heard rolling noise from below (car deck), ca. 01.00 hrs. he heard tooth brush fall out of glass and other things falling	ca. 01.00 hrs.		h b
Yngve Lien	deck passenger in cinema in aft part of deck 4		heard a noise and the vessel heeled			
Kalvet Maiko	deck passengers	behind their car there was max. space for 3 more cars				w .. a
Andrus Maidre	cabin 1022		metallic scraping noises crashing .....			n h

## 21.4 Summaries of All Available Statements of Passengers and Crew

## 21.4.1 Summaries of Passengers Statements

part two

Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel		
				time/0°	righting up ?	occurrence
Jaak Mullo truck driver	cabin 4213 (with E. Klug)	nothing	nothing			woke up when thrown out of abrupt heel to
Bengt Nilsson	cabin 1026	ca. 22.00 hrs. on 7th deck forward, nothing special, it was very dark, heavy movements of vessel	ca. 23.30 hrs. down to cabin, shower and to bed ca. 24.00 hrs., hard bangs throughout the hull			it began to crackle and simultaneously took a heel w/
Martin Nilsson	cabin 1027	heavy labouring of vessels	it cracked and sounded like the breaking of the structure, banging noises, slept for ca. 1 hour and woke up ca. 10-15 min. before the accident was a fact			woke up from movements, t scraping noise had run agro scraping and near, simular vessel started then heeled (I the others do
Ants Nadar	cabin 1025		woke up from hard banging noises			started his w/ vessel heeled
Lars-Torsten Österberg Statoil employee	cabin 5206 Karaoke Bar	rough sea state, difficult to walk, always had to hold on to something	at about 01.00 hrs. vessel rolled - 2-3 times and then heeled wider over and righted up	ca. 01.00 hrs.	yes	after righting relatively quick heeled in step
Mikael Öun Scania engineer	cabin 4217 had seen that the visor was closed	was in the sauna and heard low banging noises combined with vessel's movements in the waves	1) heavy bang, vessel almost stopped, 2) 30 sec. later another bang, 3) directly followed by 3 heavy bounces (stronger than sledge hammer), 3 short, loud noises	01.02 hrs.	yes	

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				followed each other; all subsequent noises were much lower and he thought they were turning the vessel, it appeared as if the waves were now coming from the side, the vessel heeled over wider, the alarm clock fell from the table, vessel righted up and heeled again ca. 15°			
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel			
Carl Övberg	cabin 1049	only service personnel, otherwise no crew visible, 22.30 hrs. to bed, vessel had slight list to starboard	1) woke up at about 00.30 hrs. from strong noise of rushing water at both sides, more at starboard, 2) strong metallic banging noises which had not been there before, 3) after some time heard the sudden starting up of hydraulic pumps, clicking of valves, hydraulic under load noise and, 4) simultaneously banging of sledge hammers; uncertain whether the noises came from forward, 5) hydraulic noise faded away and came back while the sledge hammering continued for ca. 10-15 minutes, 6) the other banging noises were heard for ca. 20-25 minutes, 7) the hydraulic and sledge-hammer noises stopped with a sharp, short metallic crash, 8) after 30-40 sec. silence, the next really extreme crash followed and he was thrown forward against the wall, 9) engine had stopped, 10) out of cabin (WT doors were open), into stairway, jacket hooked, looked back, 11) saw water under pressure escape from two goose-necks and also water coming out of door from cleaning room, 12) continued up and when he was halfway up to car deck the ferry heeled ca. 50-60° to starboard and righted up, 13) thereafter list increased in steps, 14) continued to deck 7.	ca. 01.00 hrs	yes		
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel			
Rait Pöllendik	cabin 1119 Pub Admiral	no report	no report			big heel to st Pub Admiral	
Gennadi M. Pärson	cabin 1013	before it all began he heard on vessel's radio that there was an alarm situation	slept only very slightly, heard a strange noise as if big drum rolling over something			felt the heel, and out of cat	
Anita Persson-Flygare	cabin 6012		came to cabin sometime before 01.00 hrs. - after 7-8 min. vessel heeled to starboard very heavily	ca. 01.00 hrs.		was pressed wall, door flew	
Juri Pekka Purliväli	cabin 4th deck	to bed at 21.00 hrs.	woke up after some time from an enormous crash	01.00 hrs.		everything m starboard and upper bed we floor	

Thure Palmgrén	cabin 4th deck about midships	vessel's movements became worse towards midnight, went to cabin	after 00.00 hrs. metallic banging noises from forward began, rang the alarm, nothing, wife changed from bed to sofa, ca. 00.45 hrs. vessel shaking, vibrating and noise as if running aground or plates smashed in	ca. 01.00 hrs.		big heel and 25(45°)
Indrek Pungar truck driver	cabin 4253		heard crash and vessel heeled			
Per-Arne Persson truck driver	cabin 4222/23	trucks were not secured	vessel was shaking very strangely, very heavy crash as if the vessel would fall to pieces			big heel to st stopped
Bert Roos	cabin 6104					heavy bangs
Manfred Rothe	Pub Admiral		ca. 10 min. before the first shock through the vessel, glasses fell off shelf, crew removed all glasses/bottles into a case which was put into a store room behind the bar		yes	next came th and every-thi store/the kitch bar
Carl-Erik Reintamm	cabin 1094	to bed ca. 00.00-00.30 hrs.	shortly later he heard/felt scraping noises/as if ice was scraping along the hull, scraping from below, vessel heeled slightly, opened door and saw water streaming on the floor, small heel			felt that vess rushed up
Georg Sörensen		was in cabin with Herbert Augustin	saw through the window that vessel heeled			in agreement Rothe's expla
Paul Siht	cabin 1021 on 5th deck	on 5th deck at the slot machines				rushed to 7th vessel heeled
Dainis Sleiners	cabin 1015	met 10 officers in uniform in Admiral's Pub which he considered strange	was sleeping at 22.30 hrs., heard strange banging noises	ca. 01.30 hrs.		woke up from and vessel w Vibrating and
Tony Spuhl	cabin 4313	banging noises when the bow struck the sea	heard below noise of rushing water, twice, something wrong, engine reduced or stopped			major crash, and heeled at everything fel alleyway
Daniel Svensson Bible School Jönköping	cabin 1027	vessel was pitching and rolling	when bow was meeting the waves something hammered against the hull			suddenly the after heeling & continued to t cabin and up
Rolf Sörman	cabin 6217 Pub Admiral	19.45 hrs. some pump started running at high noise level below their conference room on deck 4 and they closed their meeting (high rpms like pump), heard that noise still later in other parts of the ship		ca. 01.05 hrs. 45/50°	yes	vessel heeled (like at course came back, a heavy heel ar moved to the uprighted and upright-ed ag stepwise mor starboard).
Hannu Seppänen	cabin 63..... 5th deck near shops	vessel was shaking/vibrating in the sea state				1st heel, 2nd and 40° list, 1 between
Jaan Stern	cabin 1120 (most forward on deck 1)	heard hard bangs before casualty				left cabin after water had per through door
Tönn Töniiste	cabin 1st deck		00.30 hrs. woke from movements			
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel time/0°	righting up ?	occurrence
Arturas Tamasaukas	refused to testify and left hospital without permission					
Ulla Marianne Tenman	outside on deck 7 starboard side		sometime before casualty heard heavy bangs and something beating against the hull			she went fro 1098 up to de waited, sudde and the vess
Raivo Töniisson truck driver	cabin 4426 or 4226	truck was not secured	between 23.00 and 00.00 hrs. hard blow/bang/ contact	01.00 hrs.		hard bang ar everything sli side
Ainus Toobal	cabin 4224	vessel moved heavily	at 00.30 hrs. strange bangs and metal beats against metal		no	heavy heel, c
Pierre Thiger	Karaoke Br with Altti Hakanpää	vessel laboured heavily, speed too high, heeled always more to starboard (had to hold on to the bar)	- 00.45 hrs. muffled sound, ca. - 30 seconds later again (sharp, short sounds)	01.00 hrs. 45/50°	yes	- no more ba vibrations in a going astern - vibrations (gl then he heard

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			- vessel shook somewhat - vessel made slow pitch movements			
Juuse Veljo	cabin 1007	hard pitch movements, ca. 22.30 hrs. some roll movements and had to hold on to something	to Pub Admiral, glasses toppled over, vessel rolled	no	vessel heeled to starboard and up to deck 7 upon being questioned respectively he answered that he did not see a hole in the vessel's starboard side	vessel heeled
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel time/0°	righting up ?	occurrence
Rein Vaaske	deck 5 sleeping room		after 00.00 hrs. hard bang from mid of vessel, vessel was shaking			after 5-7 min starboard to 1
Vassili Vorodin	cabin 6320 together with cousin Alexander and uncle Vasili Krijutkov		24.00 hrs. to bed	ca. 01.00 hrs.		heavy heel a of bed, looked and vessel he to starboard
Alexander Vorodin	cabin 6320		ca. 00.30 hrs. very hard bang			slight heel to some minutes much strong heeling
Siegfried Wolf	cabin 6317 near Tax Free Shop		confirms statement Manfred Rothe			
Holger Wachtmeister	cabin 1047/48	heavy movements caused headache since the trucks were not secured				woke up from and heavy crash when he left cabin
Name	Location at heel	Pre-casualty observations	Noise scenario times/observations	Heel time/0°	righting up ?	occurrence
Wanda Wachtmeister	cabin 4618	together with her brother Holger until ca. 00.30 hrs.	went to bed, but could not sleep, vessel was behaving violently	ca. 01.00 hrs.	no	suddenly she downwards, if extreme sound vessel heeled
Jasmina Waidinger	cabin 1027	in cabin together with Daniel Svensson	00.30 hrs. to bed, low banging noises, she heard low, running water sound from above, it was 01.00 hrs. and she was just dozing shortly	ca. 01.00 hrs.		when she heard crash, which came from above appeared the huge moved from the other, after scraping noise heeled severely
Kerim Nisancioglu	deck passenger in cinema aft of deck 4	saw that bow door was closed	ca. 23.00 hrs. to sleep			vessel began side to side all hear the engine vessel heeled and something from star-boa

**21.5**  
**Summary of Observations and Noises Heard Before the Abrupt Heel**

**1st Deck**

**Silver Linde** : He heard and felt only one crash when he was on the car deck, i.e. about 15 minutes before the heel.

**Margus Treu** : He heard and felt two or three impacts which were not caused by waves and then the heel came.

**Henrik Sillaste** : He felt three impacts not caused by waves when he was working and then the heel followed.

**Jaan Stern** : Immediately before the heavy heel, what he thought were waves beating very hard against the vessel, then silence and then the vessel fell on the side.

**Neemi Künno Kalk** : Woke up from a loud rushing sound.

**Ulla Marianne Tenman** : Some time before the casualty heard several hard bangs and something beating against something. Later (when she was up on the 7th deck) she heard a heavy bang and the vessel heeled to starboard.

**Carl-Erik Reintamm** : He suddenly heard two strong, strange noises, something like scraping noises which came from below (like ice scraping along the vessel's bottom), shortly later the vessel fell on the side.

**Carl Övberg** : He woke up suddenly from the strong noise of rushing water which he could hear from both sides, but loudest from starboard side; these noises alarmed him;

- in addition he heard quite strong metallic banging noises which definitely had not been there before; he sat up in bed and put his feet on the floor, since the bed was athwartships he was facing the door looking aft;

- he lit a cigarette and listened attentively to the strange and frightening noise scenario;

- after a little while he suddenly heard the starting up noise of an hydraulic pump or pumps followed by the clicking of valves and then the typical noise created by an hydraulic system under load;

- simultaneously he heard the banging of sledge hammers or something like that;

- the noises came probably from forward;

- the hydraulic under load noise faded away and came back again whilst the sledge-hammer banging noise more or less continued. Both the hydraulic noise and the sledge-hammer banging noise continued for ca. 10-15 minutes whilst the other banging noises, then heard already for some 20-25 minutes, also continued;
- the hydraulic noise and the sledge-hammer noise stopped with a short, sharp metallic crash which gave him the impression that something heavy, metallic had broken;
- after a 'silence' of 30-40 seconds the next really extreme crash followed in connection with an abrupt stopping of the ferry which was so 'sudden' that he was thrown against the front wall of his bed; it was a short, sharp intense crash as if the ship had struck against something or was struck by something;
- he jumped out of his bed and put his clothes on very quickly when he realised that all the engine noises had stopped and that the ferry was now making much softer pitch movements; this must have been at about 01.00 hours, ca. 1-2 minutes later the vessel heeled very wide to starboard.

**Holger Wachtmeister** : Woke up by a scraping noise and a hard bang - the scraping noise continued - left cabin and heel.

**Ain-Alar Juhanson** : Woke up from heavy metallic bangs. Thereafter the vessel heeled to starboard.

**Martin Nilsson** : Something was frequently heavily beating against the vessel; 10-15 minutes before the big heel he heard scraping noises, i.e. cracking and scraping; the strong scraping noise was continuously heard also while the big heel occurred.

**Jan Gustavsson** : "Now we have run aground." So clear and distinct was the noise.

**Daniel Svensson** : At each pitch movement something was beating against the hull "as if somebody was hammering with a big stone".

**Jasmina Waidinger** : Heard banging noises which were abnormal, then she heard a rushing sound (water), then heard strong noise above her like something big and strong moving from one place to another; next came the heel.

**Bengt Nilsson** : Could not sleep because of something frequently beat-ing very heavily against the hull. Later heard roaring squeaking, shrieking and scraping followed by a metallic breaking noise from starboard aft.

**Ants Nadar** : Woke up due to hard banging noises.

**Andrus Maidre** : Just before the heel metallic scraping noises and the moving/falling of a heavy object; - just before the heel he heard crashing and banging noises, something like a truck toppling over.

**Tambet Herbert Lausma** : Woke up from loud rumbling noises.

**Ints Klavins** : Woke up from a dangerous (evil) noise, such as metal scraping against the bottom.

**Gennadi M. Pärson** : Heard an unusual, strange noise - had the impression that something like a barrel was rolling against something.

**Dainis Steiners** : Heard low indefinable, strange noises before the heavy bang which woke him up completely.

**N. Andrejev** : Felt extremely hard bang and was thrown against the cabin wall before he was thrown out of his bed due to the big heel; he was unable to identify from where the bang had come, but it felt as if the vessel had collided with something and at the same time came the excessive heel.

#### Deck 4

**Anders Ericson** : Ca. 01.00 hours suddenly heard two heavy bangs, one straight after the other which came from nearby his cabin.

**Einar Kukk** : Heard a strange noise which was very unusual and alarming to him.

**Mikael Öun** : - Heard continuous banging noises for a long time;

- heard 2-3 severe scraping noises;
- heard a particularly loud bang;
- heard 3 heavy scraping noises from forward, one after the other and the heel followed.

**Eckard Klug** : Heard many bangs which he had never heard before; then heard one extremely heavy bang, so heavy like breaking of a thick steel plate.

**Tony Spuhl** : Heard an enormous crash and the whole vessel was shaking/vibrating;

- then 2 metallic noises - klonk - klonk - directly after the bow was setting into the waves; then the same noise 3 times, then a rushing noise below his cabin which came from the car deck;
- heard the rushing sound once more and big heel.

**Morten Boje Jensen** : Heard continuous "small banging noises", then 3 bangs, one after the other.

**Anneli Konrad** : Woke up from a crash and the vessel's shaking.

**Wanda Wachtmeister**: Could not sleep and suddenly heard one crash or loud bang, a heavy loud noise of the type that made you realise that something is wrong. It came from the bottom of the vessel - a clear distinct "boom" - not rattle.

**Marek Kaasik** : Heard metallic noises from the upper decks, then the vessel's whole construction was shaking and then the heeling occurred.

**Magnus Lindström** : At midnight he heard strange noises which came from the car deck, something was rolling over the car deck; then he heard one heavy bang and the vessel heeled.

**Kerim Nisancioglu** : The vessel began to roll equally in the waves from side to side and he assumed that the seas did not come anymore from ahead, he did not feel the engine, in connection with the rolling the vessel heeled to starboard and he heard something sliding over to starboard below them - some large object - then came the heel.

**Hannu Seppänen** : Sometime just after midnight he felt an unusual shaking/vibrating in the vessel's hull and a little later came the heel.

#### Deck 5:

**Birgit Eriksson** : Woke up by noises indicating that steel was knocking against steel almost immediately followed by the heavy heel.

**Leif Bogren** : Heard at about 00.40/45 hours for the first time the unusual bom-bom noises, which repeated, next came an enormous VROM-BOOM followed by a CRASH and the engines stopped - ca. 1 minute later starboard heel; subsequently Bogren gave an additional explanation: - the sound was like somebody beating with a sledge hammer against vessel's hull; - he noticed the noise three times within 2 minutes, - the noises came from forward port side and below.

**Pierre Thiger** : 15 minutes before midnight (Swedish time) when he heard 3 bangs with 15-20 seconds in between, metal to metal and thought it was a collision, the ship was shaking and vibrating differently than before, shortly afterwards he noted that she was pitching more, but made much slower and deeper movements, there were no more bangs but suddenly he felt vibrations in the aft ship which made him think that they had turned the stern into the sea and the pitch was on astern, he could not see anything out of the window, he felt the vibrations from the propeller (glasses were clinking) and then he heard the strange noise: A very low noise and simultaneously the pitch movements stopped as if a wave had struck under the stern, then all vibrations stopped and in the same second she continued to pitch again, however, without any noise (i.e. with 0-pitch or stopped engine), for about one minute she was only pitching, then pitching and rolling, and then only rolling - she made two full swings - more to starboard, less to port, and the third time

she heeled over deep to starboard, did not right up again and then fell abruptly to about 40°/45°, this was just before midnight (Swedish time) and came almost back to upright position.

#### Deck 6:

**Per-Erik Ehrnsten** : - Tried to sleep, but was kept awake by hard noises created by the ferry slamming into high seas, however what kept him awake, in particular, were the indefinable shocks, which deviated from the normal noises of the ferry,

- the shocks and the noises repeated themselves indefinitely, regularly 4-5 times. "Tong-tong, tong, tong"; noise, short pause and the same again,
- he got up and started to dress when the ferry suddenly heeled to starboard and the furniture was sliding against the door,
- the mentioned noise came from below and from forward,
- the noise was not caused by the sea and also was not a sudden sound like an explosion but it was regular, each unit - tong, tong, was equally strong, a little pause and the same regularity,
- it was no impact noise (collision, grounding).

**Marianne Ehn** : Lots of noises in the vessel woke her up, she asked her husband for the time and it was 00.00 hours (Swedish time);

- something was beating heavily against the vessel;
- shortly afterwards the vessel was diving into a deep wave trough, there was a heavy bang - the vessel heeled severely and the engines stopped.

**Mihai Turdeau** : In the casino he suddenly heard a strong metallic noise followed by 3-4 bangs one after the other which appeared to come from down below - heel.

#### Deck 7:

**Peeter Tüür (2nd engineer)** : Heard metallic bangs apparently caused by objects hitting against each other.

**Andres Verro (reefer engineer)** : Heard strange metallic noises.

**Aarne Koppel (car deck worker)** : Heard a low breaking sound.

**Elmar Siegel (motorman)** : 3-5 minutes before the heel he heard noises like someone beating against the vessel's hull with a large hammer - it sounded as if the vessel had hit something with the bow.

**Andres Vihmar (purser)** : Heard - what he believed were heavy seas - beating against the vessel's bow.

#### In summary of the above it can be concluded, that

- (a) the noises heard and observations made by the survivors depend on the deck they were on and whether they were forward or more aft on that deck; the survivors from decks 1 and 4 (forward part) having been closest to the action heard more and more detailed noise scenarios than those from decks 5 and 6;
- (b) there had been heard low banging noises from the foreship area already during the evening hours which had continued all the time.
- (c) some survivors have noted that the vessel behaved differently at about midnight;
- (d) all survivors having testified in this respect had heard and felt either one - two - or three major bangs, crashes combined with shaking/vibrating of the vessel shortly before the big heel - even Ulla Marianne Tenman on the 7th deck.
- (e) since 10-15 minutes before the big heel some survivors from the 4th deck, but in particular those from the 1st deck, heard very clear and distinct "scraping sounds" from below, a noise which is heard when a vessel runs aground or proceeds through ice. The noises continued even after the heel;
- (f) about 15 minutes before the heel, 3 sharp metallic bangs were heard with 15-20 seconds in between and thereafter steel knocking against steel noises respectively metal against metal noises or sledge-hammer noises or stone against the hull noises were heard which ended in the 2 or 3 big crashes shortly before the heel;
- (g) hydraulic noises were heard by one possibly two passengers on the 1st deck, which were clearly identified by one passenger and explained by the other to sound like roaring, squeaking and shrieking and which were combined with the sledge-hammer noises and ended together with them in the first of the two major crashes shortly before the big heel;
- (h) some survivors from the 1st deck had heard rushing water sounds about 30 minutes before the heel and later again, and then shortly before the heel also survivors from the 4th deck heard sounds of rushing water from the car deck;
- (i) some survivors from the 1st deck and 4th deck had heard something heavy and large "rolling - moving" on the car deck to starboard before the big heel;

#### 21.6 Time Statements of the Big Heel

The evaluation of all the statements taken by the Estonian, Swedish and Finnish police as well as the statements subsequently taken by members of this 'Group of Experts' and/or others reveal that 133 survivors have testified, some several times and sometimes differently. Only 45 of them have stated the exact or approximate time of the big heel to starboard, when everybody realised that it was then getting serious. In detail:

before 01.00 hours : 4  
 about 01.00 or 01.02 hours : 25  
 at 01.05 hours : 3  
 at 01.10 hours or about : 4  
 at 01.15 hours or about : 3  
 at 01.20 hours or later : 6  
 =45

Since the electric clock of passenger Mikael Öun fell off the table at the big heel and the batteries became disconnected, the clock stopped at this very moment at **00.02 hours Swedish time = 01.02 hours ship's time**. This is supported by the obvious fact that 25 of the 45 have stated the time of the heel to have been about 01.00 hours. It is further confirmed by the evidence of Wanda Wachtmeister who looked at her wristwatch after she had reached the 7th deck from the 4th deck and the time was 01.05 hours. It can thus be reasonably assumed that the big heel occurred at **01.02 hours ship's time**.

## 21.7 The Righting Up after the Big Heel

Thirty survivors have repeated that this big heel was up to 45° or more degrees and that the vessel had almost righted up again, while approximately 40 others have indicated a very big and rapid heel without stating that the vessel came back up. This as well as many other uncertainties in the statements are doubtlessly due to the survivors having been mainly asked by policemen untrained for the questioning of witnesses after maritime casualties.

## 21.8 Other Observations

This subchapter contains observations of survivors after they had reached the open deck 7 and/or were on the outside hull and/or in the water/liferaft/lifeboat which might be of relevance for the casualty scenario and/or the causes for the sinking.

**Christer Eklöf:** - See Enclosure 21.3.4.346.1

- He walked down the side below the bridge and diagonally further towards the fenderbar. Then he saw the other ferries far away. The port side was the lee side.

**Note:** The picture below shows the vessel's port side while still on slip. Arrow 1 indicates the forward end of the fenderbar, arrow 2 the forward end of the bilge keel.



- When he was at the forward part of the fenderbar he saw something like a fin sticking out of the hull, dark like the bottom, maybe 1.5 m or less, looking like a propeller blade of a plane. It was not moving.

- He tried to reach it but was washed into the sea by a wave.

**Note:** The photo which Mikael Öun made of the Estonian boy sitting on the vessel's bilge strake probably shows this sticking out part.

**Pierre Thiger:** - See [Enclosure 21.3.3.319.1](#)

PT: There were maybe up to 100 persons at the most who were on the ship's outside, of which about 50 or half of them crawled up to the keel or the bottom and later more forward as she began to go down aft. And I knew that gradually she would sink. And now the stern went down first. And she raised up forward, and therefore I did not want to climb up more, and I tried to stop others, or to calm down others who were blindly rushing towards the highest spot where a crowd of about 50 people had gathered, exactly above a fin stabilizer which stood and worked to and fro for the whole time.

OF: There was a fin stabilizer out?

PT: Yes, oh yes.

OF: You could see this also?

PT: Yes, I could see it on the port side. It stood and went to and fro like this all the time, very fast. About 50 percent of the people had gathered up there. And she began to go down aft, and I had come (down) to about half of the depth (of the ship).

**Note:** When Pierre Thiger was shown the general arrangement plan, he indicated his way down the port side approximately below the port bridge wing and emphasized that what he thought to have been the stabilizer had been to his right, i.e. to forward. After he had seen on the drawing that the stabilizer was fitted about midships above the bilge strake, i.e. to his left he was certain that it could not have been the stabilizer he had seen to his right far forward but something else which was moving and which, according to his statement, had been vertically bigger than horizontally.

**Tony Spuhl:** - See [Enclosure 21.3.2.306.1](#)

- He crawled down the port side below the bridge and saw a big object to his right, i.e. towards forward, which was big and moving in/out.

- He thought that it was the stabilizer.

- He managed to get into a raft.

- The vessel turned more than 90° and the bridge, deck 8, deck 7, etc. disappeared while his raft was still alongside the hull where the bridge had been before.

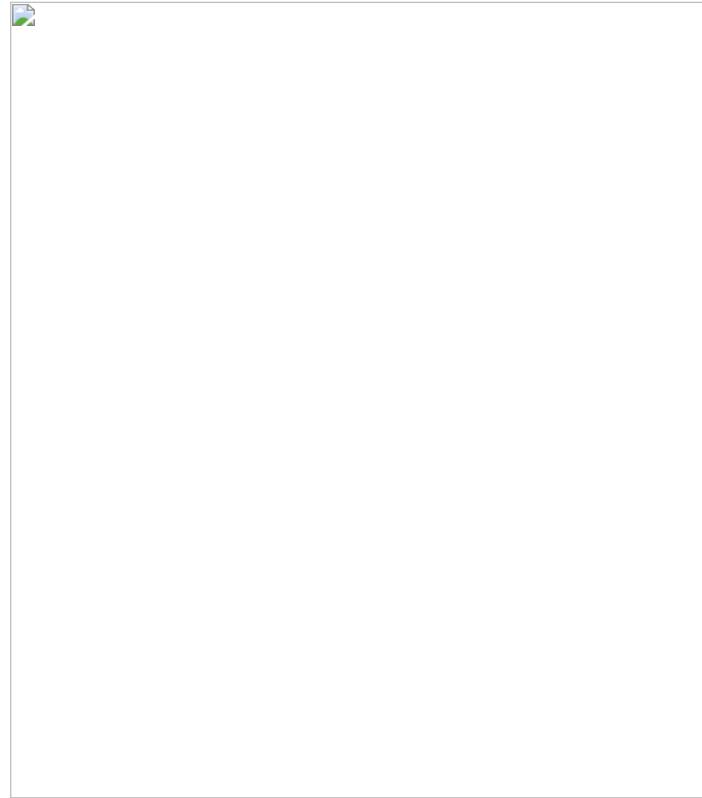
**Note:** When Tony Spuhl was shown the actual location of the stabilizer on the general arrangement plan, he admitted that it must have been some thing else what he saw forward at the bow, probably the visor then still connected to the vessel.

## 21.9 The Sinking

At 01.30/32 hours the ferry was on her side according to the statements of many survivors, e.g. Lars-Olof Lamke who was then washed from board where-by the glass of his wristwatch was broken and his watch stopped at that time, and Einar Kukk, who looked at his watch before going into the water. The vessel was then only slightly trimmed to the stern. The funnel smashed several times onto the waves and then disappeared while the vessel turned further to starboard and the stern sank deep down. Finally the vessel was completely upside down with the stern area resting aground already and the bow rising high, the highest point being the bulbous bow. The drifting stopped and the bow was turned, towards East by the westerly storm, while it sank stepwise deeper in the waves. It was in this position that several crew members and passengers being in liferafts in the area of the foreship noted that the visor was no more in place, but that the bow ramp was visible in closed or almost closed condition. The bow sank slowly down and the last visible part of the vessel was the bulbous bow looking like a whale with the waves washing over it.

At 01.53 hours the echo of ESTONIA disappeared from the radar screens of the MARIELLA.

The biggest shipping catastrophe in peace time in Europe had become a fact.



## CHAPTER 22

### THE RESCUE OPERATION

#### 22.1 The Distress Communication

The ESTONIA was equipped, in compliance with the old system, with a radio-telegraphy station and a radio-telephone system. The radio installation and the competence of those serving it satisfied the SOLAS Requirements. In addition, there were some 30-35 portable VHF maritime radio-telephones (walkie-talkies) available to particular crew members which were not indicated in the vessel's radio licence. These VHF-sets could also communicate on channel 16. It is obvious that the transmission power of such VHF-sets is much less than the power of the permanent VHF-installations on the bridge with antennas on top of the mast. As parts of the 'Mayday' transmissions were received very weakly and partly interrupted, it has to be assumed that the mates used their walkie-talkies. Also the many disturbances on channel 16 during this time might have played a role.

It cannot, therefore, be excluded that those on the bridge had already tried to get out a 'Mayday message' much earlier. The anonymous information from an A.B. sailor of a large Swedish ferry in the vicinity of the casualty, who called during the "Efterlys"\*) TV program in summer 1996 might be a confirmation for this assumption.

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\*) "Efterlys" is a Swedish TV program comparable to the German program "Akten-zeichen XY ungelöst" which presents unsolved criminal cases to the public.

The sailor reported that they had heard a very weak 'Mayday' from the ESTONIA already about 30 minutes before the 'Mayday' at 01.22 hours which finally triggered off the rescue operation. They had not reacted because it had been very weak and was not repeated, at least they did not hear anything more and other ferries were much closer. When it subsequently turned out that ESTONIA was really in trouble, he and the mate decided to remain silent about the first weak 'Mayday'. Therefore the first official 'Mayday' was recorded by the Marine Rescue Coordinating Centre (MRCC) Turku, also very weak and very strange, at

**01.21.55 "Mayday, Mayday Estonia, please."**

This in itself already implies the urgent request to (finally) being heard, under-stood and helped. Also on the bridge of the Swedish ferry SILJA SYMPHONY this 'Mayday' was heard and the watch A.B. sailor Jan Öhrn started the tape recorder, thus the subsequent distress communication is fully recorded and the respective transcript, already translated into English, is attached as [Enclosure 22.1.365](#).

The actual distress traffic under participation of the ESTONIA was very short, only 8 minutes, and according to the recordings of MRCC Turku reads as follows:

Time, hr:min.sec	From	To	Transmission
<b>01:21.55</b>	<b>Estonia</b>		<b>Mayday Mayday Estonia please (unclear)</b>
01:22.14	Mariella	Estonia	Estonia, Mariella
01:22.34	Mariella	Estonia	Estonia, Mariella over
Recorded by SILJA SYMPHONY:			
<b>01:23.11</b>	<b>Estonia</b>		<b>Europa, Estonia, Silja Europa, Estonia</b>
01:23.19	Silja Europa	Estonia	Estonia, this is Silja Europa replying on channel 16
01:23.26	Estonia		Silja Europa
01:23.33	Silja Europa	Estonia	Estonia, this is Silja Europa on channel 16
<b>01:23.54</b>	<b>Estonia</b>		<b>Silja Europa,Viking, Estonia</b>
01:23.58	Mariella	Estonia	Estonia, Estonia
<b>01:24.00</b>	<b>Estonia</b>		<b>Mayday Mayday.</b>
01:24.05	Estonia		Silja Europa, Estonia
01:24.07	Silja Europa	Estonia	Estonia, Silja Europa. Are you calling Mayday?
01:24.28	Silja Europa	Estonia	Estonia, what's going on? Can you reply?
<b>01:24.31</b>	<b>Estonia</b>		<b>This is Estonia. Who is it there? Silja Europa, Estonia</b> (now 3rd officer Andres Tammes has taken over)
Note: The voices of the persons having participated in the short distress communication on board the ESTONIA have been identified. At first 2nd officer Tormi Ainsalu speaks and then 3rd officer Andres Tammes takes over, while chief officer Juhan Herma is subsequently heard shouting the position. The first words from Andres Tammes are the above-mentioned: "This is Estonia. Who is there?"			
01:24.40	Silja Europa	Estonia	Yes, Estonia this is Silja Europa
<b>01:24.42</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>Good morning, Do you speak Finnish?</b>
01:24.45	Silja Europa	Estonia	Yes, I speak Finnish.
<b>01:24.46</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>Yes, we have a problem here now, a bad list to the right side. I believe that it is twenty, thirty degrees. Could you come to our assistance and also ask Viking Line to come to our assistance?</b>
01:25.58	Silja Europa	Estonia	Yes, Viking Line is just behind us and they surely got the information. Can you give your position?
<b>01:25.04</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>...(unclear)... we have blackout, we cannot get it now. I cannot say it.</b>
01:25.12	Silja Europa	Estonia	Okay, understood, we'll take measures.
Note: The statement of Andres Tammes was wrong in some respects, viz. (a) at 01.24 hours the list was at least 50°-60° and therefore they had a blackout of most consumers, because after the auxiliaries shut off at a list of 40°-45° the emergency generator only supplies power to a restricted number of consumers to which the GPS Navigator should have belonged (was installed subsequently and is thus unknown to the yard);			
(b) even if the GPS Navigator had not been connected to the emergency generator's power supply, it still would have shown the last position for the following 15 minutes. Consequently, Andres Tammes cannot have been right in explaining his inability to provide the position with 'blackout'. Rather, it has to be assumed that he was unable to look at the GPS Navigator from the position inside the bridge where he was desperately holding fast to something at the high port side, probably near the aft door. In this connection it has to be borne in mind that - straight after the end of the distress communication at 01.25 hrs. Tammes and Ainsalu left the bridge through the port aft door (statement Henrik Sillaste), and - at 01.25 hrs.			
Silver Linde and others were already in the liferaft.			
01:25.24	Mariella		Silja Europa, Mariella
01:25.26	Silja Europa	Mariella	Yes Europa here, Mariella ... Mariella this is Europa 16.
01:25.33	Mariella	Silja Europa	Did you determine their position, is it they who are here on our port side?
01:25.39	Silja Europa	Mariella	No, I didn't get any position from them, but they must be here in the neighbourhood, they have 20-30 degrees starboard list and blackout.
01:25.50	Mariella	Silja Europa	I think that they are here on our port side approximately 45 degrees.
01:25.56	Silja Europa	Mariella	Okay, yes, I am just waking up the skipper.
<b>01:26.41</b>	<b>Estonia</b>		<b>Silja Europa, Estonia</b>
01:26.44	Silja Europa	Estonia	Estonia, Silja Europa
01:26.45	Estonia	Silja Estonia	Are you coming to assistance?
01:26.47	Silja Europa	Estonia	Yes, we are. Can you tell me if you have an exact position?
<b>01:26.50</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>I cannot say because we have blackout here.</b>
01:26.54	Silja Europa	Estonia	Yes, can you see us, or?
<b>01:26.57</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>Yes, I can hear you.</b>
01:27.01	Silja Europa	Estonia	Okay, we will start to determine your position here now. Just a moment.
01:27.07	Silja Europa	Estonia	Yes, of course we will come to your assistance, but now we have to determine your position.
01:27.15	Mariella		Helsinki Radio, Helsinki Radio ... calling on channel 16 ... Helsinki
01:28.17	Silja Europa		Mariella, Silja Europa
01:28.25	Mariella	Silja Europa	Yes, this is Mariella
01:28.27	Silja Europa	Mariella	Yes, have you any visual contact at all with Estonia?
01:28.31	Mariella	Silja Europa	No
01:28.35	Silja Europa	Mariella	We must start and try to find her some-where, it is a bit difficult to say as they didn't give any position.
<b>01:28.43</b>	<b>Estonia</b>		<b>Silja Europa, Estonia</b>
01:28.45	Silja Europa	Estonia	Yes, Estonia, Silja Europa
<b>01:28.47</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>I'll tell you our position now.</b>
01:28.50	Silja Europa	Estonia	Yes, go ahead.
<b>01:28.52</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>58 latitude, just a moment ... 22 degrees</b>
01:29.01	Silja Europa	Estonia	Okay, 22 degrees, understood, we're on our way there.
<b>01:29.05</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>So 59 latitude and 22 minutes.</b>
01:29.16	Silja Europa	Estonia	59.22 minutes and longitude?

<b>01:29.19</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>21.40 East.</b>
01:29.23	Silja Europa	Estonia	21.40 East, okay.
<b>01:29.27</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>Really bad, it looks really bad here now.</b>
01:29.36	Silja Europa	Estonia	Yes, looks bad. We are on our way and it was 21.40.
<b>01:29.39</b>	<b>Estonia</b>	<b>Silja Europa</b>	<b>... you said (unclear)</b>
01:29.42	Silja Europa	Estonia	48, okay.

The original and complete distress communication is available on tape.

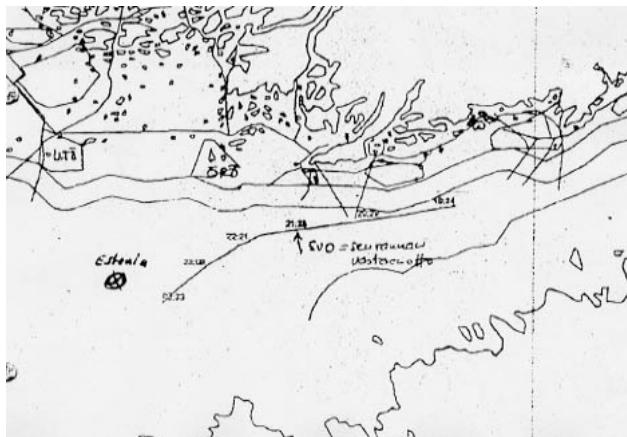
At the MRCC Turku there was reportedly the operator/communication officer Ilkka Jouko Kalevi Kärppälä on duty. He states to have heard ESTONIA's 'Mayday' at 01.24 hours and to have contacted immediately the Turku Coast Guard Station Nagu/Pärnäs where the operator Rauli Tapio Winberg was on duty. While MRCC Turku allegedly picked up the first message weak and unclear, the Coast Guard station Nagu understood the message clearly and in such a tone of voice that the distress situation was at once understood. The statement from the MRCC Turku operator is attached as Enclosure 22.1.372 and the statement of the CG Nagu operator as Enclosure 22.1.373.

**Note:** According to Finnish media reports both stations were unattended at the time in question and the "distress" calls were recorded automatically. See also telephone interview of Captain Thörnroos by Inspector Lars-Erik Andersson.

Also the **military radar station Utö** did reportedly overhear the distress communication between ESTONIA and SILJA EUROPA since 01.24 hours and did apparently also record the tracks of all the vessels in the wide surrounding since midnight or even earlier - in total 8, viz.

SILJA EUROPA  
SILJA SYMPHONY  
MARIELLA  
ISABELLA  
FINN JET  
FINN HANSA  
FINN MERCHANT  
WESTON

but, allegedly except for ESTONIA. In spite of the radar stations Ossarö, Russarö and Orö having tracked a vessel sailing along the Finnish Coast which they assumed to have been the ESTONIA, however, allegedly the echo got lost due to bad radar weather when being handed over from Orö to Utö radar station. The track, which - according to the Finnish Navy was with 90% certainty the ESTONIA. The wreck position is marked by a cross.



The complete plot which was sent by fax on the 28.09.94 to the Navy Head-quarters is attached behind this page. The comment of the Navy to the ESTONIA tracking, received in December 1998, was as follows:

**»Sinking position :**

59°22,92' N  
21°41,6' W  
18 M 3 A10 (a20)

**Visor position :**

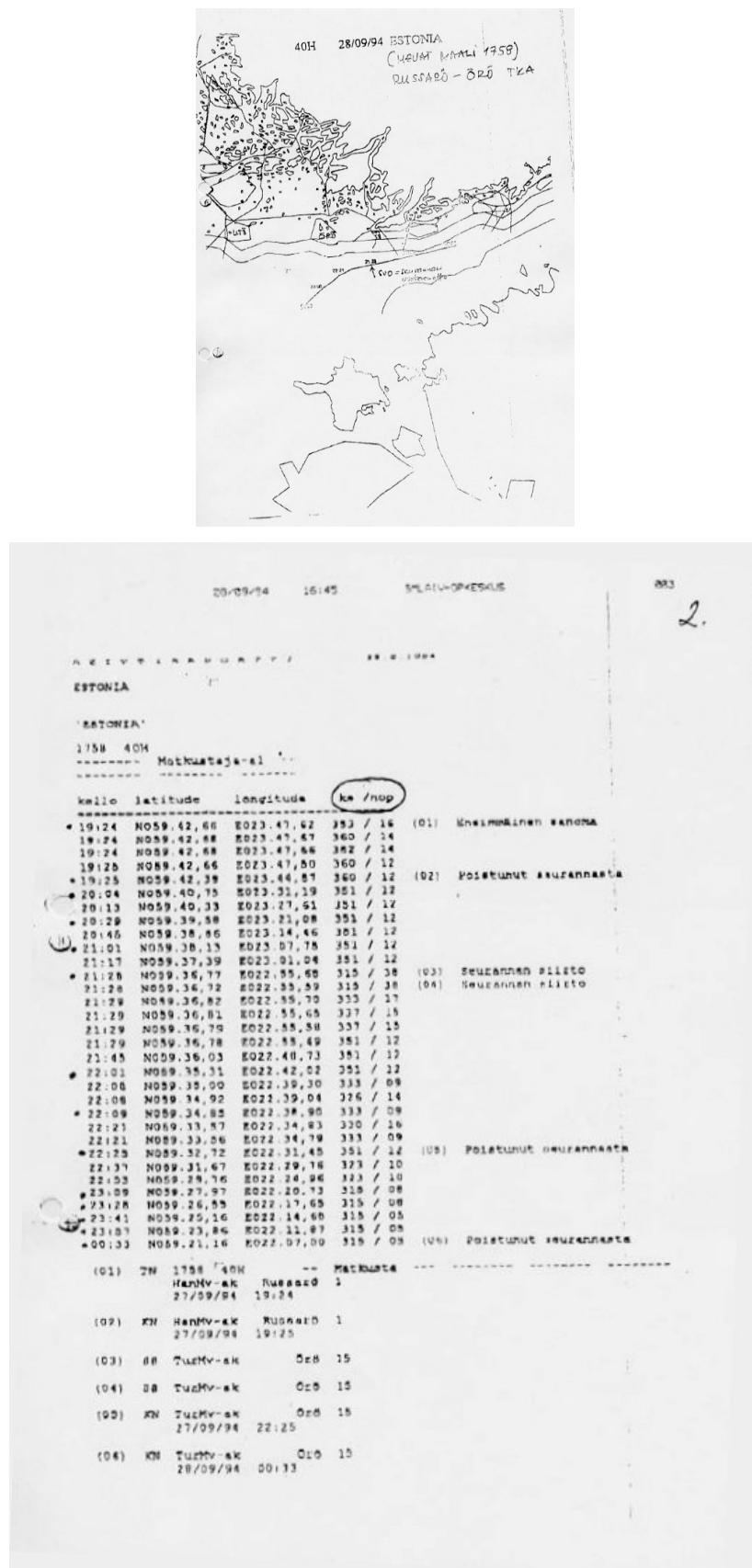
59°23' N; 21°39' W  
18 M 3 A19

The route cannot be true? Didn't Estonia leave Tallinn at 19.00 hours? There are 2 other Utö observations at 01.40/01.48.  
Didn't the vessel sink at 01.45 hours?

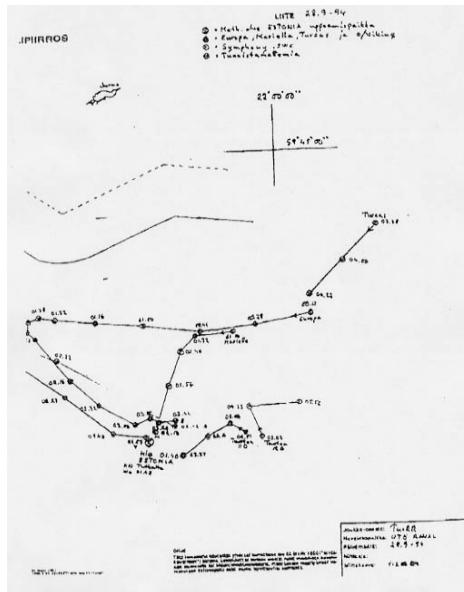
**Radar station Örö :** Received the "apparent" Estonia surveillance from Russarö Radar on 27.09.94 - 21.28 hours in position 18 N 1 C06. The tracking stopped on the 28th at 00.02 hours when the object was in position 18 M 4 A14.

**Radar station Utö :** Commenced tracking this vessel on 28th at 00.00 hours, but as an unidentified object, which was allegedly lost due to very bad radar weather and only found back at 01.40 hours when the Distress Traffic was overheard since 01.24 hours already. The radio transmission were also very bad and repeatedly interrupted and cut into short pieces.«

In summary it has to be concluded that the track thought to be the ESTONIA cannot have been this vessel, because she could not have made this much longer route within the time available between the departure from Tallinn and her sinking. What remains is the track of an unidentified vessel disappearing from the Utö radar screen at 00.33 hours at a position about 8 nm East of the possible ESTONIA position at that time is shown below.



On the plot below the tracks of most of the vessels participating in the rescue operation are shown. The plot was received from the Finnish Navy in December 1998.



The following entries from the Utö log were also made available:

»28.09.94

- 01.24 ESTONIA radio traffic with SILJA EUROPA overheard
- 01.40-01.48 Target tracked on Utö radar
- 01.48 Radar supervisor Eija Viiala lost the target from the screen
- 01.50 The officer on duty is informed about a Mayday at sea
- 01.55 PU? on the radar
- 02.20 The Sea Rescue centre assigns Utö to operate in the evacuation centre capacity
- 02.50 The fort ready to receive patients
- 04.20 First patients arrive
- 06.00-09.00 Medical teams arrive - Mariehamn, - Stockholm, - Pargas, - Turku University Hospital
- 09.00 The last survivors transferred to Utö, total 23
- 10.00-12.30 Evacuation of patients to Turku
- 10.17 Main part of flight squadron arrives at Utö
- 11.40 The fort ready to receive corpses - Part of the flight squadron - Permanent staff
- 12.00-20.30 Receiving corpses, total 41«

The complete available Utö log with office translation is attached as [Enclosure 22.1.374](#).

Possible further observations by Utö radar and related circumstances are also explained in Subchapter 22.3.

The other participants in the drama were the watch officers on the bridges of SILJA EUROPA and MARIELLA and subsequently also the masters of these large ferries, both being on their way from Helsinki to Stockholm. On board of SILJA EUROPA was the **1st officer Teijo Karl Peter Seppelin** on watch. In his statement, taken by the Finnish part of the JAIC he reported the following:

*»It was Wednesday, i.e. the 28th, and the time was about 01.20 when I heard the Mayday on Channel 16. The call was weak and I could not make out the name of the broadcasting vessel. In this instance the radio traffic did not come through as normal, crystal clear. I immediately responded: "Who called and transmitted a Mayday"? After this I got in contact with the ESTONIA. The conversation was initially in English and then the guy on the ESTONIA asked if I spoke Finnish. I answered in the affirmative and after that we continued in Finnish. ESTONIA reported a bad 20°-30° list and asked for help. These details have been recorded in the SILJA EUROPA's radio log and in the ship's log.*

*The Mayday was received but after that the guy on the ESTONIA was unable to give his position. I got the information that they had a complete black out on the ESTONIA. I called ESTONIA again and managed to reach them. This time the ESTONIA gave me their position which was 59° 22' N and 21° 48' E. The SILJA EUROPA's position at that stage was 59° 32' N and 21° 28' E. After this I called the Master to the bridge and myself started navigating towards the area indicated by the ESTONIA. Simultaneously I started up more engines in order to have full speed.«*

The complete statement is attached as [Enclosure 22.1.375](#).

The distance to the casualty was ca. 15 nm and the ferry had to be turned on opposite course.

On board of the Viking Line ferry MARIELLA the mate Ingmar Hans-Göran Eklund was on watch and he reports in his statement, which is only available in Swedish, as follows:

*»The wind was quite strong and blowing from WSW with 16-17 m/sec. The sea was rough and spray was over the whole vessel. Our speed was about 11-13 kn. When I took over the watch at 22.00 hours I saw the ESTONIA at port side about 30° forward of abeam. I saw SILJA EUROPA further ahead of us at starboard side. ESTONIA was proceeding faster than we were. I saw once by the vector that their speed was 14.3 kn which is the highest speed I would have dared during this night. I estimate that the average speed on ESTONIA was 14 kn. Her course at 22.00 hours was almost West and she was holding herself quite well at our side. We steered a little more to the West to have the wind from right ahead, which was westerly. I saw ESTONIA all the time on the radar. I had a vector every 15 minutes.*

*At 01.30 hours the master, Captain Thörnroos phoned the bridge and asked how the weather was. I replied something like the vessel's pitching and at the same time I heard on Channel 16 that ESTONIA said one time 'Mayday'. I think that the following words were "blackout" and "heavy listing". I asked the master to come up and that's what he did. I replied immediately to ESTONIA but they did not answer. Also after the master had come up to the bridge I continuously tried to get contact but ESTONIA did not answer. Simultaneously with my attempts to establish contact with ESTONIA I took her radar position ..... .*

*As soon as the master was on the bridge we altered course towards ESTONIA. The distance was ca. 9 nm when he called 'Mayday'. We could even see ESTONIA visually. Earlier many times I had looked at her through binoculars and knew her silhouette quite well.*

*After we had heard the 'Mayday' call we saw the lights of ESTONIA. While I was taking care of the navigation, the master was trying to get in contact with Helsinki Radio, first over VHF and then on MF 2182 kHz, both of which failed. He finally managed to get in contact with the shore by mobile phone.«*

The complete statement is attached as [Enclosure 22.1.376](#).

There is a similar statement from Captain Jan Tore Thörnroos of MARIELLA which does not say much more, however, in the files of the public prosecutor from Stockholm the protocol of the telephone questioning of Captain Thörnroos on 06.10.94 by the Criminal Inspector Lars-Erik Andersson, Stockholm, was found which is more interesting and the relevant parts shall be quoted as follows:

*»A: We had met in a hurry on that evening on board MARIELLA.*

*T: So it was you that I spoke to?*

*A: Yes, but it was a little chaotic then, but I thought by all means to have a word with you. (They agreed to meet personally in Stockholm on 26 October 1994.)*

T: There are no problems as long as we are inside the Gulf of Finland, i.e. before Hangö. There we go on normal speed, but after Hangö the problems begin.

A: I saw an interview with you on TV when you said that you were making 12 kn?

T: Yes, between 10-12 kn and this is normal speed for us in such weather.

A: After midnight, how high were the waves?

T: 5-6, later it was more 7-10 m.

A: Did you see ESTONIA visually?

T: Yes.

A: Did you see ESTONIA earlier that evening?

T: No, not me, because I was not on the bridge earlier that evening.

A: But could she be seen from MARIELLA?

T: Yes, we proceeded parallel to each other and when I came up to the bridge I saw her visually and the mate said: "I am scared. We proceeded side by side the whole evening."

A: And he also followed ESTONIA by radar?

T: Yes, he did and when I came up and we had plotted her, but it is so that we can get much more information, we can plot up to 100 vessels. We can take for example course, speed, passing distance, etc., but we did nothing like this with ESTONIA because she was on parallel course and was no threat to us. It is more the vessels on opposite course that are interesting.

A: How about her speed?

T: According to my estimate between 12-14 kn; they say 15 kn in the mass media, but I do not think that she went that fast. I phoned the mate to instruct him to further reduce the speed because I felt that we were pitching too hard.

A: And just then you got the call?

T: They were calling 'Mayday' and I jumped into my clothes and up to the bridge which took maybe just 20 seconds.

A: Mayday, was this all that came?

T: Yes, "Mayday, Estonia", he called and so he called again, and so he called for us and so he called for SILJA EUROPA, but he - one could hear that he was in full panic. Therefore we got no reasonable explanation, but then they were shooting up emergency rockets. But we got no contact with them ..... This went on for 1 or 2 minutes. Then he called again "Mayday, Estonia" and we tried again to establish contact, but then EUROPA got contact and he tried to call in English "Do you speak Finnish?" We knew that they could speak Finnish. Then he shouted that they "Have 30° list. Blackout!" and again "30° list. Blackout!" Yes, that's what he said.

A: When you came to the bridge did you see ESTONIA all the time?

T: Then I saw ESTONIA exactly. The mate pointed to her and said: "There she is." She was then ca. 45° to port of our head-on line.

A: Distance?

T: 9 nm. A: 9 nm and then you changed course?

T: Then we changed course, because before we had contact with them we did not know what had happened.

A: Did you see when the vessel disappeared?

T: Yes, ..... At first all the lights were blinking and then extinguished altogether. From then on it remained completely dark. But we still saw her on the radar. We continued to proceed towards her and when the distance was between 4-5 nm she disappeared from the radar screen, but came back and so on due to the bad weather. But between 4 and 5 nm distance there was no more radar contact. After 40 minutes we sighted the first liferafts.

It looked like a tumbled over Christmas tree with lots of small lights. Then we understood that these were the lights of liferafts and lifebuoys. We could do no more but stop and then we heard from people on deck that that they were shouting in the water.

SILJA EUROPA came about 1/2 hour after us and we reported to them what we saw .....

SYMPHONY and ISABELLA arrived somewhat later.

Another matter is, I believe, worth mentioning and which should be remembered by you, who are investigating this here, it concerns the alerting. After they had called out the emergency messages it was only EUROPA and we who confirmed to them, and we really had big problems establishing contact with the coastal stations. It is not as they told the media that they picked up the emergency messages. They did not do that. They did not do that before we called them over mobile phone. EUROPA phoned Turku by mobile phone and we phoned Helsinki by mobile phone. After they had sent out the emergency messages it was just EUROPA and we who replied to them.

A: Does this mean that the Rescue Services ashore never confirmed the receipt?

T: They never confirmed anything.

A: Not the receipt of the messages?

T: No, they never did so before we stirred them up by mobile phone. At first we didn't even know whom to call.

We tried at once after he had received the information from ESTONIA about her position and so on, and after the contact was interrupted we both tried, we and EUROPA, to contact MRCC and Helsinki Radio, Mariehamn radio. At first over VHF Channel 16, the emergency channel. No reaction at all. Nobody was listening in and not even in Stockholm. So we changed over to 2182, which covers the whole Baltic Sea, and were calling and calling. No contact whatsoever. The only thing we heard was somebody else calling. He spoke to EUROPA thereafter. He heard that we were calling and we heard that he was calling, but there was no reaction from ashore.

A: That means in summary that ESTONIA was sending a Mayday which was immediately only received by MARIELLA and EUROPA. It was just you two confirming receipt?

T: Yes, that was, in any event, what we heard.

A: You then tried to contact the Rescue Services?

T: Yes.

A: Both in Finland and in Sweden.

T: Yes.

A: And you did not get any reply?

T: No.

A: And then you used a mobile phone to phone the Rescue Services in Finland?

T: To phone the Rescue Services in Finland and EUROPA they did the same independently of each other. They decided to phone Turku and we decided to phone Helsinki. Subsequently they went out with a PAN PAN message which means 'Man Over Board' and only later with 'Mayday' after they had sent out the PAN PAN. This was Helsinki Radio.

A: What's the name of this message?

T: PAN PAN. It is not as heavy as a 'Mayday' call. This is used when somebody has fallen overboard, for example, when there is no danger for the vessel itself.

A: So, this came from Helsinki Radio?

T: Yes, this came from Helsinki and subsequently I knew that they later also came out with a 'Mayday' relay which we did not hear ourselves, but EUROPA heard it.

A: All this has to be discussed in detail when you come to Stockholm.

T: Yes.

A: But I know from you already that in any event it had been very difficult to get in contact with the Rescues Services.

T: We had co-operated a lot with them and it was not the first time that we had to use the mobile phone.

A: Yes, and was it the same with Sweden, with Stockholm?

T: Yes, however, since we were on the Finnish side we should not alert Sweden unless there are particular circumstances, but as we did not know what had happened. The only thing we knew when we alerted the Rescue Services was that they had sent out a 'Mayday'. Then we had no idea what had happened and we still could see the ferry and could not imagine that such a catastrophe had happened.

T: This is also something which we did not tell the media and have just discussed between ourselves, thus it has not in fact reached the outside yet.

A: No, this is good so. We will keep this to ourselves during the investigation.

T: Yes.«

It was agreed to meet at Thörnroos's next visit to Stockholm when also the mate Ingmar Eklund should be heard. The protocols of these meetings are not available. The complete protocol of the telephone interview is attached as Enclosure 22.1.377.

**Note:** Based on the above statement of Captain Thörnroos which is confirmed by the statement of mate Ingmar Eklund - Enclosure 22.1.376 - it has to be assumed that the statements of the operators on duty at MRCC Turku, Ilkka Jouko Kalevi Kärppälä, and at the Coast Guard station Nagu/Pärnäs, Rauli Tapio Winberg, must be wrong. Reportedly it had been admitted in the media that the Mayday calls were recorded automatically, but that actually nobody had been on watch at these stations and that this is the explanation why nobody reacted at the beginning (see also the following Subchapter 22.3 - The Rescue Operation). The above might be the explanation for the initial silence of the Finnish MRCCs, but what about Sweden and Estonia?

**Note:** According to Finnish media reports both stations were unattended at the time in question and the "distress" calls were recorded automatically. See also the telephone interview of Captain Thörnroos by Inspector Lars-Erik Andersson

Also the following two questions are difficult to answer. It shall, nevertheless, be attempted:

(1) Why was the Mayday transmitted so late?

(2) Why did SILJA EUROPA and MARIELLA insist on establishing ESTONIA's position, although they knew exactly that the vessel between them and somewhat more to the South was ESTONIA? (These 3 ferries had been arriving at and sailing from Stockholm together since February 1993). This refers in particular to MARIELLA because those on the bridge saw ESTONIA continuously since being overtaken by her off Hangö an the watch officers established her position immediately after they heard the 'Mayday'.

as to 1.):

Based on the investigation results of this 'Group of Experts' question one might be explained as follows:

It has been mentioned already at the beginning of this subchapter that the transmissions had been very weak for two reasons, viz.

- the mates most probably had used their 'walkie-talkies', and
- Channel 16 was considerably disturbed.

Therefore it cannot be excluded and has to be assumed that a 'Mayday' had been called earlier already. This is confirmed, on one hand, by the anonymous telephone report of a watch A.B. on a ferry in the vicinity and, secondly, by the circumstances on board which had mandatorily required the 'Mayday' at the very latest after the big heel at 01.02 hours. The indication of Silver Linde in his statement no. 3 on 17.10.94 (Enclosure 21.2.2.255), that he was sent down from the bridge to inform them about the alarm to the Information desk minutes before the big heel, could confirm this as could the statement of Henrik Sillaste that the lifeboat lashings had been released in advance.

Furthermore, those on the bridge of ESTONIA had been aware of the following problems:

(a) The starboard stabiliser which did not move out and a respective alarm had appeared at about 00.30 hours, which activated Margus Treu and was - according to the book of Andi Meister - the real reason to call down Henrik Sillaste, and subsequently Kadak and Sillaste tried to get the stabiliser fin out, probably by beating with a sledge hammer while Treu returned to the ECR.

(b) Margus Treu reported to the bridge that "the bow ramp had been struck and became broke" (that is what Treu told Kadak), most probably after he had seen it.

(c) Silver Linde reported to the bridge that "there is a lot of water on the car deck, we have to leave the vessel" (overheard by Ervin Roden).

It can be assumed with certainty that the watch officer, 2nd officer Peeter Kannussaar, immediately informed the master and chief officer, who certainly came to the bridge probably together with the chief engineer within 2 or 3 minutes maximum. As a next step, the speed was reduced to probably 6 kn (Margus Treu) and the course was slowly changed to starboard with the aim of taking the pressure off the visor and wind and sea on the stern at slow speed and then to send crew members down to the car deck to close the partly open bow ramp. It has to be assumed further that 4th officer Kikas was steering manually during this manoeuvre. When the wind and sea came almost abeam from starboard the vessel began to roll more and more, less to port / wider to starboard and those on the bridge realised that there was the risk of capsizing to starboard and decided to turn back to port. This was apparently done too fast in the attempt to stop the dangerous rolls and the ferry swung rapidly to port and made a wide heel to starboard - reportedly 45°-50° - and came back to almost upright condition. The very abrupt and rapid heel caused numerous people to be catapulted out of their bunks, to be thrown against walls, roulette tables and other heavy objects to be torn loose and smashed against the wall and the like. Therefore it has to be assumed that at the highest point of the superstructure -

the bridge - also some or all of those on duty there lost their hold and were catapulted the very long distance across the breadth of the bridge into the starboard wing (where indeed one body was found by the divers). It is not unrealistic to assume that it took them - at least - several minutes to recover, if at all, and then to realise the situation. It has further to be assumed that 2nd officer (B) Kannussaar, whose watch was over at 01.00 hours, was sent down to the car deck, probably together with the nautical adviser Juri Aavik, the chief engineer Lembit Leiger, the boatswain Vello Ruben and some A.B.s, among them Aulis Lee and Arne Koppel. They were working on the car deck when the two severe impacts occurred around 01.00 hours, shortly afterwards followed by the big starboard heel at 01.02 hours, the vessel righted almost up, but the heel increased again and those on the car deck realised that they had no chance to hold the visor and to close the bow ramp and tried to get up to the bridge, respectively to deck 7. Silver Linde, Arne Koppel and Aulis Lee made it, they were already on deck 7 opening liferafts when crew members from the cabins on deck 7 came out (the purser Andres Vihmar for example). The passenger Per-Erik Ehrnsten, coming from his cabin on deck 6, i.e. only one deck below and located near the forward central stairway, even saw Silver Linde and two other crew members walking in the inner alleyway from the aft crew accommodation forward towards the centre stairway only minutes after the big heel. Aulis Lee even managed to get back to his cabin on the starboard side of deck 4, to pick-up his wife Aina and both got back to deck 7 in time and survived. Simultaneously those on the bridge obviously considered their options whilst the situation was deteriorating by the minute, the vessel being now on a south-easterly heading with the deep starboard side exposed to the wind and waves, the main engines shut off, but when the vessel stabilised for some time at a heel of 40°-50° this might have raised hopes for a while that the vessel might stay afloat until the arrival of assistance from shore. This might have caused them to delay the urgently required transmission of 'Mayday' and alarm for the passengers even further. When finally at about 01.21/01.22 hours the heeling started again to increase 2nd officer Ainsalu desperately called "Mayday, Estonia, please", etc.

All this does not explain why Ainsalu and subsequently also Tammes did not use the bridge installed VHF or even the MF installation being much stronger, which would have connected them with the outside world immediately.

Consequently there must have been circumstances on the bridge which prevented them from using the installations. One reason could be the authority of ESTONIA's master, Arvo Andresson, who never permitted the mates on duty to take any action on their own. Therefore also during this night the mates on the bridge presumably did not dare to undertake on their own such a drastic step as advising the outside world by transmitting a 'Mayday' that the pride of their nation, the ESTONIA, was in serious trouble. Unthinkable according to the philosophy of Arvo Andresson and his superiors ashore, and this could be a reason why the 'Mayday' was transmitted so late, i.e. in a situation when main engines and auxiliaries had already shut off automatically and the vessel was heeling at 45°-50° since 01.22 hours.

On the other hand, it also cannot be excluded that the mates transmitted a 'Mayday' much earlier, i.e. before 01.00 hours already, but by means of the "walkie-talkies" and at a time when transmissions over Channel 16 were severely affected by heavy disturbances.

As, however, no one from the bridge has survived and the evidence of watch A.B. Silver Linde in respect of his observations on the bridge around 01.00 hours have proven to be wrong, because he never was on the bridge after 00.30 hours, and furthermore the four bodies found on the bridge by the divers were not examined - at least not officially - it will probably never become known what happened on the bridge after 00.30 hours, unless the unmanipulated videos are released and/or new diving investigations are carried out.

## as to 2.):

Why did SILJA EUROPA and MARIELLA insist on establishing ESTONIA's position, although they knew exactly that the vessel between them and somewhat more to the South was ESTONIA? In particular MARIELLA had seen ESTONIA continuously since being overtaken by her off Hangö. On MARIELLA, only 9 nm away from the casualty, the master Jan-Tore Thörnroos phoned the bridge just at that minute from his bedroom to instruct 2nd officer Ingmar Eklund to further reduce speed as the vessel was pitching in too hard. At that time MARIELLA, being almost twice as large as ESTONIA, was already going several knots slower than the Estonian vessel.

Thörnroos heard Eklund shouting:

»Now Estonia is sending a distress message.«

Within less than 1 minute Thörnroos appeared barefoot on the bridge. In the meantime Eklund had twice tried to get in contact with ESTONIA.

»Estonia - Mariella.«

»Estonia - Mariella.«

The name of the own vessel always has to be mentioned after the name of the vessel being called.

But there came no answer. Not before 1 minute and 5 seconds later when a sound, as from a whistle, was heard which most probably was a disturbance caused by somebody activating the transmitter on channel 16 without using it.

After a further 15 seconds the desperate voice from ESTONIA came again:

»Europa - Estonia - Silja Europa - Estonia.«

Now chief officer Teijo Seppelin from SILJA EUROPA replied directly in English, which is the normal radio communication language in international waters:

»Estonia, this is Silja Europa replying on channel 16.«

Ainsalu called again as if he had not heard SILJA EUROPA:

»Silja Europa.«

Seppelin replied again:

»Estonia, this is Silja Europa replying on channel 16.«

He got no reply, 21 seconds elapsed before Ainsalu came back:

»Silja Europa, Viking - Estonia.«

Now Ainsalu suddenly called both SILJA EUROPA and the undefined Viking apparently not knowing which Viking vessel was the nearest. The master of MARIELLA had meanwhile arrived on the bridge and tried to get in contact with ESTONIA himself:

»Estonia, Estonia.«

Immediately thereafter came Ainsalu:

»Mayday, Mayday.«

Two minutes and 9 seconds had by now elapsed since the first Mayday. Teijo Seppelin on SILJA EUROPA apparently had difficulties accepting that one of the large Baltic ferries was calling Mayday. He asked again and not fully in line with the international rules for distress traffic by VHF:

»Estonia - Silja Europa - asking you - eh. Are calling you Mayday? Estonia, what's going on? Can you reply?«

A correct reply should have been an immediate acknowledgement of the Mayday call and a question for the position. Now a new and somewhat more energetic voice came from the ESTONIA, the 3rd officer Andres Tammes who continued in English:

»This is Estonia.«

Then he changed into Finnish.

»Who is there? Silja Europa, Estonia.«

Seppelin replied in English.

»Yes, Estonia. This is Silja Europa.«

Tammes, who according to his professional qualifications spoke English, continued in Finnish and now obviously tried to calm down the emotions somewhat by being polite:

»Good morning. Do you speak Finnish?«

»Yes,«

Seppelin replied  
 »I speak Finnish.«

The further communication between Tammes and Seppelin continued in Finnish.

»Yes, we have a problem here now,« said Tammes  
 »a bad list to the right side. I believe that it is 20°, 30°. Could you come to our assistance and also ask Viking Line to come to our assistance?«

Seppelin replied:  
 »Yes, Viking Line is behind us and they surely got the information. Can you give your position?«

Tammes:  
 »...(unclear)...we have blackout, we cannot get it now. I cannot say it.«

Seppelin:  
 »Okay, understood, we'll take measures.«

This was a confusing question from Seppelin and one of the most peculiar ones of the whole rescue operation. These large vessels proceeded on almost the same course every night. SILJA and VIKING departed from Helsinki together at 18.00 hours, while ESTONIA left Tallinn one hour later. All three vessels headed for Sandhamn, where they normally arrived more or less at the same time. Only in strong southerly and south-westerly winds would all three use the northern entrance to Stockholm - Söderarm. They knew exactly where the other vessels were and one look at the radar screen would have told Seppelin where MARIELLA and ESTONIA were. This question to ESTONIA, however, also indicates that he knew where MARIELLA was. Consequently, he should also have been aware that the radar echo on port side aft of abeam was ESTONIA. However, instead of turning SILJA EUROPA soonest towards the already sinking ESTONIA a long discussion via VHF channel 16 commenced about ESTONIA's position.

Andres Tammes from ESTONIA told Teijo Seppelin that they had a 'blackout' which normally means that the power supply has totally failed and thus they were unable to state their position. Both GPS Satellite Navigators installed on the bridge - a "Shipmate" in the control panel and a "Magnavox" in the chartroom - were connected to the emergency generator as well as to the emergency batteries according to the Estonian members of the JAIC. Both GPS Navigators were automatically switched off when the auxiliaries stopped and switched on again after the start of the emergency generator. In order to overlap this break a battery installed in the GPS Navigator supplies power in the meantime and the set remains connected to the chain and shows the position continuously; consequently the position remains on the display, at least of the "Shipmate" GPS. Therefore, this could not have been the reason for Tammes's problem in stating their position. The reason was most probably his difficulties to hold to something at his position in the bridge, most likely at the aft door at port side, because at 01.35 hours when the VHF-communication between Tammes and Seppelin commenced ESTONIA must have heeled ca. 50°-60°, which was quickly increasing, and not 20°-30° as stated by Tammes. It was most probably impossible for Tammes from his position to have a look at the "Shipmate" GPS installed in the front console. It took some time for chief mate Juhani Herma to get to the Shipmate from where he had been before inside the bridge and shout the position to Tammes.

Now the master of MARIELLA came in:

»Silia Europa, Mariella.«  
 »Yes, Mariella, Europa here - Mariella on 16.«

Thörnroos asked:  
 »Yes, listen, is their position clear to you? Is it they who are on our port side?«

More peculiar questions, this time from Captain Thörnroos of MARIELLA. The 2nd officer Ingmar Eklund, who had been on the bridge all the time, was able to inform his master directly which echo on the radar screen belonged to ESTONIA.

»There is Estonia!« said Eklund and pointed to the lights on the horizon.

In his statement to the Finnish criminal police Captain Thörnroos subsequently also testified that he »saw the lights of Estonia without the help of binoculars.« Eklund had seen ESTONIA overtaking MARIELLA outside Hangö and had followed the radar track ever since. Thus, there could be no doubt which echo was ESTONIA and consequently what her position was.

Seppelin replied to Thörnroos:  
 »No, I didn't get any position from them, but they must be here in the neighbourhood, they have 20°-30° starboard list and blackout.«

Thörnroos replied:  
 »I think that they are here at our port side approximately 45°.«

Now more than 4 minutes had passed since the 1st Mayday of ESTONIA.

Seppelin said,  
 »Okay, yes, I am just waking up the skipper.«

At about this time MARIELLA altered course towards ESTONIA.

Suddenly Andres Tammes came back, now clearly with desperation in his voice:

»Are you coming to assistance?«

Obviously the Estonians had now given up all hope, because the list must then have been some 70°, only 2 minutes later the bridge was under water.

Seppelin asked:  
 »Yes, can you see us?«

Tammes, however, in his desperate situation, having to face the loss of his life within the next minutes, apparently did not understand this as he replied:

»Yes, I can hear you.«

As ESTONIA had been on a south-easterly heading for some time already her deep starboard side was exposed to the wind and sea; SILJA EUROPA was at port side aft of abeam whilst MARIELLA was at port side about abeam, thus both vessels could most likely be seen by those on the bridge of ESTONIA.

Seppelin then said:  
 »Okay, we will start to determine your position here now. Just a moment.«

After Thörnroos had tried in vain to get in contact with Helsinki Radio via VHF or on 2182 kHz, SILJA EUROPA asked:

»Yes, have you any visual contact at all with Estonia?«  
 »No.«

Thörnroos replied (which was wrong, because at that time the emergency illumination of ESTONIA was still on.) Since he had seen the lights of ESTONIA clearly on the horizon during the last minutes, this reply is not understandable.

Thörnroos said later:  
 »This was wrong and I shall, of course, be criticised for that.«

Seppelin then came back to Thörnroos, expressing himself rather softly by saying:  
 »We must start and try to find her somewhere, it is a bit difficult to say as they didn't give any position.«

But now, after all hope for ESTONIA had apparently been given up, the chief mate of ESTONIA managed to lower himself down to the front console where the Shipmate was installed and read their position; his voice has been identified on the tape of the distress communication shouting the position to Andres Tammes, who repeated:

»59°22' (W), 21°40' (E)«.

It is unknown whether this was really the correct Mayday position, because on the bridge of MARIELLA the 2nd officer Ingmar Eklund noted the position having been 59°22' N, 21°39' E, about 0.5 nm more to the West. Receipt of the position was confirmed by SILJA EUROPA and then ESTONIA came back for the last time at 01.29.55 hours - 7 minutes and 15 seconds after the first Mayday call and 5 minutes before the battery-powered clock on the starboard side of the bridge stopped:

»Really bad, it looks really bad here now.«

Andres Tammes said and Seppelin replied:

»Yes, it looks really bad«, in a sort of routine way always repeating what the other vessel said.

»We are on our way and it is 21.40.«

Tammes came back once more at 01.30.06 hours, apparently in Estonian with a phrase which according to the master of MARE BALTIMUM, Erik Moik, meant:

»How far away are you?«, which would certainly make sense.

**Note:** At that time the ferry must have been more or less on the side. According to Henrik Sillaste - who was then already in the liferaft together with Silver Linde and others - that was approximately the situation when Andres Tammes and Tormi Ainsalu left the bridge through the port door and climbed down to the 7th deck where they helped with the opening of liferafts and pushing them into the water. Whereas the body of Andres Tammes was subsequently found, Tormi Ainsalu is missing.

The behaviour of those on the bridges of SILJA EUROPA and MARIELLA can simply be explained by their reluctance to accept whatever the Estonians did or did not do. When the first rather weak and hesitantly spoken Mayday was heard already at about 00.45 hours, the first thought of the officers on the bridges of the MARIELLA, SILJA SYMPHONY and SILJA EUROPA was probably something to the effect of "Oh no, not ESTONIA again, don't they even know what Mayday means?" and, indeed, the first message was not repeated. When the 2nd officer Ainsalu called 'Mayday' again rather weakly and hesitantly and even added "please" at 01.22 hours the reaction on the bridges of the Finnish and Swedish ferries was not much different (in the meantime the officers on SILJA EUROPA had changed watch at 01.00 hours). They simply could not believe that the situation on the ESTONIA was so bad as to justify a Mayday call, an impression which at the beginning may even have been underlined by Andres Tammes's statement: »We have a bad list .... I believe that it is 20°, 30°.... we have blackout.« Only later, when his voice had become really desperate and the lights of ESTONIA had disappeared, did they realise that the situation was indeed very serious and then they reacted appropriately.

A similar way of thinking may probably have influenced the speed at which the rescue operation was set into motion by those responsible, as will be explained in Chapter 22.3.

## 22.2 The EPIRB Buoys

The ESTONIA was equipped with two modern EPIRB buoys (Emergency Position Indicating Radio Beacons) of type Kannad 406 F.

The last check of the radio beacons was reported to have been made about one week prior to the disaster by the radio operator. The check confirmed that the EPIRBs were in full working order and it has to be assumed that both were left in "switched-on" condition after the test.

Nevertheless, no signals from the two buoys were received in the course of the rescue operation.

## 22.3 The Rescue Operation

The investigation of the performance and success of those having participated in the rescue operation is not the subject of this report. Nevertheless, the rescue operation is a vital part of the ESTONIA catastrophe and therefore just the chronology reflecting the developments since the "first", weak Mayday message at 01.22 hours on Wednesday, 28 September 1994, until Thursday, 29 September 1994, shall be outlined.

As explained in Subchapter 22.1 it has to be considered likely that the "1st Mayday" had been transmitted already 30 minutes earlier, i.e. around 00.50 hours.

The now following information has been partly received from the Finnish part of the JAIC and has partly been taken from Enclosure No. 2 of the Finnish book "Uutinen Estonia". All times are in Finnish = Estonian time = ship's time. The SAR Log of MRCC Stockholm and the Alarm Log of ARCC Arlanda - attached as enclosures - are in Swedish time, i.e. Finnish time minus one hour. Accordingly the following vessels - all proceeding along the Finnish coast from East to West - have participated in the rescue operation and their tracks were plotted by the Finnish radar stations between Porkala and Utö:

SILJA EUROPA - plotted track see [Enclosure 22.3.378](#)

MARIELLA - plotted track see [Enclosure 22.3.379](#)

FINN JET - plotted track see [Enclosure 22.3.380](#)

FINN MERCHANT - plotted track see [Enclosure 22.3.381](#)

FINN HANSA - plotted track see [Enclosure 22.3.382](#)

WESTÖN - plotted track see [Enclosure 22.3.383](#)

The plots begin as early as 20.59 hours (SILJA EUROPA) and show the tracks of the vessels throughout the entire rescue operation until the next morning at 07.00 hours or so. Also SILJA SYMPHONY on voyage from Stockholm to Helsinki, thus sailing from the West to the East, had been plotted since 01.03 hours when she was still West of Utö. The tracks of most rescue vessels during the operation has been transferred on to one sheet - see page 642. This sheet even includes two unidentified vessels to the east respectively south-east of the casualty area.

On all available plotting sheets, however, ESTONIA is only shown at her casualty position, although it is stated in the report of the Coast Guard Section Turku - Skärgårdshavet Sjöbevakningssektion Åbo - dated 28.04.95 on page 3, at the bottom, that

»From the moment of her departure Estonia was under the Finnish Coast Guard's radar surveillance, the same as the other vessels' traffic. The vessel disappeared from Utö's automatic radar follow-up at 01.48 hours. At the same time the vessel also disappeared from MARIELLA's and SILJA EUROPA's radar screens.«

The complete report is attached as [Enclosure 22.3.384](#).

**Note:** According to the above information the vessels were tracked automatically (and apparently recorded by radar), although it is stated in the Utö log that "the target had been tracked by Utö radar only from 01.40-01.48 hours" and that "at 01.48 hours radar supervisor Eija Viiala lost the target from the screen". In another report put into the INTERNET already on 01.10.94 by Kari Ili-Kuha from Tampere, Finland it is stated: »According to today's papers the ship seems to have been in trouble already over one hour before the distress signal. A female radar operator on duty in Utö fort noticed that the ship had gradually gone astray from her normal route, so that by the time of the distress signal the ship was already about 15 km South off the course and the signal was weak. The operator was surprised that the ship had not called for help earlier if they had problems. The ship had obviously had both engine and electrical problems. It remains a mystery why the crew on the bridge delayed the alarm, didn't they realise how serious the situation was? In the aftermath this is just plain useless speculation, but had they acted earlier in giving the alarm both in the ship and over the radio the number of casualties would likely not have been as high as they are now.«

Since "Eija" is a female name in Finland, the radar operator Eija Viiala stated in the Utö log could be identical to the "female radar operator" mentioned in the INTERNET message quoted above, although according to the Utö log she tracked ESTONIA only from 01.40-01.48 hours, when ESTONIA's stern was probably just settling down on the sea bottom and her bow rose out of the water, thus ESTONIA could not have changed her position very much during these 8 minutes. Two alleged radar plots were received from the Finnish Navy in this respect which are shown below.



Apparently the Navy was more talkative in the early days as obvious from the quoted INTERNET message which is apparently based on a newspaper report. The complete message is attached as [Enclosure 22.3.385](#).

In order to find out what the Finnish Navy records had on file, a meeting was held with Commander Vesa Ennevaara at the head office of the Finnish Navy in December 1998 and the results of the discussions are summarised as follows:

*»The 1994 radar system was based on the equipment from the 1980s. The software was not as comprehensive as the current one. The main difference was that the 1994 system did not record data in permanent memory, which the new system will do when fully implemented.*

*Tracking units, such as radar stations, aeroplanes and ships etc pick up targets and report all new objects to the next level op's centre. The acquisition of targets involves all military arms (navy, air force and army) as well as pilots, coast guard and customs. New targets are assigned a number ID and as soon as identification is possible, either by VHF or visually, the name of the object is determined. The new system will operate the identification process also by radar transponder codes, combined with the old system.*

*Tracking was done by one radar station at a time - feeding data to the OP's centre - until the target was formally "handed over" to the next tracking station. At the same time an object could be visible and followed on the screens of other tracking stations, as well, but they would not feed data into the system.*

*Tracking details were stored and transmitted in bursts from radar stations to the OP's centres. The data was stored in buffer memories. Overflow of data in a buffer memory would automatically cause deletion of the oldest data. Depending on the amount of data on each separate object this could mean anything from hours to maybe a full day or more of data remained in each buffer. The buffer for Estonia (if the ship was within range and was tracked at all, which according to Ennevaara is unclear) probably would have contained data all the way from Tallinn/Nayssaar, but no one thought to ask for it immediately after the accident. All old data was lost due to the lack of memory storage space and unavailability of such a software facility in 1994, because when the rescue operation commenced much older information was quickly lost from the buffers since intense tracking at short time differentials will rapidly fill a buffer.*

*The area of interest to the Navy Command charged with synchronising the rescue efforts was narrow, comprising the area between Utö and Hangö only. According to Commander Ennevaara no one thought about saving historical tracking data from other areas in time.«*

**Note:** This is obviously wrong as far as the ESTONIA is concerned, because the plot received and which is titled "40H 28/09/94 ESTONIA" was sent by fax on the day of the casualty - 28.09.94 - at 16.45 hours to the Navy's head office, thus then the stored data must still have been available as also confirmed by the also received list of times/positions/ bearings which reportedly refer to the radar station Örö (between Russarö [Hangö] and Utö). While the times and positions are mostly reflected by the plot, the bearing/speed items do not make sense and are - according to the Navy - based on the Coast Artilleries' own system which they could not explain.

*»Any ship could enter Finnish territorial waters at night, without being properly identified, and leave again - unless the manoeuvre was interesting enough to cause an investigation. After such a visitor had left, the buffer memory would be used again when needed and such historical data would be lost. Coast guard stations, responsible for shipping security, would sometimes call such targets (ships) to advise them if they were heading towards danger. In case there was reply a positive ID would have been established - otherwise none at all. This could be the case irrespective of whether a target was a "red" object, unless this was known in advance and the target duly picked up and identified by plane or surface ship.«*

**Note:** "Red" objects are warships of "unfriendly" nations.

*»Coast guard radars are not operated by dedicated and trained personnel on uninterrupted duty - like the Navy and Air Force radar stations are. Even when tracking, the operator may leave the radar set for coffee or lunch or even for watch duty, without a replacement at the screen. Coast guard, pilot and customs radars are commercial equipment, without the refined electronics of military equipment. Range and resolving power, as well as tracking accuracy are therefore inferior. The most reliable plotting is always obtained by hand. Plots obtained from stored data is always less reliable and contains spurious data. This is due to the fact that stored data contains past, present and predicted data. The predicted data may be incorrect and will be corrected on the next sweep or data transfer sequence. Even a stationary target will thus from time to time show a vector although it does not move at all.*

*The Navy's Estonia track was obtained from stored "buffer data" and is therefore not entirely reliable, besides not having an absolutely reliable identification (name of the ship). Nevertheless, according to Commander Ennevaara the Navy is about 90% sure that it was the Estonia. The plot in question is layed into chapter 22.*

*If it was not the Estonia, it would be an unidentified vessel. The radar weather was said to have been very bad and the radio communications were frequently interrupted according to the Utö radar station notes.«*

**Note:** In any event, the radar observer Eija Viiala saw a radar target which she believed to have been the ESTONIA from the time she took over from Örö radar station apparently at 00.33 hours. Apparently she told the local newspaper shortly after the casualty what she had seen for more than 1 hour before the 'Mayday' at 01.22 hours, which makes it even more difficult to understand why the respective data should not have been secured although the respective data of all the other vessels were secured.

Commander Ennevaara explained instead that

*»the radar range was only barely sufficient to pick up the site of the accident due to the distance and the very bad radar weather. The track, designated Estonia by the Navy, was named Estonia without any optical or secure identification of the target. The identity has been checked backward from the known location of the wreck by the Navy - but may have been an entirely different ship as well.«*

Ennevaara offered that the radar operators may be interviewed and that the station logs be searched which, to his knowledge, has never been done so far.

**Note:** For time reasons it has also not been done by this 'Group of Experts'.

In reply to a respective question Commander Ennevaara said that

*»the Finnish Intelligence service in 1994 did not listen with the objective of locating the transmissions but in order to pick up contents of messages. Interesting messages would be transmitted to op's centres without confidentiality. (This of course must depend on the contents of the intercepted message, although Commander Ennevaara did not say so.)«*

In a subsequent telephone interview the watch officer of SILJA EUROPA, Teijo Seppelin (the MARIELLA witnesses could not be reached), stated the following:

*»- as far as he could see, the Estonia was never in front of SILJA EUROPA - but came up from the south-east. This track would be different from the Navy radar track designated Estonia - and would be similar to the one put forward by the JAIC. Seppelin said that the Estonia normally came up straight from the south-east, i.e. from what must have been the Estonia/Nayssaar sound and crossed the track of the SILJA EUROPA. One crew of the Estonia would arrogantly cross the SILJA EUROPA track close under the bow and force the Officer to pull back on the engines, while the other crew would always pass politely under the stern. This was in the summer when the SILJA EUROPA entered at Sandhamn and the Estonia at Söderarm.*

*- he does not believe that the Navy track is that of the Estonia. Neither does the officer (Capt. Ltn. Niemelä from Utö), who was in charge of the radar station, primarily because the Navy track follows the normal routing system, initially west then, west-south-west.*

*- he does not recall radio interruptions but remembers that the MARIELLA's inability to reach Helsinki Radio on VHF Ch 16 and MF 2182 was widely discussed afterwards. He recalls the Mayday signals were of distinctly different character, one very weak and the other quite normal in strength.«*

So much for the Finnish Navy.

While searching through the files of the public prosecutor in Stockholm a copy was found referring to a drawing belonging to an article which had appeared in the Estonian newspaper ILTA-SANOMAT on 01.10.1994. It shows the deviation of ESTONIA to the South of the normal route (see interview above of the Utö radar observer in the INTERNET message - [Enclosure 22.3.385](#)) and the apparent existence of another vessel in the vicinity of the casualty position, viz. the BALANGA QUEEN which had allegedly passed "very close" to the casualty position. On the above-mentioned copy it is handwritten in Swedish:

*»If the BALANGA QUEEN had not been ahead of schedule and if ESTONIA had called for help when her problems actually started, then hundreds of lives could have been saved.«*

*»Why ESTONIA's emergency messages or other radio communications were delayed and did not reach BALANGA QUEEN is still unclear.«*

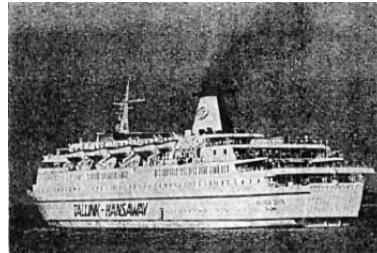
The (available) files of the prosecutor do not contain any more documentation in regard to BALANGA QUEEN nor do the (available) files of the Swedish and Finnish parts of the JAIC. The logbook page 2 is attached as [Enclosure 22.3.386](#). Consequently another INTERNET search was performed and under the date 29.09.94 the following was found:

*»Not that my opinion of Estonian seamen is much higher. The papers quote surviving truck drivers who had asked why their trucks were not chained to their places, stormy weather and all. "It's not necessary", they were answered. And there was an Estonian passenger ship, Balanga something, that was only 30 sea miles south of "Estonia" but didn't pick up the emergency signal while four Finnish ones did and went to help.«*

Further inquiries revealed that the BALANGA QUEEN was a car/passenger ferry bareboat chartered by TALLINK, the ferry subsidiary of ESCO, the 50% shareholders of the ESTONIA. The ferry was trading between Travemünde and Tallinn and had an Estonian crew.

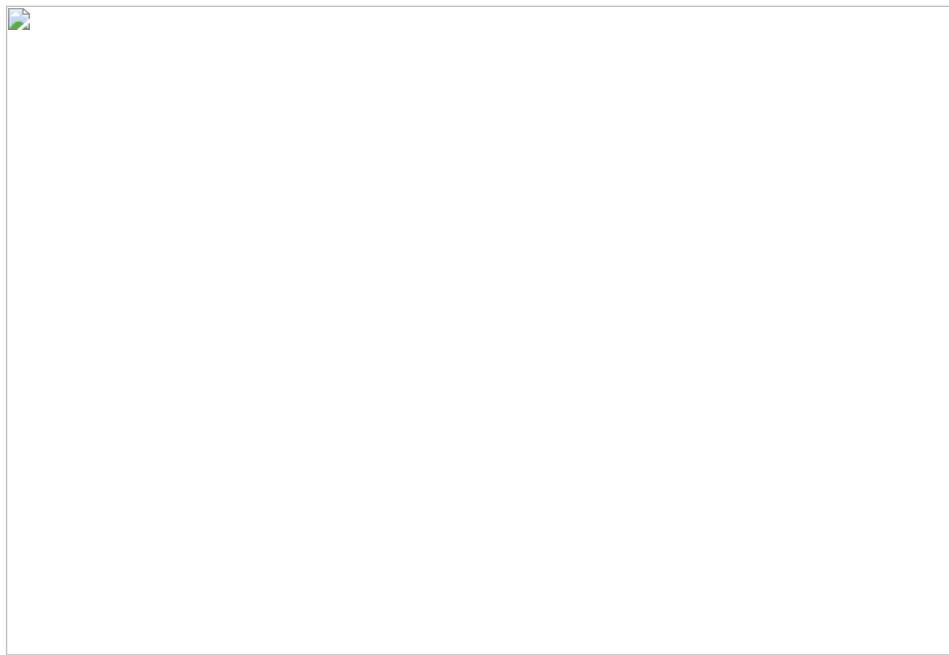
Her particulars are as follows:

BALANGA QUEEN ex SCANDINAVIAN SUN ex CARIBE  
9963 GRT / 4759 NRT / 2337 TDW  
length: 134.45 m breadth: 21.87 m draught: 5.52 m  
main engine: 20EW-Pielstick 16,000 hp - 21.0 kn.  
built: 1968 by LMG, Lübeck



The ferry departed from Travemünde on 26.09.94 at 18.20 hours, i.e. based on a service speed of 18.0 kn she should have been abeam of Ristna (western tip of Hiumaa Island) at 22.30 hours plus 1 hour time difference = 23.30 hours and turned on a north-easterly heading towards Glotov buoy.

Between 00.00' and 00.30 hours ESTONIA must have passed BALANGA QUEEN at a distance of 12-13 nm, i.e. the vessels saw each other. As in all probability ESTONIA was already in trouble then, it would have been a matter of good seamanship and proper care for the passengers to ask the company vessel to standby in the vicinity and escort ESTONIA into the shelter of the Island Hiumaa, but apparently nothing like occurred.



To the contrary - reportedly the master of the BALANGA QUEEN had offered help at some time which had been rejected by the Estonian Coast Guard. This information comes from a source in Travemünde who spoke to the master of BALANGA QUEEN after his return from the voyage in question. According to the report of the JAIC - Table 7.6 on page 107 - the ferry arrived on site at 14.31 hours only, i.e. when she was already on her way back to Travemünde. The early passing is not mentioned.

A further product of the above-mentioned INTERNET search for the BALANGA QUEEN is the LEONID BYKOV incident, because on the same page the following is reported:

*»To Dragon Fly and all other fans of Russian seamanship, a minor news item from today's Aamulehti, bottom corner of page 13:  
On Wednesday night, an hour after "Estonia" had sunk, the coast guards of Jussar Lighthouse noticed a ship sailing off course towards underwater rocks. They tried to alert the crew with searchlights and radio messages in Finnish, Swedish and English. No response. The ship passed the lighthouse, averted the first rocks by sheer luck, then turned sharply to south and safety. After radio contact was established the captain of the "Leonid Bykov" explained that the fresh First Officer keeping watch didn't know any English, but when the radio messages continued, he figured out that maybe he needed to wake up the captain (who had made the safety move).  
Earlier this month another Russian vessel, "Volgoneft 104", was in a similar situation near Jussar.«*

Further inquiries in the INTERNET revealed that the vessel is a "research vessel", owned by the Moscow River Shipping Company, which is owned by the Ministry for Post and Communication. The vessel is said to have 4540 GRT and was built in 1991.

The other vessel mentioned, the VOLGONEFT 104, is owned by the same organisation of the same type - "research vessel".

After initial problems, the copies of the logbook entries from Jussar Coast Guard Station have been received. This station is located about 18 nm east of Hangö. The entries read - office translated - as follows:

*»Time 0122 Phoned to operations centre [MVAK] regarding an unidentified target in position 59 degrees 46' P [longitude] 23 degrees 45' I [latitude], heading 265 degrees.«  
»Time 0132 Enquired the position of Valpas [patrol boat?], it was east of Porkkala.«  
»Time 0135 Tried several times to get contact via VHF-16 without result. The heading of the target still straight to Segelskär. AP [abbreviation of aluepäällikkö = district chief] is informed about the situation.«  
»Time 0205 I tried to get in radio contact via VHF-1 without result. The reserves have been awakened.«  
»Time 0225 RV-124 left the quay. As master Ilman and as crew Englund and Lehtinen.«  
»Time 0256 The target (cargo) turned in position 59 degrees 45'4 P, 23 degrees 31'31 to the south.«  
»Time 0257 Achieved radio contact via VHF-16 with the vessel "Leonid Bykov" from St. Petersburg, on voyage from Vyborg to Pori. The name of the master Juri Chikov. According to the master the explanation for the odd heading was that the helm man did not know the position and did not understand English.«  
»Time 0310 Commanded RV-124 to return.«  
»Time 0344 "Leonid Bykov" left the territorial waters in position 59 degrees 41'8 P 23 degrees 29'5 I.«*

A further inquiry with Lloyd's Maritime Information Services has revealed the following:

- »1. The Russian flag motor general cargo vessel "Leonid Bykov", of 4,096 tonnes gross, 4,540 deadweight, built 1991, has a draught of 3.16 m, a length overall of 138.40 m, and an extreme breadth of 16.75 m. Vessel's former name is "Volzhskiy-41".
- 2. With regard to her whereabouts on 27th to 30th September 1994, the "Leonid Bykov" was reported to have arrived at Vyborg, Russia, on 24th September 1994, then to have sailed from Vyborg on 27th September 1994. Vessel was then next reported to have arrived at Mantyluoto, Finland, on 1st October 1994.«

It was subsequently confirmed by the port authorities of Pori (Mantyluoto) that the LEONID BYKOV arrived at this port on October 1st, 1994 and discharged 4326 ts of coal. Consequently it has to be assumed that this vessel had nothing to do with the sinking of the ESTONIA. However, it has been known for many years that the Russian Intelligence name their "research vessels", equipped for electronic surveillance and other activities, the same as their ordinary merchant vessels, i.e. while the research vessel is doing its job silently - not too far away - the ordinary vessel with the same name is attracting the attention of the authorities one way or the other by some spectacular activity as the merchant vessel "LEONID BYKOV" indeed did. The distance between the ESTONIA's casualty position and the "near-grounding" of "LEONID BYKOV" was about 65 kn. So much for the vessels and shore stations having participated or not participated in the ESTONIA drama before, during or after the distress communication.

Next the schedule of the rescue operation, the alert of the media, the notification of the government and other activities shall be outlined from the Finnish point of view: Thereby following abbreviations are used:

DVS = Disaster Victims Investigation  
MRCC = Maritime Rescue Co-ordination Centre  
MRSC = Maritime Rescue Sub Centre  
STT = Finnish News Agency  
TT = Swedish News Agency  
TYKS = The University Hospital in Turku

In detail:

**01.22** Received weak Mayday, probably from ESTONIA.

**01.24** The Mayday message from ESTONIA is picked up at least by the following stations:

MRCC Turku, MRSC Turku, MRSC Mariehamn, Coast Guard Kökar, Utö Fortress, the ferries: ANETTE, FINNJET, FINN MERCHANT, MARIELLA, SILJA EUROPA, SILJA SYMPHONY.

- 01.25** MRCC Turku calls Nauvo to instruct MRSC Turku to alert the coast guard vessel TURSAS.
- 01.24/25** ESTONIA informs SILJA EUROPA about her problems, the last communication with ESTONIA ends at 01.29m39sec.
- 01.29** MARIELLA tries to reach Helsinki Radio on VHF-Channel 16 and 2182 kHz, in vain. MRSC Turku (Nauvo) informs TURSAS about the casualty. MRSC Mariehamn alerts the commander of the rescue area, Pekka Kiviniemi, who arrives at the MRSC at 01.45.
- 01.31** MRSC confirms that MRCC Turku has been informed.
- 01.33** MRCC Turku alerts Mikko Montonen, who is on watch. He arrives at the MRCC at 01.40.
- 01.35** The bridge of ESTONIA is submerged. MARIELLA observes that the lights of ESTONIA black out. MRCC Turku transfers the alarm to the SAR-helicopter crew on standby. The alarm is confirmed by the crew.
- 01.42** SILJA EUROPA relays the distress call of ESTONIA by mobile phone to MRCC Helsinki (after they had tried to reach them in vain on channel 16 and 2182 kHz). MARIELLA informs Helsinki Radio simultaneously.
- 01.45** MRCC Helsinki informs MRCC Turku that they are aware of the distress case.
- 01.47** SILJA EUROPA in communication with Helsinki Radio on channel 16, they are going to transmit a PAN PAN message.
- 01.48** ESTONIA disappears from the screen of the Utö radar station. This is also observed by MRCC Turku and MRSC Mariehamn. MRCC admonishes Helsinki Radio to transmit a "Mayday relay" message on channel 16 instead of PAN PAN.
- 01.50** Helsinki Radio begins transmitting the PAN PAN message on channel 16.
- 01.52** MRSC Mariehamn informs MRCC Stockholm about the casualty (this was recorded in Stockholm at 01.55).
- 01.57** MRCC Stockholm calls MRCC Helsinki and offers help. They are informed that MRCC Turku is co-ordinating the rescue operation.
- 01.58** MRCC Stockholm calls MRCC Turku, they are brought up-to-date and are requested to send helicopters. MRCC Stockholm alerts ARCC Arlanda and requests the activation of all available helicopters.
- 02.00** M. Montonen (MRCC Turku) calls for the first time at Commodore Raimo Tillikainen's home at Espoo and informs him about the Mayday call. The second call follows about 5 minutes later when the sinking of the ferry is already reported. Tillikainen advises that he shall proceed to Turku.
- 02.03** Heikki Himanen, on standby service, arrives at MRCC Turku.
- 02.05** MRCC Turku appoints Esa Mäkelä, Master of the SILJA EUROPA, as Commander-on-scene of the rescue operation.
- 02.06** MRCC Turku informs MRSC Hangö about the casualty.
- 02.07** The Swedish helicopter Q98 is alerted in Visby.
- 02.10** Helicopter Q91 is alerted in Ronneby.
- 02.12** MARIELLA is sighting lights, lifevests, lifeboats, liferafts.
- 02.15** MRCC Turku informs the District Emergency Centre Turku.

about

- 02.15** The serviceman of TT-Stockholm calls the serviceman of STT-Helsinki and requests information about the casualty. STT knows nothing. Some minutes later TT-calls again. The serviceman of STT phones MRCC Turku and receives the respective information, informs the manager of STT and puts into motion the alerting of the media, draws up a flash message which is transmitted at 02.43.
- 02.18** MRCC Turku requests MRCC Helsinki to call the standby helicopter crew on standby.
- 02.20** MRCC Turku appoints Utö as evacuation centre. Vice Commander Simo Pitkänen arrives at MRCC Turku.
- 02.21** MRCC puts on alert the standby helicopter. (at 03.36 hours the helicopter departs from Helsinki).
- 02.30** MARIELLA, at the casualty position, confirms that the ferry sank and that passengers are in the water, drops liferafts into the water, observes one person in a lifeboat, at 02.34 MARIELLA reports that several persons are in the water. Super Puma helicopter departs from Turku airport. MRCC defines casualty as "large casualty" and puts into motion the respective alarm, a/o the leading group of the rescue area is called to the MRCC.
- 02.36** MRCC Turku requests the SAR Centre to send one helicopter, subsequently - at 02.52 - to send more. According to the SAR Centre the first contact was at 02.50. At 02.58 the SAR Centre is requesting the Airforce to send as many helicopters as possible, as soon as possible.
- 02.43** STT-Flash: "ESTONIA capsized and sank. Lifeboats and people in the sea."
- 02.44** SILJA EUROPA arrives at the casualty position.
- ca. 02.45** A propeller plane flies over the liferafts.
- 02.50** MRCC Stockholm contacts the Estline representative, Mats Björnrudd, and asks for the passenger list.
- 02.55** MRCC Helsinki is asking MRCC Tallinn for information about the passengers and is informed that ESTONIA sailed from Tallinn on the previous evening with 679 passengers and 188 crew members. **Helsinki does not inform Tallinn in detail about the casualty, only that something has happened and that people are in distress.**
- 03.00** MRCC Stockholm offers 2 helicopters from Denmark.
- 03.05** The first helicopter, a Super Puma OH-HVG from Turku, arrives at the casualty site, is at first searching for people in the water, in vain, is then searching the liferafts. By 04.15 four persons have been winched up, landed on SILJA EUROPA, whereafter the helicopter returns to Turku for refuelling and to pick up another surface rescuer.
- 03.08** MARIELLA rescues 6-7 persons by means of her own raft.
- 03.15** The transport air fleet of Utö is alerted.
- 03.30** MRCC Helsinki reports the casualty to the watch officer of the border police. He contacts MRCC Turku at 03.40 and receives the latest news. He alerts the commander of the border control and the Government.
- 03.35** \*MRCC Turku informs SAR Tallinn that no further search vessels are required.
- 03.39** 2nd flash message from STT: The sea watch Turku was alarmed at about 02.00. By 03.00 some persons were found in the sea. On the ferry there were 679 passengers and 188 crew members.
- 03.49** STT: at 05.00 press conference at the police headquarters Turku.
- 03.50** The first special news by Radio Finland, thereafter up-date reports every half hour.
- 04.05** \*MRCC Helsinki informs SAR Tallinn that no further search vessels are required.
- 04.15** Commodore Raimo Tillikainen arrives at the MRCC Turku. The helicopter crew of Rovaniemi's watch fleet is alerted.
- 04.28** STT: Up until 04.00, 7 persons rescued.
- 04.30** Text TV is from now on continuously reporting about the casualty.
- 04.38** The first helicopter of the military forces (HS-14X-92) departs from Utö.
- 04.40** The watch officer of the border guard staff is reporting the casualty to the safety adviser of the Government, who re-checks the facts with MRCC Turku and who calls the Speaker of the Government at
- 04.50.** He in turn informs the Prime Minister at 04.55. The members of the Government are informed up until 05.40.
- 05.00** Press conference at police headquarters Turku. News from Radio Finland: A more detailed telegram and a telephone interview with Per-Erik Cederqvist, information manager of MARIELLA, who reports that a Swedish passenger, interviewed by him, has said \* According to the book by Andi Meister "The Unfinished Logbook". that the casualty occurred very quickly. Shifting of cargo might have caused the casualty. The question whether all people could have been rescued is answered with: hopeless.
- 05.35** STT: According to doctors, the situation of the people in the water is almost hopeless due to hypothermia.
- 05.40** STT: It is feared that about 850 people have died, because up until 05.00 only 10-20 were picked up.
- 05.50** The Estonian coast guard reports to MRCC Helsinki that a plane from Estonia is flying to the casualty position. MRCC replies that the plane is not needed, it would only disturb the helicopters.
- 06.00** Radio Finland News, among other things an interview with Raimo Tillikainen, telephone reports from Stockholm and Tallinn. First news from Radio Mafia, thereafter news every half hour. MTB/BBC News: ESTONIA sank within 5 minutes, 677 passengers and 188 crew, of which 25 rescued, presumably several hundred drowned. *"Uncertainty about the cause, but shifting of cargo is possible."*
- 06.14** MTV 3 / Good morning, Finland: Launi Karhuvaara: *"Information about the sinking, 640 passengers and 188 crew, about 20 rescued, a photo from Sandell, reporter from Turku, who just returned from the press conference, VIKING SALLY in the background, Sandell about the reasons: The rescue people say, in case of blackout such a large ferry cannot be controlled in a storm, probably the cargo shifted, the list increases and the ferry capsizes! Interview with Cedergqvist from MARIELLA: They have picked up 12. I am fearing the worst, it looks bad, hundreds died. Everything happened very fast, maybe in 5 minutes only."*
- 06.38** MTV 3 / Good morning, Finland: Chief pilot Hartikainen from the helicopter service takes off with a cameraman from MTV in order to film on site. In the studio remains Kristian Rehström from the Finnish Rescue Service who stayed all morning.
- 07.00** The first special news from TV 1 from Uleis-Radio (TV - Radio), logo of ESTONIA in the background, report from Turku: distress call, chart, picture of press conference, interview with Raimo Tillikainen. News from Radio Finland: Interviews with
- Raimo Tillikainen -
  - Antti Jääskeläinen
  - Jarkko Miettinen (Utö)
  - Juha Niinikoski (University Hospital, Turku)
  - Esa Mäkelä - SILJA EUROPA
  - Cederqvist - MARIELLA
  - Ulla-Maija Määttänen from Tallinn (criticises the bad information policy of Estonia).
- 07.10** TV-Nytt: The first Swedish news (in Finland)
- 07.30** MTV 3 / Good morning, Finland: News/Telegram: *"Cause of the casualty possibly shifting of cargo. 28 trucks on the ferry."* Government in special meeting.

**07.35 STT:** According to information from Stockholm most of the passengers are Swedes, 3 Finnish passengers, 1 Finnish crew member.

**07.56 MTV 3 / Good morning, Finland:** Raimo Tillikainen in a direct telephone interview.

**08.13 SILJA EUROPA** reports to have rescued about 90. At 09.19 MRCC Turku informs Stockholm that about 90 were rescued.

**08.15 MTV / Good morning, Finland:** Direct telephone interview with Lennart Meri (President of Estonia), picture in background: "I received the first reports at about 03.00. I am thankful that the Finnish rescuers have been so effective and active."

**08.24 STT:** Survivors are continuously being brought to Utö. According to Lieutenant Miettinen they are shaken and cold, hardly remember the casualty and are unable to report how they got into the water.

**08.25 STT:** According to the doctors and rescue crew the situation for those still in the sea or in the ESTONIA is hopeless.

**08.44 MTV 3 / Good morning, Finland:** A direct telephone interview with Raimo Tillikainen: 90 rescued. Lauri Karkkavaara: 90 in such a short time? How is this possible? RT: The rescue operation is carried out effectively, a plane is guiding the helicopters all the time. At 08.56 from Turku: a picture is shown of a patient being brought from a helicopter into Turku Hospital (the first action picture on TV).

**08.54 STT:** The Finnish Government has been informed, has agreed the co-ordination of the activities, has ordered the rescue organisations from Estonia and Sweden to come to Finland and has nominated a working team of 4 Ministers (Pekkarinen, Norrbach, Huuhtanen, Jää Heenmäki). According to the Minister of the Interior, Pekkarinen, the rescue operation has gone well up to now.

**09.00** The last survivor is brought to Utö. A press conference at the police headquarters Turku.

**09.00 Yle TV 1 Extra News:** 90 rescued, the reason for the sinking is unknown to us. Apparently the ferry sustained a bad list after the trucks had shifted. Interview with Raimo Tillikainen. A telephone call from Ulla-Maija Määttänen from Tallinn, the speaker asks: "This casualty will raise serious questions about the safety of Estonian shipping. Has this already been mentioned?" Ulla-Maija Määttänen reports about the ferry traffic to Tallinn, "the ferries are all Swedish, i.e. it is for sure that subsequently the seaworthiness of jumbo ferries shall be discussed." Yle's first picture of the survivors: a Swedish helicopter at Turku Hospital.

**09.10 TV-Nytt:** Interview with a Swedish helicopter pilot refuelling at Mariehamn.

**09.35 STT-Ako:** Government is shaken. Altsisaari expresses his sympathy to Lennart Meri. After Ako also Bildt expresses his appreciation to the Finnish Authorities for their well organised rescue operation. "The Swedish rescue units found good working conditions, in that respect everything went well according to the circumstances", said Ako.

**10.00 Press conference of the Finnish Government in Helsinki.**

**10.03 STT:** A group of volunteers from the Finnish Red Cross and a psychological organisation commence working.

**10.05 STT:** According to Pekkarinen the co-operation with the Swedish Authorities is very good. **Pekkarinen reports that the Estonian Authorities** were informed at 02.00 by the Finnish Authorities. The flow of information is functioning well assures the minister.

**10.11 STT:** According to Norrbach the rescue operation has gone well up to now. Norrbach warns not to draw too early conclusions concerning the ferry traffic between Sweden and Finland.

**10.14 STT:** Bildt expresses his thanks to the helicopter crews for their good performance.

**10.22 STT:** Press conference of the Finnish President, whereby, among other things, also the contacts to the King of Sweden and to the Estonian President are reported. Both thereafter expressed their thanks to those participating in the rescue operation.

**10.44 STT:** The Ministry of the Interior orders a flag-mourning day for Finland, in Estonia it is a mourning day.

**11.00 Yle TV 1, News:** Interview with Raimo Tillikainen (taken at about 10.00): Is it possible to still find survivors in the afternoon? RT: I hope so. The first interview with relatives in Stockholm harbour; an interview with Lennart Meri (the most quiet and devout part of a rather hectic news broadcast). The flow of information between Finland, Sweden and Estonia has gone well, **the Estonian Authorities were informed already shortly after 02.00**. Statements by Esko Ako and Mauri Pekkarinen.

**11.26 STT:** One of the survivors reports at Utö Fortress: "that he was awakened, in his cabin near the car deck, by loud banging noises from this deck".

**12.00 MTV 3:** The first interview with a survivor (Kärmä). The first of the bodies are landed at Utö. Press conference in the police headquarters Turku.

**12.46 STT:** A rescued Estonian crew member tells TT that "one of the car doors in the bow could not be closed during the night. **The door which was used by the cars let water in. According to Sillaste the ferry heeled over only thereafter.**"

**13.00 Yle TV 1, News:** More than 100 have survived, bodies found so far: 5. An interview with was Vassili Märtsen, Estonian, just being transported on a stretcher into the hospital of Tammsaari informs about the causes of the casualty: "**A crew member of the ferry told me that one of the bow doors could not be closed during the night and through that water was flooding on to the car deck.**" STT: "...the reasons for the casualty are still completely in the dark."

**13.20 TV-Nytt:** The cause of the casualty: "**Slarvigt lockt, lucka**", i.e. a care-lessly/or sloppily closed lock. The first interview with Vihlo Itäranta (from the hospital in Tammsaari). 13.25-15.30: The first helicopter flight with journalists to the casualty site and to Utö.

**15.00 Yle TV 1:** "According to an eye witness from the crew the cause for the casualty was a bow door left open. According to the eye witness it was not possible to close the door and before midnight water started to flow on to the car deck." An interview of Sillaste.

**17.19 STT:** Report by a Dutch truck driver that the trucks were not secured.

**19.58 STT:** The Prime Ministers decide on mutual co-operation. Finland and Sweden are to send experts to the Estonian Investigation Commission.

**20.40 STT:** **Swedish inspectors of Sjöfartsverket ascertain defects on the ESTONIA on Tuesday evening** (overaged lashings, worn sealings, no lashing manual). "**The deficiencies, however, were not so big that they could have caused such a large casualty. We are of the opinion that the ferry was well maintained.**"

**22.24 MRCC Tallinn** is requesting MRCC Helsinki to find out whether Capt. Avo Piht has survived. Helsinki asks Turku. There is no information on Piht.

**Thursday, 29.09.94:**

**09.15 STT:** The search for the wreck begins today for investigation purposes. "**We can neither deny nor confirm the theory that the casualty was caused by opened doors**", says Kari Lethola.

**20.50 Captain Avo Piht** is not on the list of survivors. Tallinn is informed respectively.

The above is an office translation of Enclosure No. 2 of the Finnish book "Uutinen Estonia". The German version is attached as [Enclosure 22.3.387](#). Further attached are in Swedish original

- the SAR Log of MRCC Stockholm - [Enclosure 22.3.388](#)

- the Alarm Log of ARCC Arlanda - [Enclosure 22.3.389](#)

In summary the following statements made by surviving crew members at a very early stage after just having been rescued and still suffering from hypothermia shall be quoted:

**28.09.94:**

- 11.26 STT: One of the survivors reports at Utö Fortress: "that he was awakened, in his cabin near the car deck, by loud banging noises from this deck".

- 12.46 STT: A rescued Estonian crew member tells TT that "one of the car doors in the bow could not be closed during the night. **The door which was used by the cars let water in. According to Sillaste the ferry heeled over only thereafter.**"

- 13.00 Yle TV 1, News: More than 100 have survived, bodies found so far: 5. An interview with was Vassili Märtsen, Estonian, just being transported on a stretcher into the hospital of Tammsaari informs about the causes of the casualty: "**A crew member of the ferry told me that one of the bow doors could not be closed during the night and through that water was flooding on to the car deck.**"

- 13.20 TV-Nytt: The cause of the casualty: "**Slarvigt lockt, lucka**", i.e. a care-lessly/or sloppily closed lock. The first interview with Vihlo Itäranta (from the hospital in Tammsaari).

- 15.00 Yle TV 1: "According to an eye witness from the crew the cause for the casualty was a bow door left open. According to the eye witness it was not possible to close the door and before midnight water started to flow on to the car deck." An interview of Sillaste.

- 17.19 STT: Report by a Dutch truck driver that the trucks were not secured.

- 20.40 STT: **Swedish inspectors of Sjöfartsverket ascertain defects on the ESTONIA on Tuesday evening** (overaged lashings, worn sealings, no lashing manual). "**The deficiencies, however, were not so big that they could have caused such a large casualty. We are of the opinion that the ferry was well maintained.**"

**29.09.94:**

- "**We can neither deny nor confirm the theory that the casualty was caused by opened doors**", says Kari Lethola.

The above is the only comment made by a member of the JAIC to the effect that the casualty might have been caused by "not properly" or even "opened" doors.

Thereby it is unclear whether the visor - also called 'bow door' or the 'bow ramp', sometimes also called 'door' or 'gate' - is meant.

It is also interesting that the President of Estonia, Lennart Meri, told the press that he had been informed about the catastrophe already at about 03.00 hours, while the Finnish Government, first of all the Prime Minister, was informed only at 04.55 hours and the other Government members thereafter until about 05.40 hours. At that time the chairman of the Finnish part of the JAIC, Kari Lethola, was already on his way to Turku.

On the other hand, MRCC Helsinki did inform MRCC Tallinn at 02.55 hours, but "not in detail, only that something had happened and that people were in distress", whilst subsequently - at 10.05 hours - the Finnish Minister of the Interior Pekkavinen told the press that "the Estonian Authorities were informed at 02.00 hours by the Finnish Authorities".

Apparently there were "other authorities" also involved in the casualty which had nothing to do with the rescue services and which must have been informed already that ESTONIA was in trouble while the vessel was still afloat.

It also has to be assumed with certainty that there had been intense communication between the ESTONIA and Tallinn, at least during the last hour, and that ESCO knew what was going on onboard the ESTONIA much before the first, weak 'Mayday' was received by MARIELLA. Officially 137 persons survived the catastrophe, 93 bodies were brought ashore and identified, and 759 persons are officially missing. These figures do not include the Iraqis in the trailer on the car deck, the unregistered Pakistanis and the also unregistered relatives of crew members also said to have been on board.

## 22.4 Further Evidence

In the previous subchapters many of the survivors have made a number of relevant observations of which the following shall be quoted:

**Motorman Elmar Siegel:** He saw from the liferaft the "man over board" boat proceeding away from the ESTONIA without caring for those in the water or in the liferafts.

**Note:** This boat is a motor launch located on the starboard side behind the bridge. It is lifeboat no. 1 specially equipped for emergency actions, e.g. if somebody has fallen over board. - See further in Subchapter 23.1.

**Passenger Thure Palmgren:** He saw from the liferaft something like a fishing boat proceeding away from the vessel without taking care for those in the water and in the liferafts.

## V INVESTIGATIONS AFTER THE SINKING

### CHAPTER 23

#### SEARCH FOR DRIFTING OBJECTS

Due to the wind and current conditions prevailing after the sinking, the floating objects from the ESTONIA drifted southeast to south-southeast according to the Annexes 6/4 and 6/5 of Supplement No. 402 of the Final Report of the JAIC and stranded on the north Estonian islands or on the coast of the mainland.

## 23.1 Lifeboats and Other Lifesaving Equipment

On 29 and 30 September 1994 in total 433 immersion suits, 289 lifevests and 8 containers full of lifevests were found along the coast of the Island of Hiumaa. All but one of the 10 lifeboats of the ESTONIA got away from the vessel. Life-boat no. 2, i.e. the first one on port side, was still attached to its davits during the ROV and diving investigations. Eight of the remaining 9 lifeboats were found drifting upside down or water filled and they stranded subsequently either on the Estonian mainland beaches or on the Island Hiumaa (Dagö). Lifeboat no. 1 - a motor launch specifically equipped for emergency actions, e.g. man overboard manoeuvres and thus called on board the "MOB rescue boat" - was found near Hangö according to the JAIC report page 130, subchapter 8.10. Upon request for details about the position and condition of the boat the National Bureau of Investigation - Criminal Technological Laboratory - advised however that life-boat No. 1 had actually been picked up on 29 September 1994 at 14.30 hours by the M.V. "HYLJE" (F.B.N. vessel) in position 59°16'40"N; 22°52'12"E and subsequently brought to Hangö - see [Enclosure 23.1.391](#).

This position is only 8.5 nm to the south-east of the wreck position and not very likely because the lifeboat had to break loose from its davits before the vessel had settled down on her starboard side at the sea bottom as it otherwise would have been buried in the sea bottom below the vessel. This means that the lifeboat had to break loose from the davits and start drifting on 28.09.94 at about 02.00 hours. At 14.30 hours on 29.09.94 when it was allegedly found, it had been drifting for 36.5 hours already but covered a distance of 8.5 nm only.

On the other hand according to Supplement 402 to the JAIC Report Annexes 5/5 and 6/4 the lifeboats had drifted already 27.68 nm to the south-east within the first 24 hours, while the total distance to the Island Hiumaa (Dagö) is only 33 nm. Therefore the alleged as-found position for lifeboat No. 1 is unrealistic.

Lifeboat No. 9 - the last one on the starboard side - was found on the Estonian coast. When it was inspected a camera with two films, belonging to the Swedish press photographer Håkan Isefjord, was found jammed inside the boat. Håkan Isefjord was a passenger but did not survive. The finding of the camera with the two films was reported only days later to the Swedish Embassy in Tallinn from where the information was passed immediately to the criminal police in Stockholm - See [Enclosure 21.1.392](#). Instructions on how to treat the films were passed to Tallinn and the then acting prosecutor Birgitta Croner ordered camera and films to be brought to Stockholm soonest. When the objects arrived in Stockholm, however, there were said to be no films. All this is revealed from the files of the finally acting prosecutor Tomas Lindstrand.

## 23.2 The EPIRB Buoys

The buoys floated off the sinking ferry and were found on 2 October 1994 along the Estonian coast near Dirhami in switched-off condition. This was reported by fax by Uno Laur, a member of the Estonian part of the JAIC, on 29.12.94 - [Enclosure 23.2.392.1](#) - to the Swedish part of the JAIC.

### CHAPTER 24

#### LOCATING THE WRECK AND THE VISOR

The search for the wreck and the visor of the ESTONIA was organised and performed by the Finnish Board of Navigation (F.B.N.), the Finnish Navy and the Finnish Coast Guard in close co-operation with the Accident Investigation Board, the Finnish part of the JAIC. The survey vessels SUUNTA and EVA-200 (Estonian) as well as the oil-pollution fighting vessel HALLI and the Coast Guard vessel TURSAS were employed for various operations. In addition, an unknown Finnish reconnaissance vessel and three Swedish mine hunters were engaged during the time between locating the wreck (and the visor) on 30.09.94 and the official locating of the visor on 18.10.94.

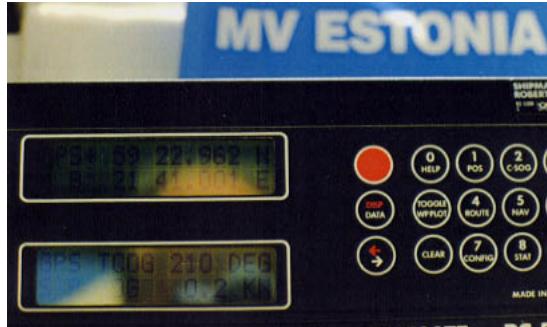
What actually happened during this time lies in darkness and can only be assumed to some extent from the facsimile messages sent by Kari Lethola, head of the Finnish part of

the JAIC (PCIMA), to Olof Forsberg, head of the Swedish part of the JAIC. These faxes were found in the archives of the Swedish Commission (SHK), but it has to be excluded that the sequence is complete. Also some of the publications in "Svenska Dagbladet" (SvD) and "Dagens Nyheter" (DN) in those days throw light on the probable occurrences.

**In detail:**

(a) By fax of 30.09.94 Kari Lethola informed SHK that the wreck had been found on position 59°23'N; 21°42'E. - See [Enclosure 24.393](#) - although this position lies 0.5 nm in direction 83° away from the actual wreck position 59°22.9'N; 21°41.0'E which is correctly stated to be the as-found position in the report of the JAIC.

The photo below shows the DGPS position of the wreck taken on board of a tug directly above.



The heading is approximately east and the wreck is lying on her starboard side with a list of about 120°. The water depth above the bow is 85 m and above the stern is 74 m. The highest point of the wreck is the stern with 58 m of water above. The wreck is resting on soft clay on the top with stiff boulder clay below. A side scan sonar survey of the area around the wreck revealed debris in an area of up to 350 m to the south and the west of the wreck.

**Note:**

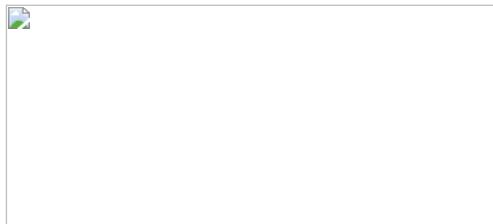
For easy reference the dates with respective week days of the time frame in question shall be outlined as follows:

Wednesday 28.09.94 5.10.94 12.10.94 19.10.94  
 Thursday 29.09.94 06.10.94 13.10.94 20.10.94  
 Friday 30.09.94 07.10.94 14.10.94 21.10.94  
 Saturday 01.10.94 08.10.94 15.10.94 22.10.94  
 Sunday 02.10.94 09.10.94 16.10.94 23.10.94  
 Monday 03.10.94 10.10.94 17.10.94 24.10.94  
 Tuesday 04.10.94 11.10.94 18.10.94 25.10.94

(b) By fax of 01.10.94 PCIMA did send sonar recordings and a radar plot to SHK. The sonar record showed the vessel apparently on the side with a big dark spot at one end. - See [Enclosure 24.394](#). - This sonar recording was given to the media with some explanations and the media subsequently reported on it as per the following article:

**(c) Article "Svenska Dagbladet" of 01.10.94. »First pictures from the wreck**

*On Saturday at a press conference in Turku the first sonar pictures showing "Estonia" at a depth of about 70 m were presented. On the pictures the bow of the vessel looks flat. "It is possible that this might be so, but the pictures are very bad and we will not draw conclusions from them", said Dr. Jouko Nuorteva.*



*Two sailors of the "Estonia" have stated that the "Estonia" sank with open visor. This information is revealed from the testimonies of the surviving "Estonia" crew members ..... The first video pictures will be taken on Sunday weather permitting. The storm over the Baltic shall then have disappeared so that the oil-pollution fighting vessel "Halli" can send down 2 ROVs.«*

The complete article is attached as [Enclosure 24.395](#).

**Note:** Dr. Jouko Nuorteva, employed by the Finnish Navy, was in charge of the interpretation of the sonar recordings.

On 02.10.94 the wreck was examined for several hours by two ROVs from M.V. HALLI and the media were informed accordingly (see below). Simultaneously the wreck was examined by Swedish and other countries' navy divers, which was kept secret until today.

**(d) Article "Dagens Nyheter" of 03.10.94 - [Enclosure 24.396](#).**

**»New pictures from the wreck point to the bow visor.**

*Two ROVs were successful on Sunday in video filming the "Estonia". The commission has issued strict orders to the oil-pollution fighting vessel "Halli", which carried out the operation, not to talk about or show the films made so far.*

*Apparently it becomes more and more certain that the visor in front of the bow ramp to the car deck has been the cause for the casualty. Dr. Jouko Nuorteva, who analysed the sonar pictures taken after "Estonia" had been located, could give them a new interpretation on Sunday.*

*According to Nuorteva is the vessel lying on an easterly heading and in the course direction as it had been assumed in the beginning. Adjacent to the bow there is a big object which was either torn off or is hanging from the hull. According to Nuorteva the object could be the damaged visor or part of it. The video pictures should explain if the visor had indeed such a big damage.*

**Detailed photographs.**

*The investigators do have access now to many hours of video tapes as well as to numerous still pictures both in black and white and in colour. "The pictures are of high quality, so much we can say", said Kari Lethola. "At first the pictures shall be analysed by the commission and then we shall decide what can be published", said Lethola.«*

**Note:** It has been confirmed by the man in charge of the interpretation / evaluation work that there was a **big object adjacent to the hull which could be the damaged visor or part of it**. The question whether this was the case or not was clearly answered by the ROV investigations of the bow area on 02.10. and 09.10.94, however, no clear answers were given to the public and the respective sequences of the relevant video tapes received subsequently from the JAIC were cut out. See Chapter 25 and Subchapter 34.6.

(e) On 03.04.10.94 the JAIC held a meeting in Turku when the videos were analysed, respective conclusions were drawn and obviously the future strategy was decided which, among other things, was to continue the search for the visor.  
On 04.10.94 SvD reported:

»Estonia's visor torn off.

*Pictures from the wreck of the "Estonia" published on Monday evening by the JAIC do confirm that the bow visor had broken off from the vessel ...*

*Thereby the theory that the damaged visor caused the casualty is supported ...*

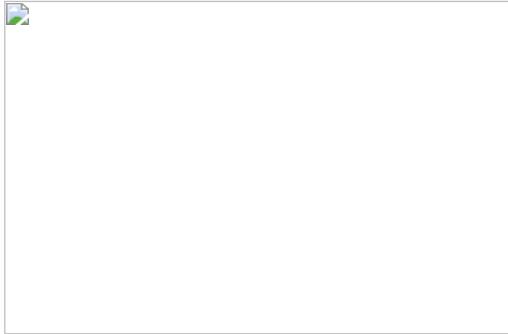
*The JAIC gave a few preliminary explanations of the video pictures taken during the first ROV examination, but was careful when commenting the cause of the accident. "Today we are able to say approximately what happened, but we are far away from being able to state why it happened", said Olof Forsberg.«*

(f) The next available facsimile message from PCIMA to AIB (Accident Investigation Board) is dated 06.10.94. It reads as follows:

»page 1

*The Finnish guard vessel "Tursas" has searched for the visor from 5.10. - 12.00 hrs. to 6.10 - 02.00 hrs. Now the wind is too strong. The Estonian "EVA-200" arrived in the early morning and searches somewhere further to the east. The communication between the vessels is not the best due to difficulties they have with equipment and language. The area indicated by the drawing has meanwhile been searched preliminarily.*

page 2



*The visor has still not been found. Pieces of scrap have been found in the vicinity of the wreck. They indicate the course the vessel held.*

*Southeast of the wreck there is an area where the bottom mud layer is soft and several tens of metres deep. It is difficult to find anything there.*

*The Norwegian SCS is still active and receives free marketing by the press. If the search is delayed and problems arise before we find what we are looking for we may have problems with the press. Might the next possible measure be to involve Sweden too in the search? Could you clarify your possibilities to participate? I have not informed Estonia about this suggestion and I shall not do so until I have your confirmation.«*

See also [Enclosure 24.397](#).

**Note:** Lethola states that the search for the visor continued, although it had been known to the JAIC already since 02.10.94 that the visor was lying next to the bow of the wreck. This is even indicated on the drawing being part of the fax where a smaller separate object can be noted to the starboard side of the bow. Moreover, the area indicated on the same drawing as having been searched - 2 nm to the east of the wreck, 1 nm to the west of the wreck and 1 nm to the south, i.e. a rectangular 3 nm x 1 nm - includes the position where the visor was allegedly found on 18.10.94, i.e. in position 59°22,97'N; 21°39,33'E according to the Finnish Navy and in position 59°23'N, 21°39,2'E according to the Swedish Navy - see [Enclosure 24.398](#) - Letter Försvarsmakten (Defence Forces) to SHK dated 09.12.94. It is difficult to believe that such a big steel mass as the visor should have been overlooked or should not have been indicated on the sonar. The remark at the end of the fax that "the Norwegian SCS is still active and receives free marketing by the press" suggests that the Norwegians had offered some services which had been rejected by the JAIC and that the operation was performed by Finnish vessels apparently without the expected success. Therefore Lethola was now asking Sweden to send vessels to help search for "what we were looking for". It is difficult to believe that this relates to the visor which then must have already been found since some days. The Norwegian involvement needs to be investigated.

(g) Next two facsimile messages are available from PCIMA to AIB written on 06.10.94, but sent on 07.10.94.

The first one was sent at 10.03 hours and reads in substance:

»To everybody: Dr. Jouko Nuorteva informed in the evening that while photographing from "Tursas" a new, very promising object has been found which could theoretically be the visor of "Estonia". Heimo Iivonen and Nuorteva have jointly analysed MV "Estonia's" possible last route and the object is lying on this route. The weather at the casualty site is again so bad that photographing shall be possible on Friday at the earliest ... «

The complete fax with office translation is attached as [Enclosure 24.399](#). The second one is addressed to Rune Lundin, who apparently is the JAIC contact in the Swedish Navy and was sent at 15.08 hours.

»Message for Rune Lundin: The proposal that a Swedish vessel is ready for action on Monday at 12.00 hrs. is good. We shall try to determine whether the big object, which I mentioned in my fax from this morning, is really the visor before we send the invitation. To whom can we send an eventual invitation for a Swedish vessel over the weekend?

Could you also inform us about the name of the Swedish vessel? I need this since I shall create for safety purposes a blanco-condition for the vessel when it enters Finnish territorial waters.«

Fax with office translation is attached as [Enclosure 24.400](#).

(h) Next a facsimile message from AIB to PCIMA dated 07.10.94 is available - see [Enclosure 24.401](#):

»Hej Kari, With reference to our last fax concerning the participation of a Swedish vessel Rune advised the following:

1) Concerning invitation for Swedish vessels over the weekend: "Message over the weekend concerning SÖK phone to: VB/head office Tel. 8 - 788 8114"

2) 3 vessels are available (at least 2 on the security scale) mine hunters VON, KONTER and ULVÖN.

3) "Kari, advise the contact person at the Finnish Coast Guard / MRCC from whom the vessels may obtain instructions."«

(i) The next fax was sent on 09.10.94 from PCIMA to AIB:

»Message: Good morning! Due to bad weather the search for the visor was discontinued during the whole day, but now Nuorteva has further analysed the pictures. At the location on the sea bottom, where "Estonia" on basis of the object did capsize, there is a 10 m long and 5-7 m broad object on the bottom. It is probably of metal. The form fits well with the visor. Depth is 70 m, the bottom is hard.

Karpinnen, Aarnio and the ROV I team go onboard of "Tursas" at Nagu at 11.00 (Finnish time) and the work starts at ca. 13.00 hrs. They shall video film at first the "large object". Attached please find a sonar picture including an enlargement of it.«

**Note:** Again they indicate that the visor is lying next to the vessel and even, that ESTONIA on basis (or because of) the object (the visor) did capsize. The attached sonar picture turned out to be part of the sonar recordings with print-outs at the right side indicating latitude and longitude and possibly course and speed every 30 seconds commencing at 22.47.01 and ending 22.49.31. The big object is visible on the recording between 24.47.31 and 22.49.01. Latitude (y) and longitude (x) are stated by code groups of 6 or 7 digits which were found to be based on the Finnish geodetic system. The Federal Maritime and Hydrographic Agency of Germany was able to decode the groups indicating latitude / longitude although some uncertainty remains, because the quality of the recordings is very poor and one or two digits might be missing. Under consideration of these uncertainties the positions indicated on the sonar recording are approximately 450-500 m to the NW of the actual wreck position. Attempts to get a clear copy of the recordings are in progress.

The fax with sonar recordings is attached as [Enclosure 24.402](#).

(k) Fax PCIMA to BAI dated 10.10.94 - [Enclosure 24.403](#).

»Message: Good morning! The large object turned out to be a steel plate. The search for the visor has again been discontinued due to strong wind. Nuorteva is of the opinion that it is not useful to continue the search without having drawn up a probable plan. It does not make sense to drive around at sea into the blue. It takes a few days to make up the plan. This is the reason to consider whether the Swedish vessels should come along. What do you think about it?«

**Note:** Now the probable visor next to the ship is a steel plate of 7 x 10 m, which still has to be adjacent to the wreck. But it is never mentioned again.

(l) Fax BAI to PCIMA dated 10.10.94 - [Enclosure 24.404](#).

»Thanks for the fax. From Sweden Hans Rosengren, Sten Andersson and Börje Stenström are coming to Turku. ... Concerning the question about the participation of Swedish vessels Olof shall revert soonest. He is in a meeting right now.«

(m) Fax Tuomo Karpinnen to Börje Stenström dated 10.10.94 - [Enclosure 24.405](#).

»Börje. Thanks for your fax and the good pictures of visor and ramp. We changed our plans and went out already on Sunday because we thought that we had found the visor by sonar. We could not find the visor by ROV. We filmed again visor and ramp by ROV. A summary of our observations is attached. I will have the video film with me and we can look at it on Monday evening at Nadendal if this should suit you.«

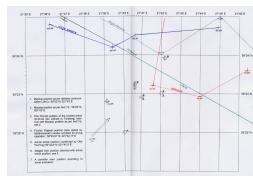
**Note:** This is confusing because Karpinnen states on the one hand that they could not find the visor by ROV, but says on the other hand that they filmed again visor and ramp.

(n) Fax PCIMA to BAI dated 12.10.94 - [Enclosure 24.406](#).

»Message: Heimo Iivonen has now investigated the possibilities of continuing the search for the visor. We are ready to commence the search on Monday, 17.10. We will receive assistance from Navy forces. Dr. Nuorteva is employed by them. If it suits you, we are requesting that Sweden sends an expert in mine hunting by Friday, 14.10. He could come along with the Finnish reconnaissance vessel and simultaneously he could prepare himself for the situation, in case assistance from Swedish vessels should be required. Assistance might become actual at the beginning of week 43, i.e. as from 24.10.94. If our proposal suits you, we kindly ask you to inform us of the name of the expert and contact details.«

**Note:** Now they receive assistance from Finnish Naval Forces with whom the sonar expert Dr. Nuorteva is employed. Nevertheless they need the help of a Swedish mine hunting expert already by Friday, 14.10.94, although the search for the visor was scheduled to commence only on Monday, 17.10.94. This could lead to the assumption that Swedish mines were somehow involved, i.e. since the ESTONIA and her visor were resting more or less directly on the line Utö-Ristna it might be that there was a Swedish mine field in that area.

No more facsimile messages are available and on 18.10.94 the visor was finally also officially found, however, in position **59°23,0'N; 21°39,2'E**, which is 0.85 nm in direction 272° from the actual wreck position - see also [Enclosure 24.398](#) - but 1.7 nm in direction 238° from the wreck position stated to be the original location position - see [Enclosure 24.407](#) - which is **59°23,9'N; 21°42,1'E**. The actual wreck position **59°22,9'N; 21°41,0'E**, which has been verified by tug "OTTO WULF 4" on 30.06.95, is 2112 m distant in direction 211° from the Finnish "original location position". Since a wreck from the ESTONIA dimensions cannot move for 2100 m over the sea bottom the original location position has been wrong from the beginning, which is confirmed by Kari Lethola's first fax - see [Enclosure 24.393](#) - where he stated the original position to be **59°23'N; 21°42'E** which is almost correct except that the latitude should be **21°41'**. In any event, on 02.10.94 and 09.10.94 they did carry out very detailed ROV investigations of the wreck and probably also of the visor then lying with great probability below the bulbous bow.



(click for full page image)

It therefore has to be assumed that the Finns deliberately moved the wreck position 1.7 nm to the NNE. This wrong position was maintained during October and November and was even taken over by Sjöfartsverket in the specification drawn up by this administration for tendering the diving investigation of the wreck, which was sent to 11 different companies, where the following positions are stated:

bow : **59°23,91'N; 21°42,17'E**  
stem : **59°23,92'N; 21°42,03'E**

Smit/Rockwater were awarded the contract to examine the wreck and the surrounding sea bottom. Even when their diving support vessel "SEMI I" and the survey vessel "SIRA SUPPORTER" with Johan Fransson and experts from Sjöfartsverket, Tuomo Karppinen and others from Finland, Börje Stenström from the JAIC and Arne Valgma from the E.N.M.B. together with an unknown number of criminal and other policemen were approaching the area allegedly the Smit/Rockwater people did not get a corrected position and consequently sent the ROVs down at the wrong position. This is - at least - what is reported and the actual wreck position was subsequently found by the SIRA SUPPORTER by means of the ORE sidescan sonar tow fish.

The reason why all this was necessary is unknown to this 'Group of Experts', but it has to be assumed that the apologetic letter that Kari Lethola wrote to the Traffic Ministry on 11.01.95, wherein he explains that he had possibly exceeded his authority when "isolating the wreck", has to be understood in this connection. The letter with office translation is attached as [Enclosure 24.408](#).

In summary it has to be assumed that the Swedes and Finns had found the visor next to the bow of the wreck, possibly the bulbous bow even resting on the visor, already on the 01. or 02.10.94, but decided to keep this secret as well as the actual position of the wreck and to continue the search for the visor. The Estonians were sent to search to the East (where the visor definitely never was) while the Finns with the help of Swedish mine hunting experts and vessels clarified something around the wreck which apparently had to do with Swedish mines. On 18.10.94 the visor was "officially" located and sometime later the "mines" operation was completed, whereafter the **recovery of the visor at a position about 2100 m SSW off the alleged wreck position was carried out from 12th to 19th November 1994**. The visor was picked-up and lifted to the surface by the Finnish multi-purpose ice breaker NORDICA assisted by the Swedish mine hunter FURUSUND. According to the entries into the logbook of the NORDICA - See [Enclosure 24.408.1](#) - the visor was picked-up in position **59°23'N; 21°39,4'E**. This was ca. 1400 m West of the wreck position.

## 24.1 Further Evidence

In the meantime some logbook pages from the survey vessel "SUUNTA", the "HALLI" and the "TURSAS" have been received, from which the following information has been abstracted:

(a) "SUUNTA" :

28.09.94 wind : 290°, 18 m/s - heavy weather preventing search work  
29.09.94 wind : 280°, 11 m/s - 14 m/s - heavy swell preventing search for wreck of "ESTONIA"

30.09.94

wind : 280°, 12 m/s - 08.40 departed from Hangö, heavy swell, 16.27 commenced search for the wreck, 17.32 hrs.  
located the wreck and dropped buoy on position

x = 6585590,0 = 59°22,92'N;  
y = 1538902,0 = 21°41,06'E  
18.45 hrs. left for Hangö.

Note:

This means that the correct position was known from the very beginning, but even to Olof Forssberg Kari Lethola reported a wrong one. Apparently the correct position was kept secret until the diving operation early December 1994.

(b) "HALLI" or what is believed to be from "HALLI", because these logbooks (except for SUUNTA's) do not carry the names of the vessels:

01.10.94

18.00 moored to Harun jetty

24.00 Karppinen, Aarnio, Turunen, Louhivuori, Tenhunen onboard;

02.10.94

05.00 departure for Utö area to investigate the "ESTONIA" wreck

11.15 dropped anchor in position 59°22,91'N; 21°40,93'E

12.17 lowered ROV system into the sea

16.40 change of anchor position to 59°22,54'N; 21°40,51'E

17.15 continued video recording

20.45 stopped recording

21.30 anchor up and sailed for Pärnäs

03.10.94

03.00 berthed at Pärnäs, Karppinen, Aarnio, Mykkänen, Tenhunen plus 10 ts equipment from board

Note: Consequently the recordings by ROV have taken place from 12.17 hrs. to 20.45 hrs. in the presence of Karppinen and Aarnio from the JAIC. The 3 tapes submitted by the JAIC in March 1995 do fall into this time frame.

(c) "TURSAS" (presumably)

09.10.94

10.20 berthed at Pärnäs, three JAIC representatives onboard, Saarikko, Tenhunen, Louhivuori plus ROV equipment

11.30 departure

17.30 at anchor in pos. 59°22,93'N; 21°40,73'E

21.10 up anchor

21.25 at anchor 200 m NE of previous position

Note:

Unfortunately the logbook pages for 10.10.94 were not submitted. The video footage received from the JAIC in March 1995 does not include recordings made between 17.30 and 21.10 hrs. during the 1st anchoring near the stern of the wreck. It only covers the recordings carried out at the 2nd anchoring between 21.55 hrs. and 02.16 hrs. on the

10.10.94

(d) "TURSAS" (presumably)

17.10.94

00.00 vessel at base

09.20 Capt. Lieut. Mikkilä onboard, Saarikko, Louhivouri, Turunen, Nuorteva, Ratia, Kujansuu onboard.

10.05 departure

10.25 moored alongside CG vessel "UISKO". Mikkilä from board

10.55 Swedish Captain Commander Tönnström onboard

11.00 departure

21.30 pos. 59°25,45'N; 21°43,55'E - commenced searching with sidescan sonar - cruising

18.10.94

14.30 stop, sonar up, anchored in position 59°23,10'N; 21°39,20'E

15.30 ROV equipment found the "ESTONIA" visor in

pos. x = 6585650 y = 1587250 18.45 ROV up, 19.10 anchor up, return to base

Note:

The quoted xy coordinates correspond to the position

59°22,526'N; 21°39,321'E. (See also [Chapter 26.1](#)).

## CHAPTER 25

### THE ROV INSPECTIONS OF THE WRECK AREA

## 25.1 The ROV Inspection on 02.10.94

As soon as the weather permitted Remote Operated Vehicles (ROVs) equipped with video cameras were sent down to the wreck on 02.10.94 and produced remarkably sharp pictures, which showed, among other things, that the visor was missing and that its hinges and locking devices were broken. Apparently two ROVs were used which were given the names "Jutta" and "Siimo" and which produced an unknown number of video films of which three films are available. These are:

video 1 (Jutta 2) 02.10.94 1 hour 9 min.  
video 2 (Jutta 1) 02.10.94 3 hours 4 min. 28 sec.  
video 4 (Siimo 1) 02.10.94 2 hours 56 min. 40 sec.

Copies of these three videos were handed over to this 'Group of Experts' in March 1995 by the Finnish part of the JAIC as "raw material". This turned out to be untrue, because relevant parts, e.g. showing the starboard hull and unknown objects on the bottom of the sea, had been cut out. Therefore a professional examination of the video films by experts has been conducted and revealed that the films have been cut frequently, mostly up to 3 minutes, sometimes up to 17 minutes. The cuts deleted footage taken when the ROVs were inspecting parts of the wreck and also debris on the sea bottom. Consequently it has to be assumed that the most interesting parts permitting conclusions have been cut out of the "raw" material.

The results of the professional examination of all available video films are outlined in Subchapter 34.6 - "Investigation Report of Video Tapes featuring the Car/Passenger Ferry "Estonia" by Disengage/UK. They indicate among other things that there were other activities around the wreck in progress.

## 25.2 The ROV Inspection on 05.10.94

On 05.10.94 the Finnish vessel TURSAS and the Estonian vessel EVA-200 allegedly started the search for the visor and according to the book "*The Unfinished Logbook*" by Andi Meister the video films showed the various parts on the sea bottom which had fallen off the ESTONIA as she was drifting towards her sinking position and possibly also already before.

These video films are not available. Reference is made to the explanation in Chapter 24 and the relevant enclosures.

## 25.3 The ROV Inspection on 9/10.10.94

On 09.10.94 and 10.10.94 the ROVs were sent down again to film particular parts of the wreck more in detail, but also the sea bottom.

The result - as far as it is known - was video film III - 4 hours 5 minutes long - and the detailed examination by the video experts has revealed that also this "raw" material has been cut in four places, viz.

09/10/94	19.17.33	
09/10/94	19.17.51	
09/10/94		tape 3 cut at seabed
09/10/94	21.55.53	
09/10/94	22.21.24	
09/10/94		tape 3 cut at P side bow
09/10/94	22.22.49	
10/10/94	00.52.04	
10/10/94		tape 3 cut near bow
10/10/94	00.57.52	
10/10/94	02.15.14	

It has to be assumed that the parts showing the visor were cut out. Nevertheless video III is the most productive of all videos made by ROVs as will be shown later. It is, however, most interesting to note that in particular all footage of the area of the starboard hull in way of 0-deck, approximately between frames 80-120, has been deleted from all the available videos.

Otherwise the films show pictures of high quality which are of great value for the investigation. As not all the locations of relevance were accessible for ROVs it was decided therefore - and for other reasons - to have the wreck examined by divers and again filmed by ROVs between 1st and 4th December 1994 (see Chapter 27).

## 25.4 Further Evidence

According to the JAIC Report, Chapter 8.2, the first ROV inspection from the wreck was carried out from the "HALLI" on 2 October 1994. The respective logbook pages have recently been received, although the name "HALLI" is nowhere written on the available pages. According to the logbook entries Tuomo Karppinen and Siimo Aarnio, member and expert of the Finnish JAIC were onboard besides Turunen, Louhivuori and Tenhunen who are unknown. Video recordings by ROV were performed between 12.17 hours - 20.45 hours. The three tapes received from the Finnish JAIC in March 1995 do fall into this time frame, however, substantial parts were cut out in a rather unprofessional way.

Note: During a recent telephone conversation between Tuomo Karppinen and the Swedish journalist Knut Carlqvist

Karppinen revealed that they had made certain cuts already onboard of "HALLI".

Further according to the logbook the first anchor position 59°22,91'N; 21°40,93'E was very close to the wreck, where video recordings took place between 12.17 hours and about 16.30 hours. At 16.40 hours the vessel shifted position to 59°22,54'N; 21°40,51'E where the anchor was dropped at 17.00 hours and video recording started again at 17.15 hours and stopped at 20.45 hours. This second position was about half way between the Mayday position 59°22,0'N; 21°40'E and the wreck position. This second "HALLI" position was in direction 207°, 0.45 nm distant from the wreck.

This means that the video footage provided should show after 17.00 hours only pictures from the seabed because the longest ROV umbilical is 400 m long while the wreck is 0.45 nm = 830 m away. It would also make no sense to lift anchor from a position next to the wreck and move almost 1/2 mile away and then send the ROV back all the way. Since, however, all three videos submitted by the Finnish JAIC to be raw material show numerous sequences with parts of the wreck well after 17.00 hours it has to be concluded that these videos were not only manipulated by or on behalf of the Finnish JAIC by cutting out vital parts of evidence, but also by changing the times. The reason for this time manipulation is obvious: It was the intention to create the impression that the many interesting objects on the bottom of the sea were lying relatively close to the wreck because the ROV moves away from the stern and views the objects only 2 or 3 minutes later. Actually the ROV did start from a position 0.45 nm = 830 m to the SSW of the wreck and then proceeded another 250-300 mm to the W or SW, i.e. 1100-1200 m to the SSW of the wreck these objects were found, e.g. the ramp rail, the stabiliser fin, parts from the car deck and other objects which the public was prevented from seeing by tape cuts.

This leads to the following conclusions:

- (a) The vessel drifted from SSW to NNE.
- (b) The vessel was very severely heeled or already upside down in a position about 1000 m to the SSW of the wreck.
- (c) Since the ROV found objects were about on the connection line between Mayday position and wreck position, slightly closer to the Mayday position, and the engines had stopped about 10 minutes before the Mayday already, it has to be assumed that the vessel was initially even further to the South, probably 0.5 nm to the SW of the Mayday position at about 01.10/12 hours. According to the 3rd engineer the final speed was 6 kn, i.e. going further back 10 minutes at 6 kn to 01.02 hours when the big heel occurred and the vessel was reportedly turning to port, that is to say 1 nm, the vessel was at 01.02 hours at the approximate position 59°21,6'N; 21°37,8'E, which is not unrealistic. From this position the alleged visor position lies about 30°, 1.2-1.3 nm distant and it is more than doubtful that ESTONIA had ever been up that far in the North.
- (d) It has to be concluded that the plot of ESTONIA's track in the JAIC Report on page 173 is completely wrong.

Also from the vessel "TURSAS", used for the ROV inspections on 9/10 October 1994, the logbook page for 9 October was recently made available and has meanwhile been translated. It reveals that according to the logbook entry on 9 October at 10.20 hours three JAIC representatives: Saarikko, Tenhunen and Louhivuori boarded the vessel and ROV equipment was also taken onboard. Tenhunen and Louhivuori had already taken part in the ROV inspection on 2 October.

At 17.30 hours anchor was dropped in position 59°22,93'N; 21°40,73'E which was near the stern of the wreck. At 21.10 hours the anchor was lifted and dropped again 200 m to the NE at 21.25 hours, i.e. to port of the bow of the wreck. Video recording is not mentioned in the log, but the available video covers the time between 21.55 and 02.15 hours on the following day, 10 October 1994. The video recordings made during the 1st anchoring between 17.30-21.10 hours are not available except for a short sequence of 18 seconds found between two cuts at 22.21 and 22.22 hours.

**CHAPTER 26****RECOVERING THE VISOR**

As stated already in the Chapter 24 the search for the visor was allegedly commenced on 05.10.94 by TURSAS and EVA-200, although at that time the visor was most probably located already adjacent and/or below the bulbous bow of the wreck.

The visor was finally "officially" found in position 59°23,0'N; 21°39,2'E in upside down condition. The video tape from the ROV investigation is not available.

During the time from 16-18 November 1994 the visor was lifted by the Finnish multi-purpose ice breaker NORDICA - assisted by the Swedish mine hunter FURUSUND - and brought to Hangö - see Enclosure 24.408.1 - where it was lifted ashore and placed on the premises of Levator Oy, still in upside down condition. It was left in the open air, totally unprotected, but still in remarkably good condition until 20.11.99. On this day the visor was picked-up by the Swedish navy and transported to Sweden.

The picture below was taken on 23.11.94.



**26.1  
Further Evidence**

The logbook from the search vessel "TURSAS" from 16, 17, 18 October 1994 are available and have been translated. Accordingly the vessel was in Latokori on 16th and 17th October, where at 09.20 hours the following persons boarded the vessel: Saarikko, Louhivuori, Turunen, Nuorteva, Ratia and Kujansuu. Louhivuori and Turunen were already participating in the previous ROV inspections and Nuorteva is a sonar expert from the Finnish Navy, according to the newspaper reports - see Chapter 37.2 - and he is also mentioned in the fax reports from Kari Lethola to Olof Forssberg - see Chapter 24. The "TURSAS" left her berth and shortly afterwards moored alongside the CG vessel "UISKO". From this vessel the Swedish Captain Commander Tönnström came onboard and the Finnish Captain Lieutenant Mikkilä left the vessel, which subsequently sailed. At 21.30 hours in position 59°25,45'N; 21°43,55'E the search by means of sidescan sonar was commenced. This position lies 3 nm to the NE of the wreck where in all probability ESTONIA can never have been, thus it has to be assumed that the gentlemen were searching for something different than the visor of the ESTONIA. The search was subsequently carried from ca 1 nm to the East of the wreck, to ca. 2 nm to the South and 1 nm to the West of the wreck, which according to Kari Lethola's fax to Olof Forssberg on 06.10.94 - see page 702 - had already been searched before. Anyway, according to the "TURSAS" log entries the visor was found and identified by ROV on 18.10.94 at 15.30 hours in position x = 6585650, y = 1587250 which, according to the F.B.N. computer corresponds to 59°22,526'N; 21°39,322'E which was subsequently repeated by the Finnish Navy to be 59°22,97'N; 21°39,33'E.

According to the logbook entry (manual) of icebreaker "NORDICA" the visor was found in position 59°23'N; 21°39,4'E, lifted and brought to Hankö. See Enclosure 24.408.1. There is presently no more evidence on the visor search and position available.

**CHAPTER 27****THE DIVING INVESTIGATION 01.-04.12.94**

From 1st to 4th December 1994 the wreck was examined by divers from Rockwater A/S Stavanger and by ROVs from Smit Tak, Rotterdam (parent company of Rockwater A/S) apparently contracted by the Swedish Sjöfarts-verket. The divers were working out of diving bells from the diving support vessel SEMI I. Börje Stenström, member of the Swedish part and head of the technical group, was said to have been the only member of the JAIC on board. In addition, there were on board Arne Valgma, head of the Estonian Ship Safety Division of the E.N.M.B., Ulf Hobro from Nordström & Thulin, the responsible director Johan Fransson and the operations manager Åke Vide from Sjöfartsverket, a number of Swedish criminal police officers, one English salvage expert and the Swedish diving expert Gustav Hanuliak, both on behalf of Sjöfartsverket, as well as some persons unidentified so far.

**Note:** It is doubtful whether Börje Stenström was the only JAIC representative on board as it would be against the general attitude of the Finns demonstrated before and after the diving investigation, namely to be represented by their own people whenever relevant parts of the investigation were carried out. Since the diving investigation of the wreck was the most relevant part of the investigation so far, it has to be assumed that Finland was represented by Tuomo Karppinen, as testified by Arne Valgma who attended on board.

This assumption is shared by the then chairman of the JAIC, Andi Meister, in his book "*The Unfinished Logbook*", where he states that the Estonian participant Arne Valgma shared his monitor cabin with Tuomo Karppinen from the Finnish part of JAIC. According to Andi Meister this was subsequently denied by the Finns who - for understandable reasons - did not want to take over part of the responsibility for the occurrences on board of the diving platform SEMI 1 such as the wilful manipulation and deletion of essential evidence in which Mr. Karppinen most likely participated.

The main purpose of the diving operation, which was paid by the Swedish Government, was to establish:

- (a) Could the ESTONIA be lifted up as a whole?
- (b) How many bodies could be recovered without lifting the vessel, and
- (c) would it be possible to cover the ESTONIA with stones/concrete?

The results are outlined in two official reports available to the public, viz.

- Condition Survey of the vessel ESTONIA for the Swedish National Maritime Administration by Rockwater A/S, Stavanger (attached as [Enclosure 27.409](#)), and
- Survey Report M.V. ESTONIA dated 08.12.94 by Smit Tak B.V., Rotterdam (attached as [Enclosure 27.410](#)).

In addition, the divers had to inspect and record on video tapes the foreship area as well as the navigation bridge on behalf of the JAIC and according to the instructions of Börje Stenström and/or Tuomo Karppinen.

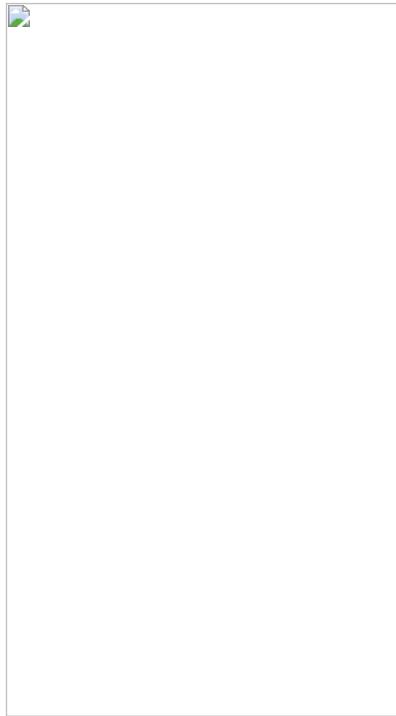
According to the Rockwater Report to Sjöfartsverket the underwater work was documented on 19 video tapes which were handed over to Sjöfartsverket/Swedish criminal police before they left the diving platform by helicopter. Allegedly Rockwater kept only those videos on which the safety of the divers was documented, in case health problems should appear, which was not the case. Those videos allegedly were destroyed one week after the last diver entered the bell.

At a subsequent meeting in Helsinki on 02.10.96 between the JAIC and the Rockwater representatives Ray Honour, managing director / Dave Cawson, project manager / Terry Jost, diver (one of the two divers having examined the bridge) the following was established:

*»Whatever the divers did was documented in detail by Rockwater in three different logbooks. It is possible to check each individual episode by comparing the entries in the logbooks with the video logs respectively with the videos themselves. It can be excluded that sequences have been removed from the videos. On some tapes date and times are recorded, on others not because the input had to be made in the operation room which was not done with all tapes. The conditions were very difficult, the visibility was poor, each movement caused a cloud of settled-down sediments.«*

The diving operation was performed by four teams of three divers who worked around the clock from two diving bells hanging next to the wreck. The first diver of the team remained in the bell, the other two proceeded to the designated area where one did the work according to instructions from the supervisor in the operation room while the other secured him by checking his umbilical, etc. The divers worked in diving suits with helmets, which were connected by the said umbilical containing all the necessary supply and communication lines to the diving bell respectively to the diving platform. On top of the helmets one searchlight and one, probably two, video cameras were mounted. The diver received his instructions through two earphones - one in each ear - and spoke into one microphone. On the video tapes available to the public only the voice of the supervisor into one of the earphones and the voice of the diver are audible. Only on some occasions does it become evident that the diver gets additional respectively other instructions when he reacts differently or replies differently, this being particularly obvious when he quickly turns his head away from areas which the public should not see as will be explained on the following pages. It is common practice - according to the diving expert Brian Braidwood - that divers carry two different earphones during an operation like the one under consideration here.

The following pictures show two of the Rockwater divers with diving suit, helmets and umbilical.



Due to being 100% supplied and disposed off via the umbilical these divers do not create air bubbles in the water. The video films were produced in the PAL format by the cameras on the helmets of the divers. From these films the following are available to this 'Group of Experts':

Tape no.	Tape name	Contents	Time
6	B40a	Bulbous bow with audio	0.14.19
7	B40b	ROV hull survey and bow area	2.56.03
8	B40c	Divers survey mainly bow	3.00.00
9	B40d	Nav bridge survey	3.03.57
10	B40e	Around the bow and then on nav bridge	2.41.29
11	ROV19/06/96	Good quality all over, but cut and various dates	2.03.49
12	ROV Sprint 3/12/94 = other		
13	ROV mudline no date	Stern, prop, hull survey, bow thruster, etc.	1.53.44
18	ROV 9/10/94-Sprint 3/12/94-diver	Good quality all sorts sprint 3/12/94 diver	
19	B40c RW/SEMi1/EST/ D/013007	Divers deck no1 & bow investigation	3.00.00
20	B40b Sprint/94/Estonia/ 01001-006	ROV Hull survey	2.56.00

Also these films were handed over to the video experts of Disengage/UK for analysis and evaluation - see Subchapter 34.6.

One of the results was that - except videos 11 and 18 - all other video films - although made in the PAL format - had been copied by a PAL/SECAM machine without a converter in between. This results in poor copies, which are much too light and unclear - a fact which makes a proper evaluation of the video material very difficult, sometimes impossible. In

addition, relevant parts had been cut out of these videos as will also be demonstrated in Subchapter 34.6. These videos were and still are being copied in Sweden by a private company called "FORSVARSMEDIA" which is said to work exclusively for the Ministry of Defence, and as such has security clearance. Reportedly Börje Stenström had decided before any copying was done which parts should be hidden from the public and cut out. These concern footage showing the hull above the starboard mudline including the starboard stabiliser and certain areas of the foreship and the bodies inside the wreck and on the bridge. While the video sequences showing undesired parts of the wreck were deleted - which fact has led to the discrepancies in the timing as shown by Disengage (see Subchapter 34.6) - the bodies have been made invisible by light spots, also the three "official" bodies on the bridge. Even though it is stated in the Rockwater Report, among other things: »The bodies on the bridge showed signs of decomposition, but were also undamaged.«, and the Sjöfartsverket Report added: »On the bridge, where many windows were missing, one body had been attacked by fish.«, the bodies on the bridge were allegedly not identified by their uniforms. This was explained by Börje Stenström, as follows:

*»The divers did not know any of the victims personally. So, how could they identify them?«*

**Note:** By the stripes on their uniforms, as it had initially been assumed that all victims were officers.

This is most annoying, because the question who was on the bridge during the final minutes is of importance, in particular, whether the master was there. From the distress communication it is known that the watch officer - 2nd mate Tormi Ainsalu - the 3rd mate Andres Tammes and most probably also chief officer Juhani Herma - had been on the bridge until 01.30 hours - the end of the 'Mayday' communication - see Subchapter 22.1 - when the vessel was practically on the side. Of these three Ainsalu and Tammes were seen by Sillaste to leave the bridge, while Herma apparently remained inside. According to 3rd engineer Margus Treu, he was asked by 4th mate Kaimar Kikas at a rather late stage after the diesel generators had already shut down, whether he could pump freshwater overboard from the starboard tanks. Thus it could be assumed that the 4th mate also stayed in the bridge. The third body should be the master according to the "evidence" of watch A.B. Silver Linde, which in all probability is wrong because he had not been back to the bridge before, at or after 01.00 hours - see Subchapter 21.2.2. Nevertheless, the crew survivors were very certain from the beginning that Captain Andresson had died on the bridge, which is not surprising because it has to be assumed with certainty that at least one of the surviving officers/engineers had been on the bridge after the big heel and seen what had happened.

In summary this would explain the three bodies as found by the divers, viz.

- 1) close to the door leading out to the aft on port side, across the door leading to the inside stairway.
- 2) inside the chart room without further details.
- 3) in the starboard wing below the broken loose flagbox.

The above is revealed from the voice communication between two divers and the supervisors on board the SEMI 1 according to video tapes B40c and B40d which are available and from the Finnish report of the JAIC, page 131. In addition, more information about the bodies became publicly known partly through the Andi Meister book "The Unfinished Logbook" and partly through the Estonian media. These are:

- the body at the aft port door was wearing a brown or red/brown suit.
- the body underneath the flagbox in the starboard bridge wing had a tattoo on his right hand.

Reportedly neither Captain Andresson nor Juhani Herma nor Kaimar Kikas had a tattoo on their right hand and certainly none of them was wearing a brown or red/brown suit. So, who are the three bodies on the bridge and where does this information come from?

On the other hand, the detailed knowledge of the Estonians about the condition of the bodies inside the bridge indicates that they had been there with own divers. Furthermore, neither the descriptions above nor the few words of the divers audible on the videos indicate that any of these bodies was badly decomposed and/or had been attacked by fish.

The explanation for this discrepancy was discovered by Disengage when analysing the available footage frame by frame. They found out that the first diver inspecting the bridge - Dave Mawston - before entering the port bridge wing through the lower aft window, which was already broken, cleared away the glass remains and meshwire and then pulled out a body by the hair to the outside where he let it go. This body was only approximately half a body because the lower half was missing, possibly due to having been attacked by fish or by being badly decomposed? Whatever the cause for this terrible injury might have been, this body was neither found near the port aft door nor in the chartroom nor in the starboard wing below a flagbox; it was removed from the bridge before the first diver entered the bridge and before the aforementioned three bodies were found. Consequently there had been a fourth body on the bridge, the existence of which is not mentioned by the Swedish participants. The evaluation of the so-called "Mudline video", showing the starboard hull - and bottom area in way of the mudline, revealed the existence of a fifth body just outside the starboard bridge wing which is also nowhere mentioned. - See Subchapter 34.6. Apparently the Swedes in the JAIC were also hiding these bodies from the only Estonian participant of the diving investigation, Arne Valgma, who was said to have been sleeping during the first inspection of the bridge, because he had been told that nothing special would happen during the hours ahead. He was interviewed on the subject by Spiegel TV, but the interview is not available.

The question remains: Why didn't the Swedes onboard the SEMI 1 arrange for proper identification of the bodies on the bridge and why do they keep secret the fourth and the fifth body?

There were several other incidents respectively observations during the diving survey to which attention has to be drawn, viz.:

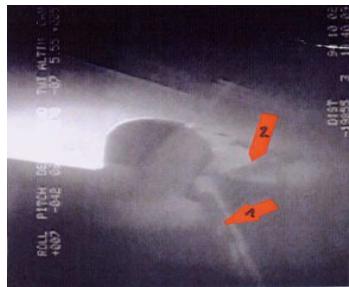
- (1) The torn and broken open underside of the starboard bridge wing.
- (2) The inspection of particular cabins on the 6th deck.
- (3) The inspection of the forward part of the 1st deck and the 0-deck.
- (4) The ROV "inspection" of the car deck and the consequences.
- (5) The activities of other divers with other equipment inside the car deck.
- (6) The condition of the rails and the preventer wires of the bow ramp.
- (7) The angle iron in the housing of the port bow ramp actuator.
- (8) The condition of the starboard stern ramp.

None of all this is mentioned in the JAIC Report.

**as to (1): The torn and broken open underside of the port bridge wing.**

The area in question and the extent of this unusual damage at an unusual location shall be illustrated by a number video images. The first ones were made from footage produced already on 02.10.94, i.e. 4 days after the casualty, and the last ones at the diving investigation between 01-04.12.94. The arrow on the picture below points to the area in question.

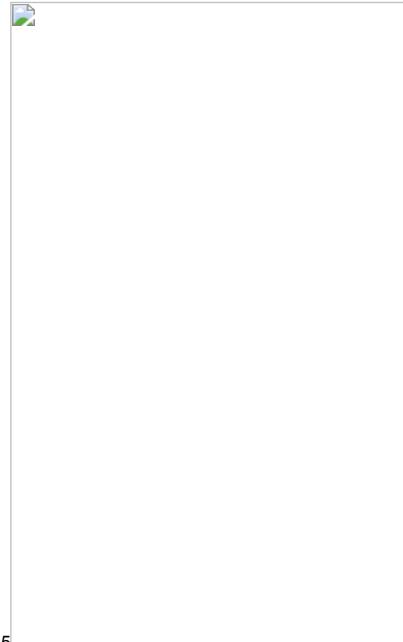




No 2, No 3



No 2, No 3



No 4, No 5

The images on the previous pages are explained as follows:

No. 1 - The arrow points to the area in question - the underside of the port bridge wing.

No. 2 - was made on 02.10.94 and shows the aft part of the port bridge wing looking from aft. The vertical stanchion, initially located vertically in line with the aft plating of the wing, is visibly bent forward (arrow 1) together with adjacent plating - arrow 2. The paint at the (port) outside of the stanchion is completely scored off.

No. 3 - made on 02.10.94 and shows the same area from below with the stanchion and plating pushed forward and a pulled down square looking like an access hatch which, however, had not been there on delivery of the ship according to the drawings.

No. 4 - made during the diving investigation on 03.12.94 and shows the plating of the underside of the port bridge wing now completely torn off. The arrow points to the window of the owners' cabin.

No. 5 - made on 03./04.12.94 shows the empty space between the bottom of the bridge and the initial underside plating which is now missing.

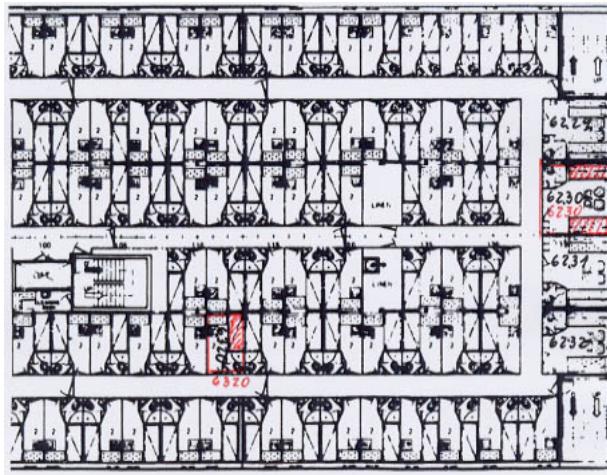
It is quite obvious that part of the damage did exist already on 02.10.94, i.e. 4 days after the casualty when the first (official) ROV went down and that the damage was enlarged during the time until the diving investigation of 01.-04.12.94. The damage is not mentioned in either the Smit-Tak/Rockwater Reports nor in the Sjöfartsverket or JAIC Reports and has also not been discussed by the media.

This damage cannot be attributed to the casualty and also does not look as having been caused by fire or explosion. It is however obvious that there is heavy impact damage at the aft lower part of the bulkhead which together with the vertical stanchion supporting the wing was pushed forward. It therefore has to be assumed that this was caused by interested parties searching for something particular hidden inside the void space between the bridge floor and wing underside, prior to and again after 02.10.94.

#### as to (2): The inspection of particular cabins on deck 6.

According to video B40a and the video tape log page - attached as Enclosure 27.411 - the diver entered the forward part of deck 6 and tried to enter cabin 6132, which had been occupied by a member of the Stockholm Police ST-Section, but failed, then tried the next cabin 6135 but failed again and then 6134 also without success. The diver returned to the outside for tools and moved in again, broke open cabin 6132 - found a suitcase without name tag and left it behind. He then worked his way to cabin 6230 which was the 2nd cabin from port side of the four luxury cabins in the fore part of deck 6 overlooking the foreship. According to the statement of purser Andres Vihamar of 15.05.96 - see Enclosure 14.195 - this cabin had been assigned to the master of the second crew, Captain Avo Piht. In the alleyway in front of this cabin the diver found a body. The diver, obviously receiving instructions through his second earphone not audible on the available video, broke up the door and headed straight for a suitcase, which was open but - according to the diver - apparently nothing was missing (how could he know?) and the suitcase had a label with the name Alexander Vorodin. The diver carried the suitcase out of the accommodation and it was apparently hoisted up to the diving platform. The diver subsequently broke open or tried to break open the cabins in the vicinity of cabin 6230, all of which had been occupied by members of the ST-Section of the Stockholm Police. The owner of the suitcase, Alexander Vorodin, had been on board together with his uncle and

nephew, and all three survived. According to the first and only statement of Alexander Vorodin and to the 2nd statement of his uncle, Vasili Krjutjkov, they had been in cabin 6320. In his 1st statement Vasili Krjutjkov testified, however, that they had been in cabin 6230 - [Enclosure 14.196](#) - which was indirectly confirmed by his young nephew Vassili Vorodin - see his statement [Enclosure 21.3.4.341](#) - who testified that he had been thrown out of his bed to the floor by the big heel and thereafter they had looked out of the window and seen the vessel heeling heavily to starboard. As can be seen from the drawing below showing the forepart of deck 6 - cabin 6320 is an inner cabin without windows and with only 2 beds (1 upper/1 lower) which are arranged athwartships, thus no one would be thrown out these beds if the vessel suddenly heeled to starboard. Cabin 6230, however, has 2 upper and 2 lower beds which are arranged in longitudinal direction, i.e. if the vessel suddenly heeled to starboard somebody in the port side beds could be thrown to the floor as it happened to Vassili Vorodin. Furthermore this cabin has two windows overlooking the foreshore.



Consequently the Vorodins had been in cabin 6230 which is also confirmed by the presence of the suitcase of Alexander Vorodin in this cabin. The question is why did Andres Vihmar testify to the police that it was the cabin of Captain Avo Piht where the suitcase of Alexander Vorodin was found, who had the reputation of being a weapons smuggler, and was therefore so interesting to the criminal police of Stockholm. A transcript with the voice communication during the above explained examinations is attached as [Enclosure 27.412](#).

#### as to (3): The inspection of the forward part of the 1st deck and the 0-deck.

According to video tape log RW/SEMI/EST/D/011 page 1 - [Enclosure 27.411.1](#) - the diver S. Jessop entered the forward part of the 1st deck through an opening cut by the divers into the shell plating. He examined the port side cabins, established that the only accessible watertight door was closed (all doors close from port to starboard, thus it has to be assumed that the door had closed by gravity due to the starboard list after the hydraulic pressure had slackened sometime after the sinking) and then - according to the video log proceeded at 14.54 hours towards the spiral stairway, which only leads to the sauna and swimming pool compartments on 0-deck, where damage to the starboard shell plating is assumed. Without any notation in between the log continues after 1 hour and 6 minutes without any explanation as to what the diver did during this time. Thereafter the diver left the wreck through the outside opening. The lower part of the video log page No. 1 - [Enclosure 27.411.1](#) - shows the respective entries. Apparently the times 14.54 and 16.00 have been manipulated and the page was cut between these figures, something which had been written in between has been taken out and both parts of the page copied together.

The part taken away concerns the activity of the diver between 14.54 and 16.00 in the area at the end of the spiral stairway which is the 0-deck with sauna- and swimming-pool compartments. It is obvious that the JAIC did not desire that the inspection results were made public.

1:45	14 52	DIVER REACHED TO ACCESS DOOR 107 - DOOR CLOSED
1:47	14 54	DIVER MOVING AFT TO SPIRAL STAIRCASE.
1:54	15 00	DIVER RETURNING TO OUTSIDE OF VESSEL
1:56	16 02	DIVER MOVING AFT TO CUT NEXT ACCESS LOCATED AT DECK 1.
8:00	17 07	DIVERS CONTINUE CUTTING - END TAPE.

#### as to (4): The ROV has not been inside the car deck and the consequences.

In spite of five attempts and although the supervisor says so, the ROV cannot have entered the car deck through the bow ramp opening, because

- (a) the video sequences do not confirm this, and
- (b) the video depth shown on the ROV display - 81 m - is too deep for the car deck.

Nevertheless the ROV moves between pallets with cement bags and other objects looking like cargo apparently lying on the sea bottom. As it is highly unlikely that this intact looking cargo originates from other vessels, it must have come from ESTONIA even though the bow ramp and both stern ramps are closed or almost closed. Although the starboard stern ramp was certainly more open at some stage when the vessel was still afloat and severely heeled, it is very difficult to assume that cement bags on pallets should have fallen off some truck or trailer and then out through the open ramp and exactly next to the position where the vessel finally settled down. The respective video is B40b from 03.12.1994. Another open question which demands clarification. See also Subchapter 34.6.

#### as to (5): Divers with other equipment were active inside the car deck.

On video B40c the "official" diver was working on top of the bow ramp looking into the car deck when suddenly a frogman type diver appeared in the beam of his searchlight who rapidly tried to get away by swimming backwards, however, was picked-up by the camera.

On another occasion air bubbles are coming up from the car deck, although the "official" divers do not produce air bubbles and allegedly were not working inside the car deck at all. On a further occasion lights can be seen inside the car deck, although the "official" divers have not been there.

On another occasion the supervisor said: "They are getting their diver(s) back." or "We have to wait until they get their divers back." On another occasion the supervisor said to the diver: "We have to stay on the outside, the inside is no good for us" obviously meaning the car deck.

All this indicates that another diving operation by other divers went on simultaneously, longer or shorter, than the official one and it is indeed the question what these divers were doing inside the car deck and why their activity was and still is kept secret?

#### as to (6): The condition of the rails and the preventer wires of the bow ramp.

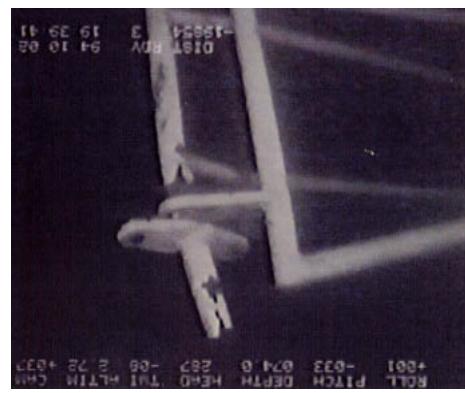
The bow ramp had rails on both sides with three sections and a movable part at the forward end on each side. The movable parts extended forward when the ramp was open and were secured in position by splints put through holes at the movable and fixed parts. The image below shows the ramp in open position.



Before the ramp was closed the splints were pulled out, the moveable parts were turned backwards and secured again by the splints. The image below shows the closed bow ramp from the inside.



Upon evaluation of the video tapes by Disengage parts of the bow ramp rails were identified on the sea bottom and the images shown below and overleaf were produced.

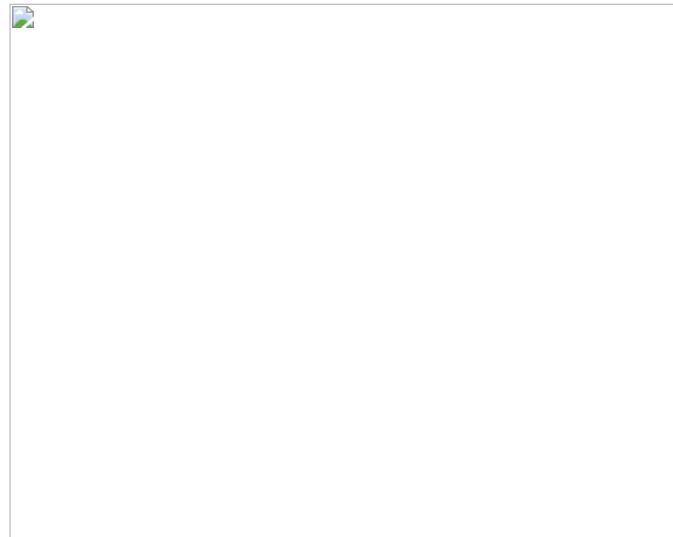


The two images above made by ROV on 2.10.94 already clearly and without doubt prove that it is the forward section with movable part of the starboard bow ramp rail which is resting on the bottom of the sea.

A reconstruction of the ROV track commencing at the stern of the wreck revealed that these rail parts are located about 250 m to the south of the stern and about 80 m to the south-east of an area where the video was cut three times, each time for about 1 minute.

For further details see Subchapter 29.2 - The Bow Area.

The following images show the remains of the clearly cut off 2nd and 3rd stanchions from forward of the port bow ramp rail. As can be seen the stanchion was located next to the port upper mating box for the ramp securing bolt.



It is obvious that this stanchion did not break off but was mechanically cut off. The image is part of the diver video tape B40c of 03.12.94 which proves that the bow ramp rail on both sides had disappeared. As it is difficult to believe that the bow ramp should have had no rails without anyone - including the Swedish safety inspectors - noting it in Tallinn, the rails must have been cut off subsequently, i.e. after departure. For further details see Subchapter 29.2.

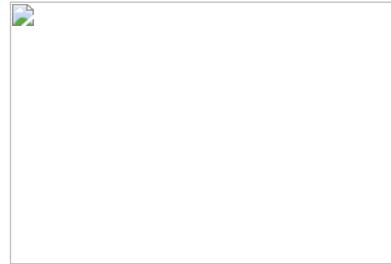
**The preventer wires attached at both sides of the bow ramp and the car deck opening** were installed to prevent the bow ramp's falling down onto the forepeak deck in case of the failure of the ramp actuators, i.e. wires, shackles, lugs were dimensioned to catch the falling ramp without breaking.



The arrows on the picture above point to the shackles by which the starboard preventer wire is connected to vessel and bow ramp. The system on the port side is identical.

The evaluation of the available video footage by Disengage reveals that

- (a) both preventer wires were still attached by shackles to the lugs at the car deck opening;
- (b) the port wire cannot be seen in full length, it disappears behind the bow ramp;
- (c) the starboard wire, however, can be seen in full length as shown on the image below.



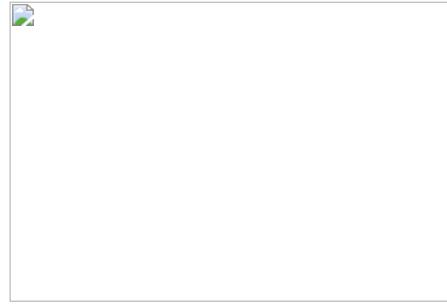
The shackle with bolt is obviously attached to the lug of the wire in undamaged condition.

(d) Both lugs at the ramp are intact and undamaged. The port lug is just slightly bent inwards as is the upper mating pocket for the securing bolt.

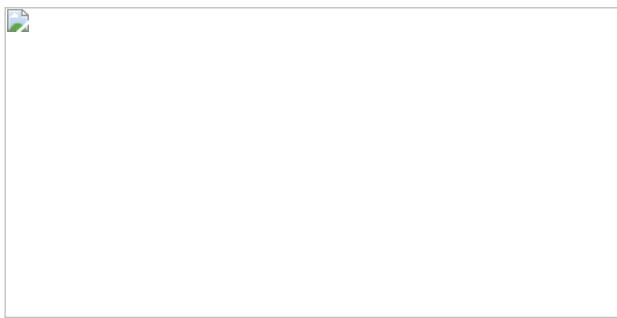
For further details see Subchapter 29.2. Also here the question arises who unshackled the preventer wire and put the bolt back into the shackle and for what purpose and at what time? As the above image was taken from the ROV video from 09.10.94 it is obvious that the explained condition existed almost two months before the official divers went down.

#### as to (7) The angle iron in the housing of the port bow ramp actuator.

The image overleaf from the diver video B40c shows the lower part of the opening of the housing of the port bow ramp actuator. The broken lug of the actuator - by which it had been connected to the bow ramp - can be seen. The actuator is in almost retracted condition.



The following image was produced from footage made when the diver looked into the actuator opening more from the side. The image was enhanced by Disengage with special equipment and it revealed that some strong steel piece was sticking behind the actuator. Further analysis of this footage revealed that this was an angle iron (arrow 1) which had obviously at some stage been pressed into the adjacent bulkhead plating (arrow 2) with the bulkhead port in between unaffected (arrow 3). It was at first assumed that this angle iron had been placed there to sabotage the complete closing of the bow ramp, however on second thought it is more likely that this steel piece had been placed there deliberately by the crew to prevent the actuator fastening from hooking at the edge of the front bulkhead because the ramp had been considerably hanging down with its port side due to the broken port hinges which had destroyed the initial alignment of the actuator fastenings in the vessel and at the ramp.



As a matter of fact - as will be demonstrated in Chapter 29 - the bow ramp was detached from the vessel at the port outer and inner hinges. Therefore the ramp was hanging down at the port side with respective effect on the port actuator which was hooking at and rubbing against the bulkhead in way of the lower edge of the opening. To smoothen these contacts the angle iron was probably installed. This was another temporary repair of the damaged bow ramp - in addition to the steel put underneath the bolt of the port outer hinge - done without the consent of the Classification Society.

#### **as to (8) The condition of the starboard stern ramp.**

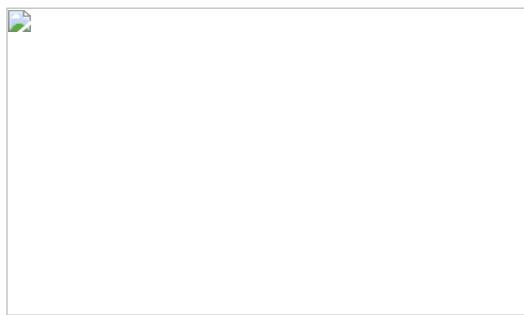
The image below shows the inside of the upper starboard stern ramp to be partly open. It was taken from the ROV video dated 09.10.94. The arrow on the picture further down points to the area in question. This fact will be explained in detail in Subchapter 29.7.





Neither the eight items explained above nor the discovery of the fourth and fifth body on/near the bridge is mentioned in the Report of the JAIC.

Another result of the diving investigation was the apparent fact that the entire starboard bilge strake area including the adjacent shell plating pointing up to car deck level was accessible and could thus be inspected by divers and ROVs, which was done. The results, as far as they are possible to achieve from the severely censored "Mudline video", are outlined in Subchapter 29.5. The drawing below demonstrate the condition of the wreck. They were taken from the Smit Tak Survey Report dated 08.12.94 and attached as [Enclosure 27.410](#).



Finally the parts officially recovered from the wreck on behalf of the JAIC have to be mentioned:

- 1 visor hinge bushing (steel bushing + bronze bushing + securing plate)
- all 3 lugs of the Atlantic lock
- the bolt of the Atlantic lock
- 1 broken lug of the port inner ramp hinge
- 2 steel distance rings from the port outer ramp hinge
- 1 EPIRB storage case
- 1 GPS receiver
- 1 portable lifeboat radio set
- 1 ship's bell
- several smaller bits and pieces

After having measured the bolt of the Atlantic lock Börje Stenström threw it back into the sea, although according to his own scenario it was one of the most important pieces of evidence. This will be explained in Subchapter 29.2.

Also the sensor plate of the Atlantic lock and the electric cables of the sensors were cut off by one diver, but instead of putting them into the net together with the other objects brought to the surface, the diver threw both to the sea bottom apparently upon instruction of the supervisor.

The other objects recovered by the divers upon instructions of the police or other organisations are unknown to the public.

## 27.1 Further Evidence

In the meantime the available ROV/diver videos B 40 b, c, e have been analysed with regard to the voice communication between those concerned with directing and controlling the ROV supposed to enter the car deck, the divers inspecting the bow ramp and their supervisor. The identities of the persons involved is unknown and they are thus referred to as:

C = controller  
 C 2 = controller 2  
 V1 = Scandinavian voice DC = diver controller  
 V2 = ROV controller D = diver  
 V3 = unknown voice

C: The ROV has started descending.

V1: I see the fact but still we were inside here and we together we took measurements of 73.5 metres and 65.5 we did it ourselves.

V: I'll come back up again, we are obviously going round in circles. I don't know exactly where exactly where we are, it doesn't make much sense for us to keep going down all the time.

V1: There is diver...That's down below that's the one took this afternoon on the video so now we follow, we follow that one inside.

C: The ROV is now heading in again.

V1: This is heading in again.

C: We are now inside.

V1 We go in. The diver is so belaying this, that is good....seven zero meter, can we then go back to the divers and check our depth.

V2: Here's the diver.

V1: That's the diver he is working at 70 meters.

---

C: Just continuing to move inside the car deck.

V1: Should come lower.

C: Just continuing inside the car deck just finding some debris.

V1: That's mud.

C: A lot of mud built up.

V1: That's not sediment.

C: It's identified not as sediment but definitely mud, large build up of mud.

C: There appears to be outside the vessel now having become disorientated while entering the car decks.

V2: We are under the bow section.

---

C: Now we just re-entered the car deck area.

C: Now going to clear the ROV tether and attempt re-entry into the car deck area from a known reference point.

C: The ROV is now going to attempt to re-enter the car deck, this time with the assistance of the divers.

V2: We're at the diver now.

DC: If you just go straight down.

V2: Roger.

V1: Yah Yah Yah Yah straight down.

V2: We've been here before.

V1: Yah but not.

DC: All stop there.

V2: The first time I went in there.

DC: Go straight down from where you are you have to go down the stairs you can't come in from the top apparently.

V2: Roger we got lost here about three times so far.

C: We are seeing some debris now....which suggests that we are inside.

V1: Yah that's a pallet, that palletised cargo, that's on a pallet, that's cargo that is cement yah.

V2: All fallen forward yes.

V1: Yah Yah that is cement come close here.

V2: Wandering around at the bottom

V1: That's a pallet.

V1: That's cement again lets go in that direction.

V1: Yah these are decks, let's continue the heading is nice.

C: Seeing some more debris of various descriptions.

V2: Look like trousers.

C: Appears to be a lot of cement and pallets.

V2: Were inside the car deck somewhere.

V1: .....it was loaded yah yah.

It follows a conversation between the diver controller (DC) and the diver (D) who tries to help the ROV into the car deck from the starboard outside because the bow ramp was obviously not far enough open for the ROV.

DC: I'm just going to put your headlights off cause when you look at him he loses his camera picture. Just put him in the hole.

D: Tell him to just drop down now.

DC: Is that him inside?

D: No not quite. He's got to go straight down.

DC: Straight down.

D: Tell him to turn to his left and he'll see some guard rails, just follow the guard rails down and then in ...hold on a minute all stop.

DC: All stop.

D: Right that him on the ramp so if he goes to his left now.

D: He'll have to go in down the bottom now, he'll not fit in at the top.

DC: Say again don't shout I can't hear you.

D: He'll have to go in down stairs because he can't go in at the top.

DC: He'll have to go down the stairs, he can't get in at the top.

D: Go straight down from where he is.

DC: Does it look like he is going the right way.

D: Yea

D: It looks like he hasn't gone in actually.

The above implies that the diver knew a way from the starboard outside into the car deck which could only have been the big hole in the forepart of the car deck extending down into the tank spaces and probably bow thruster space of the 1st deck. See also [Chapter 36.3](#).

## CHAPTER 28

### THE ROV INSPECTIONS IN 1996

In preparation of the covering of the wreck as decided by the Swedish Government already in 1995 the Finnish Environment Protection Organisation and the Finnish Board of Navigation began with preparations in spring 1996 to pump out the heavy fuel from the bunker tanks of the ESTONIA as soon as the weather situation permitted. For this purpose reportedly two sophisticated ROVs were leased from Norwegian off-shore operators, which could also perform underwater flame-cutting. Furthermore, the oil-pollution fighting vessel HALLI was equipped with an installation able to warm up the asphalt-like heavy fuel and then pump up the liquid part, a rather time consuming matter. This installation proved to be very sensitive and thus work could only be performed up to wind force Bft. 4, whereafter the installation had to be pulled up. In order to make use of the sophisticated ROVs Tuomo Karppinen and Klaus Rahka from the Finnish part of the JAIC then frequently took the chance to make further ROV surveys of the wreck. A request by a member of this 'Group of Experts' for permission to attend one of these ROV surveys of the wreck was categorically denied by the Finns.

Subsequently a copy of a video allegedly made on 19.06.96 was received which shows images of good quality (PAL format and copied to PAL) of the foreship area only, although the complete vessel had been resurveyed and more videos had been made which, however, were not made available to this 'Group of Experts'.

The evaluation of the video tape revealed that the area around the port outer ramp hinge was now quite well visible without the mattresses, blankets and whatever else the crew had squeezed into the gap created by the partly open bow ramp. A damage hole in the port lower front bulkhead can be seen which will be explained in Subchapter 29.2. Also a strong lug welded to the front bulkhead is visible which was fitted by the yard for the wire controlling the bow ramp ropes.

The video further produced very clear images of both the port and the starboard visor hinge bolts, both front bulkheads and parts of the bow ramp which improved the evidence available already and which is further discussed in Subchapter 29.2.

Upon respective questioning, Karppinen and Rahka advised that there were no holes in the hull and that otherwise no changes to the wreck had been observed. Only later did it become public that during these ROV surveys it was discovered that steel plates, which the divers had previously fitted and welded over the holes cut by them into the shell plating forward and aft in way of deck 1, had been removed from their openings in the meantime. (These plates reportedly weighed 500 kg.)

It can be assumed that those who removed the heavy steel covers from the openings are probably identical with those who broke off the steel sheeting underneath the port bridge wing - see Chapter 27. Needless to say that these facts are not mentioned in the Report of the JAIC.

### 28.1 Further Evidence

There is no further evidence available in connection with these ROV inspections.

## CHAPTER 29

### THE WRECK

In this chapter the reader is introduced to the condition of the wreck as concluded from the reports of the divers ([Enclosures 27.409](#) and [27.410](#)) and from the different videos available to this 'Group of Experts'.

### 29.1 The General Condition

This can best be explained by the Smit Tak Survey Report of December 1994 - [Enclosure 27.410](#) - where it is stated:

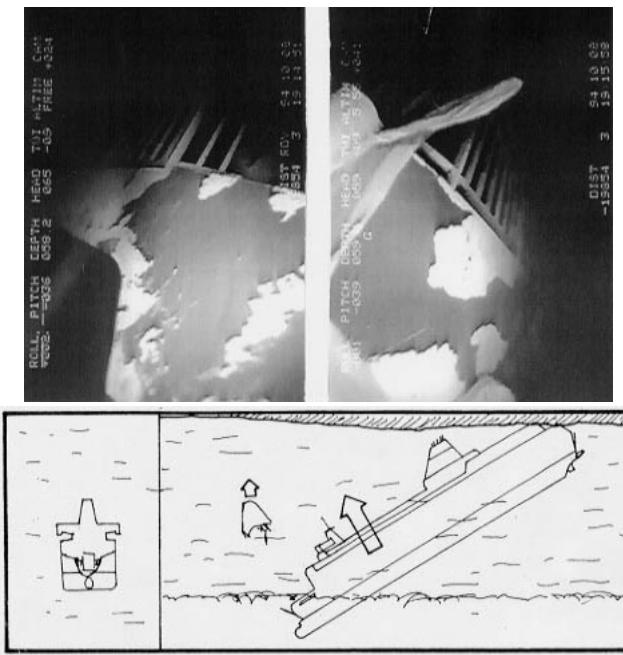
*«The wreck of the ESTONIA lies on her starboard side in a direction 095°/097° true, which consequently means her decks are facing south. In longitudinal direction there is little to no heel. Both rudders are clear and do have an angle of 35 degrees to starboard. Both propellers and propeller shafts are clear. Starboard bilge is clear from the seabed and the deck side is partly buried in the mud. Liferafts have not been noticed in the racks and since none are floating on lines between the ship and the surface it is assumed that all have been released.*

*On port side some lifeboats are still hanging in or attached to the davits, a condition which could not be established on the starboard side because of the aforementioned list. The port side anchor was reported to be in the hawse pipe, starboard side has not been seen but is assumed to be in the hawse pipe as well.»*

The visor was missing with the remains of the hinges on the forecastle deck broken, both front bulkheads and the bow ramp were noted to be severely damaged, damaged/broken railings and broken davits were found in way of deck 7 and some broken windows/port holes on other decks.

Window panels were found to have been pushed out and doors in the aft bulkheads of decks 5 and 7 were missing while the door in the front bulkhead of deck 5 leading down to the forecastle deck was noted to be open.

**Note:** This door could only be opened by crew members. The aft parts of the superstructures in way of decks 7 and 8 on the port side were found to be partly distorted and buckled. Large flakes of paint were scored off the aft parts of decks 5 and 6 - see the two images below - which was most probably caused when the vessel was in upside down condition with the stern already aground and the bow still above the water. - See the drawing below.



Otherwise no noteworthy damage was found according to the Smit-Tak/ Rockwater reports which was taken over by the JAIC as well, although much more damage could have been seen by carefully evaluating the available video footage as will be explained in the following subchapters.

## 29.2 The Bow Area

The following damage description and evaluation is based on the video footage made by the ROVs and divers as described in the previous Chapters 25, 27 and 28. The video films have been examined in close cooperation with Disengage - see Subchapter 34.6 - and images have been made of all relevant parts, which are arranged on sheets in accordance with the following "areas of interest":

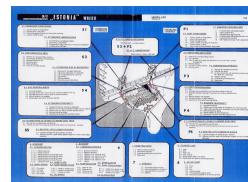
- S 1 - Starboard Visor Hinges
- P 1 - Port Visor Hinges
- S 2 - Starboard Harbour Securing
- P 2 - Port Harbour Securing
- S 3 - Starboard Forecastle Deck
- P 3 - Port Forecastle Deck
- S 4 - Starboard Front Bulkhead
- P 4 - Port Front Bulkhead
- S 5 - Foundation on B-Deck of the Starboard Visor Actuator
- P 5 - Foundation on B-Deck of the Port Visor Actuator
- 6 - The Bow Ramp
- 7 - The Forepeak Deck
- 8 - The Atlantic Lock

All the areas are shown on a 'General View' attached behind the page after next. Furthermore each "area of interest" is explained separately on one or more sheets, on which numbered detailed photos are arranged around an overview drawing showing the foreship of the wreck with slightly open bow ramp. On this drawing the respective "area of interest" is indicated and on a further detailed drawing this area is enlarged with added information. Thereby the numbers on the drawing correspond to the numbers on the images.

In addition to the information and explanation already provided by these sheets, the pictures are evaluated and interpreted and, if considered necessary, other photos and/or drawings are added.

The sheets are arranged at the beginning of the comments and it is recommended to the reader to look at these sheets when reading.

The authors do apologise for the partly very poor quality which is due the faulty copying of the video tapes from PAL format to PAL/SECAM without the use of a converter. - See Subchapter 34.6.



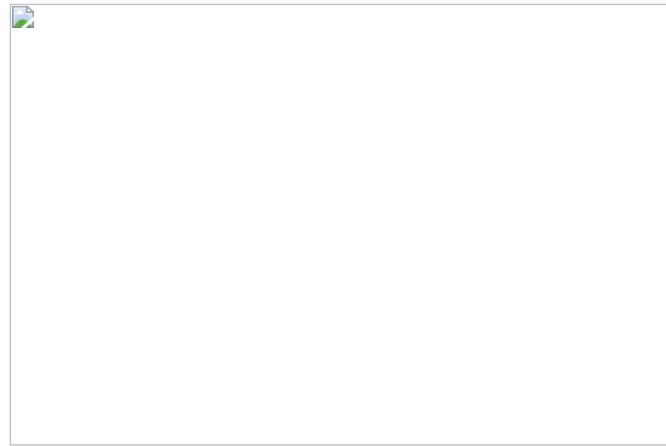
(click for full page images)

### S 1 - Starboard Visor Hinges

The technical description of the intact visor hinges can be found in Subchapter 2.6.2, the damaged condition is explained in Subchapter 12.5, whereby reference is made to the report of Bryan Roberts - see [Enclosure 12.5.180](#) - and to the enlarged images showing this hinge arrangement on 17.09.94, i.e. 10 days before the last departure. These enlargements are attached as [Enclosures 12.5.181/12.5.181.1](#). Furthermore reference is made to the statements and the interview of Rain Oolmets - see [Enclosures 12.5.177](#).

179.

**Interpretation:** Images 1-4 show the two lugs with the fixed bushing in between fitted on the forecastle deck which are facing forward. Both lugs show hammering/scoring marks (1), which were, in all probability, caused by the broken parts of the visor hinge plates and the aft end of the visor arm lower closing plate. - See the drawing below.



In addition images 2 and 4 show an area of burnt deck paint to starboard of the outer lug plate, i.e. below the location of the bushing in normal condition. This indicates that flame cutting had been carried out that close to the deck that the paint became burnt.

Images 5 and 6 show the middle and outer part of the hinge bolt (3). The bolt moved out of the hinges due to the list of the wreck and is ever since standing on the adjacent railbar. There are three areas of green paint visible which are indicated by red dots. Since only the deck was painted green it has to be assumed that the green paint visible on the bolt was deck paint. The hinge arrangement was a closed system without gaps between bushings and lug plates. This was evidently no more the case when the green deck paint was able to reach the bolt at least in three places! The explanation that this was possible can also be found in Subchapter 12.5 and on the enlarged images attached as [Enclosures 12.5.181/12.5.181.1](#), i.e. the starboard visor hinge arrangement was totally misaligned with the outer bushing sticking out too much which created the gaps between hinge plates/bushings enabling the green paint to reach the bolt. The condition of the outer part of the outer bushings of which the lower part was evidently cut off explains the following:

- (a) The bolt had only to some extent engaged the outer visor hinge plate.
- (b) The burnt off lower part of the bushing made it possible for the bushing to fall off the bolt (contrary to the port where the bushing was intact and consequently remained attached to the bolt - see the following item P 1).
- (c) During the flame cutting (burning) of the lower part of the said bushing the deck paint below the bushing was burnt because of the narrow distance between the lower part of the bushing and the green deck.

Image 4 shows also scoring marks on the deck in front of the hinge plates evidently caused by the visor arm lower closing plate during opening/closing of the visor. This indicates that the visor was too low in the hinges, a consequence of the burnt out hinge plates. - See Chapter 30.



(click for full page images)

#### P 1 - Port Visor Hinges

The technical description of the intact visor hinges can be found in Subchapter 2.6.2 and some indications about damage can be found in Subchapter 12.5 and in the statements and interview of Rain Oolmets attached as [Enclosures 12.5.177-179](#).

**Interpretation:** Images 1-5 show the port hinge bolt moved out of the hinge plates/lugs and resting on the adjacent railbar, however, contrary to the starboard side - without green paint but with the inner bushing still attached to the bolt.

No. 1 shows in addition severe hammering/contact marks in way of the fracture area of the visor hinge plates still attached to the bushing; (item 3.1. on the detail drawing) the counterpart at the visor side was the lower part of the inner hinge plate in way of the fracture area which is pictured below.



The upper and lower parts of the outer hinge plate do not show signs of hammering or contact. This will be demonstrated in more detail on sheet P 3 - Port Visor Arm - See Chapter 30.

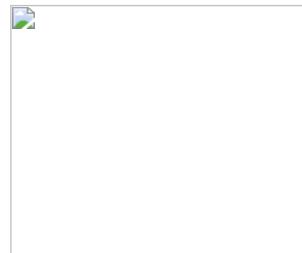
No. 2 shows two areas of interest, viz.

- (a) the deck area below the previous location of the bushing with the green deck paint undamaged; i.e. not burnt. (item 2 on detail drawing)
- (b) the rubbing respectively contact marks between the deck opening and the hinge plates, most probably caused during the normal operation by the too low visor arm as a further result of the completely misaligned visor.  
(item 4 on detail drawing)

No. 3 shows the moderate contact marks at the upper part of the inner hinge plate.

No. 4 shows the two hinge plates with the fixed bushing in between (diver looking out of the deck opening for the port lifting cylinder); the hole in the fixed bushing (item 5 in detail drawing) should be noted which most likely was cut into the bushing to reach the bolt with oil and grease for lubrication purposes (see statement 2nd engineer Peeter Tüür - Enclosure 12.5.167); also the contact marks at the lower part of the hinge plates (item 1) should be noted whereby it is obvious that the outer (port) marks are higher than the inner (starboard) ones.

No. 6 shows severe hammering marks at the upper part of the outer hinge plate (item 1) evidently caused by the visor closing plate. - See the drawing below.



(click for full page images)

#### S 1 and P 1 - Visor Hinges

The sheet demonstrates the condition of the port and starboard visor hinges upon departure from Tallinn on 27.09.94 and the condition of the hinge parts on the forecastle deck of the wreck as found after the sinking.

Images 1-3 on the left side show the starboard hinge parts with **hinge bolt evidently without attached bushing**, i.e. the bushing fell off the bolt after the visor hinge plate were broken.

Images 4 and 6 show the forecastle deck parts of the port visor hinges with the **hinge bolt evidently with attached bushing**.

The drawing No. 5 demonstrates the various hard contacts between the broken parts of the visor hinge plates and the fixed lug plates on the forecastle deck.



(click for full page images)

#### S 2 and P 2 - Harbour Securing for Visor

The sheet shows two pictures of the open port and starboard harbour securing. It is clearly visible that both bolts are open. When the visor was opening, a strong lug on top of each of the visor arms moved between the mating parts of the harbour securing, a sensor was contacted and activated a green light on the car deck control panel indicating "visor open", whereupon the operator closed the bolts of the harbour securing hydraulically and the red light, indicating "harbour securing open", went out and the green light, indicating "harbour securing closed", went on. When the visor was closed the sequence was the other way around, i.e. when the bolts moved into the open position before the visor was closed there was no more contact with the sensor and on the control panel the green light went out and the red light went on indicating "harbour securing open". The red light remained on until the sensor was again in contact with the bolt during the next opening of the visor.



(click for full page images)

**S 3 - Starboard Forecastle Deck**

The area under investigation is restricted to the deck opening for the lifting cylinder of the visor (actuator) and forward towards the deck edge as indicated on the overview drawing and on the detailed drawing.

The sheet shows the images 1, 2, 3, 4 of which No. 3 has been compiled together from two images in order to be able to show the entire deck opening of the cut through deck beam at frame 149.

**Interpretation:**

Image No. 1 and 2 show pieces of green deck paint, probably from B-deck, which obviously fell into the as-found position only after the actuator had moved forward through the big hole in the front bulkhead - see sheet S 4. This raises the question what caused such a big steel piece to break off the B-deck? This will be answered in Chapter 32 - Unexplained Damage / Unexplained Evidence.

No. 3 shows the opening in the forecastle deck from the deck beam at frame 149 to the forward aft end in front of the lug plates of the visor hinges, welded to the forecastle deck. Attention had to be drawn to the apparently unaffected edges of the opening aft of the deck beam and the remains of the quite strong deck beam.

**Note:** Computer simulation and calculation to determine the force required to break through this deck beam have been carried out by the Technical University Hamburg-Harburg and are commented in Subchapter 34.11.

Contrary to the port opening - see sheet P 3 - where the ramp hook arrangement is clearly visible when the ROV looked into the opening - see the image on the next page - the starboard opening is just a big black hole. This can only mean that the starboard ramp hook was not where it was supposed to be.



Also the flat bars around the deck opening into which the rubber packings - fitted below the visor arm - should be pressed, when the visor was closed, were missing. The same refers to the flat bars having initially been welded athwartships at the forward part of the forecastle deck into which the rubber packings at the aft part, i.e. below the recess of the visor, should be pressed when the visor was closing (see also item 5 on the detail drawing). This can be seen from the following two pictures, of which the first one shows the starboard aft part of the visor deck with untouched rubber packings, intact and in place and the 2nd is the port side which is evidently in worse condition.



The picture below shows the rubber packing underneath the starboard visor arm which was obviously never pressed into any flat bar and is not affected at all, which confirms the apparent fact that

- a) the flat bars around the deck opening had been removed prior to the casualty and that
- b) the visor was raised to some extent at this side after the hinges were broken since otherwise this rubber packing would have been destroyed as it did happen at port side - see P 3 - Port Side Fore-castle Deck.



No. 4 shows the area between the hinge plates and the deck opening which is evidently covered with numerous rubbing marks caused by the opening and closing of the visor during normal operation.



(click for full page images)

### P 3 - Port Forecastle Deck

The area under investigation is restricted to the deck opening for the lifting cylinder of the visor and forward towards the deck edge as indicated on the overview drawing and on the detail drawing.

The picture below shows the area with the deck beam (arrow 1), the forward edge of the deck opening (arrow 2), the visor lug (arrow 3) and actuator (arrow 4) in its original sound condition.

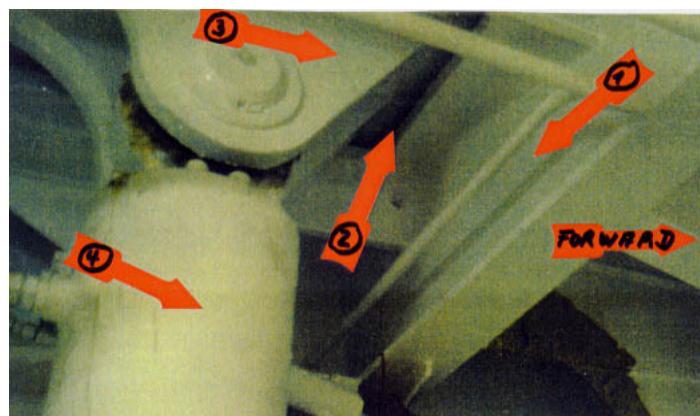


Image No. 1, 2 and 6 show the starboard inner side of the cut through the deck beam at frame 149, which are evidently pressed together, partly cracked and bent up, indicating pressure from port to starboard. The edges of the deck opening aft of the deck beam are not affected at all, same as on the starboard side. This is only indicated on the detail drawing but is clearly shown on the available video footage. The starboard side of the cut through deck beam and the deck plating as well as the rubber marks are shown also on the picture below.



It must have taken some time for the visor lugs to cut through this deck beam while the visor moved forward/aft in the sea state ending when the visor lug plates had finally cut through this strong deck beam. It has to be assumed that during this cutting process at least the paint on both the inner and the outer lug plates should have been destroyed in way of the contact area. This was, however, evidently only the case with the inner lug plate as can be seen on the picture overleaf.

**Note:** As to the forces required to break through this deck beam see Subchapter 34.11.



The lug plate has very deep and - at the upside - straight scoring marks, almost engraved, which indicate

- (a) the movements of the visor and
- (b) that the weight of the visor was to some extent resting on this inner lug plate which caused these very deep scraping marks, whilst the opposite side, i.e. the outer lug plate, remained completely unaffected as visible on the next picture.

This outer lug plate does not even show scratches, i.e. the paint is totally intact.



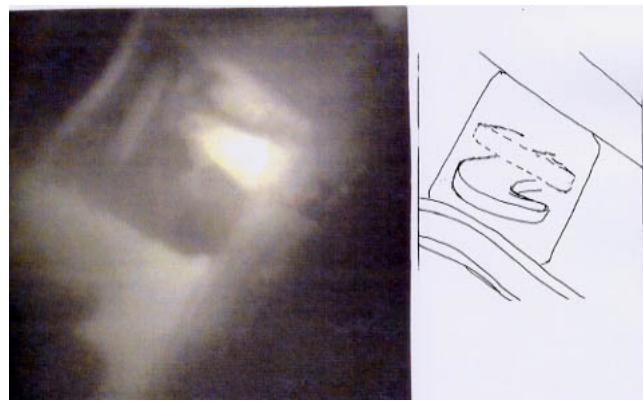
This will be discussed in more detail in Chapter 30 - Damage to the Visor - where also other pictures are shown.

Images No. 3, 4 and 5 show the forepart of the cut through the deck plating and down the front bulkhead with the rubber packing of the visor in way.

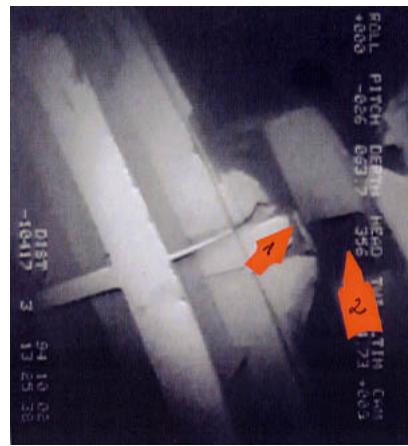
No. 7 shows the view of the ROV into the deck opening with the ramp hook arrangement clearly visible.

No. 8 shows the view of the diver onto the same area from a slightly different angle. At the upside the more or less unaffected port edge of the opening is visible, at the downside the remains of the deck beam are visible. It is evident that the hydraulic cylinder of the ramp hook was in extended condition, i.e. the ramp hook was in locked condition.

From subsequently obtained video footage - evaluated by Disengage - it was ascertained that the port ramp hook was intact and complete, i.e. neither broken nor bent straight. This means that this hook had not been engaged in its mating lug because this lug is also intact with the bolt undamaged. - See also item 6. The following image shows the intact ramp hook, the adjacent drawing explains the image.



The following picture shows the misalignment between the mating lug at the ramp side and the opening in the front bulkhead out of which the hook would extend, i.e. it was impossible for the hook to engage the mating lug in this condition. This explains the undamaged condition of both hook and mating lug.

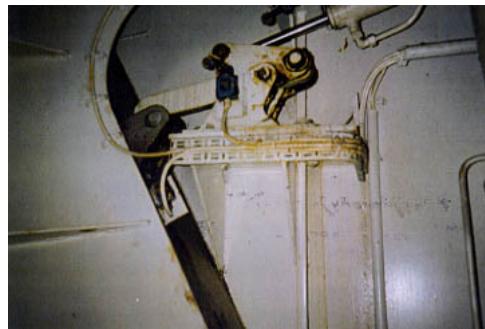


Arrow 1 points to the mating lug at the ramp

Arrow 2 points to the location where the hook would reach out of the opening

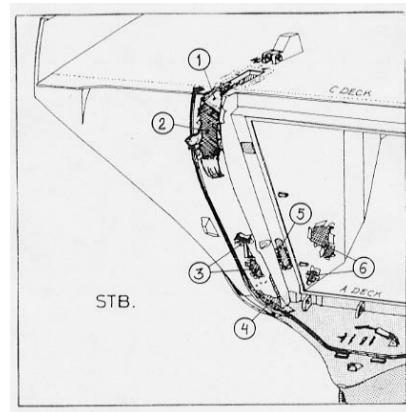
**Note:** The 4 inches = 100 cm misalignment between the bolts on the ship's side and the mating pockets on the port side of the bow ramp as reported by the diver must logically exist also between the ramp hook on the ship's side and the mating lug on the bow ramp. This is further evidence that neither the bolts could have engaged the mating boxes nor the ramp hook the mating lug on the port side.

In order to be able to compare the "original" with the "as-found" condition reference is made to the photo below.

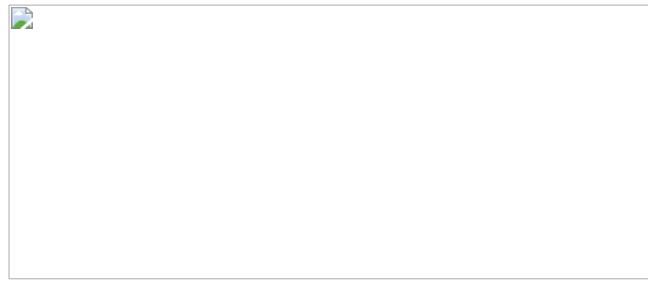


#### S4 -Starboard Front Bulkhead

The area under investigation is restricted to the starboard front bulkhead of the wreck as shown on the drawing below. There is no sheet available for this area. For easy reference the explanations will be given by photos/video images incorporated into the text. The numbers on the drawing indicate the damage areas which shall be explained and illustrated as follows:



Area No. 1 shows the cut at the edge of the forecastle deck down to the front bulkhead with a deck piece sticking into it and in the front bulk-head further down.

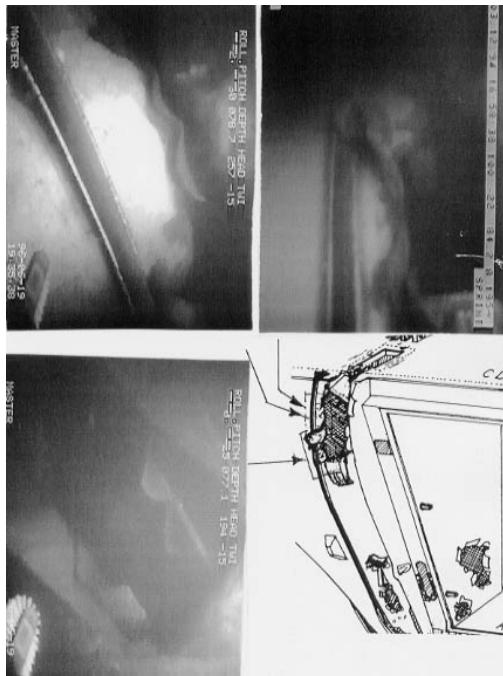


Area No. 2 shows the damage further down the front bulkhead. Note the torn open steel bent to starboard and to port.

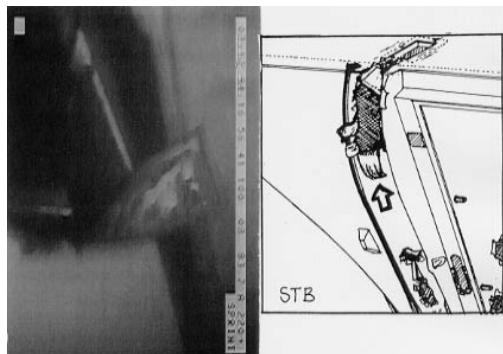


The arrow on the left picture points to the severely distorted mating lug for the ramp hook.

The three images on this page show details of this large damage, in particular the bent and cracked steel parts at the edges.

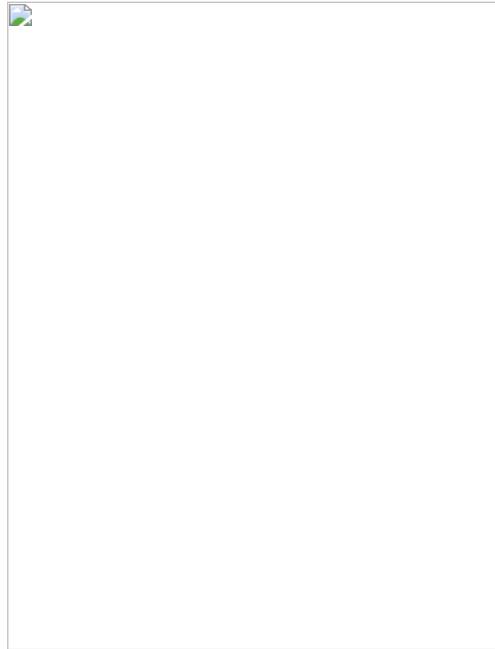


The picture below shows the lowest part of the damage, i.e. an almost horizontal, slightly upwards pointing steel flap.



Area No. 3 shows the damage above the torn off lug being part of the hydraulic side lock of the visor, the lug itself and the opening for the manual side lock. The most probable cause for these damages is explained in Chapter 32.

The following image shows the big hole above the opening for the lug of the hydraulic side lock which extends beyond the bulkhead edge. - See arrow.



The previous image shows an enlargement of this hole with the bulkhead pushed upwards (inside to outside) creating a big gap towards the lug of the side lock, the plating in way is cracked - see arrow 1. At the bottom of the picture the upper part of the lug of the hydraulic side lock of the visor, torn off the visor, is visible. Arrow 2 points to a small white painted steel piece originating from the visor bulkhead.

Note:

According to the diver - video tape B40c - this small steel piece was the only part of the starboard aft bulkhead torn off when the lug separated from the bulkhead. See the following page.

The next images show the lug of the hydraulic side lock which was evidently torn off the visor bulkhead together with the welding seams by which it had been welded to the bulkhead.



**Note:** When the diver examined the area of the starboard side lock the following discussion developed between the supervisor in the operations room and the diver.

Supervisor: "How many mm's play?"

Diver: "About 10 mm."

Diver: "It has ripped the weld, there is no plate there at all (pointing to the very thick welding seam at the lug). That's the edge of the weld."

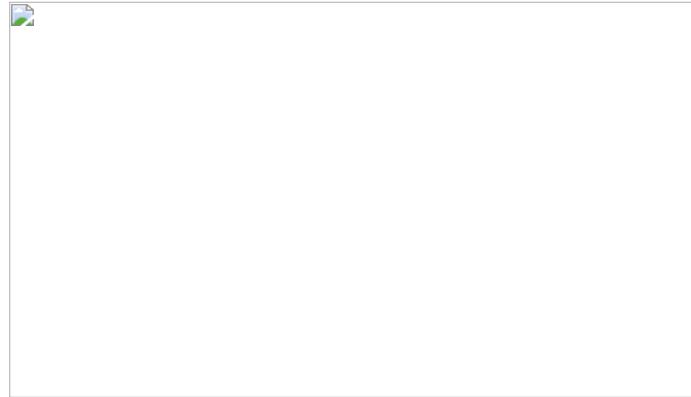
Supervisor: "So it hasn't taken away anything of the bulkhead, but just ripped the weld off."

Diver: "That's right."

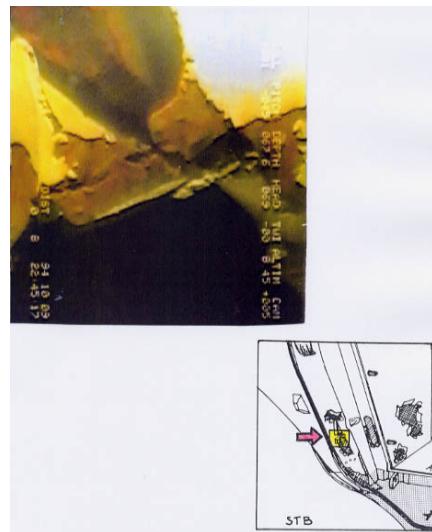
The picture shows the lug with very thick welding seams by which it had been attached to the visor bulkhead.

**Note:** It is obvious that these welding seams do not originate from one welding procedure only but from several weldings on top of each other, i. e. after each cutting off the new weld was laid on top of the previous ones without grinding off the remains of the previous welds as required by proper workmanship to assure the required load-carrying capacity of the weld. The required load-carry capacity of these lugs being part of the locking system of the visor did already since sometime before the last departure no more exist and was reduced to a fraction of the initial load-carrying capacity by such unqualified repairs.

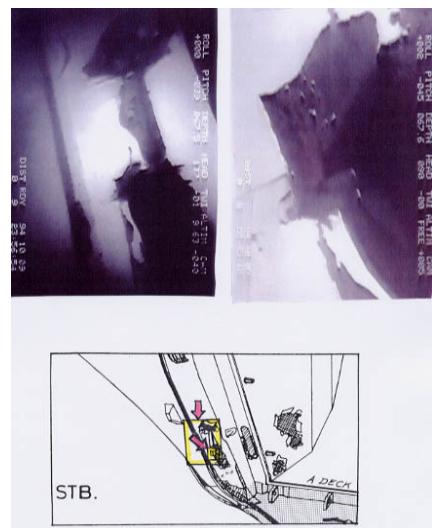
The two pictures below show this part of the visor bulkhead, the 1st one from the top and the 2nd one from the side.



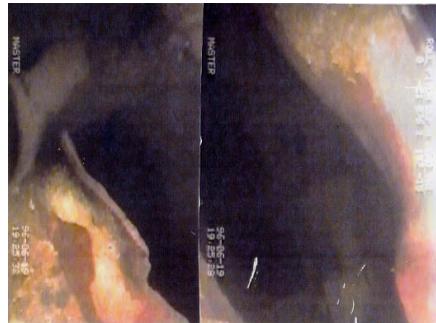
The next image shows the broken bulkhead part between the opening with the lug of the hydraulic side lock and the much enlarged opening for the manual side lock below.



The following pictures show the upper part of the enlarged opening for the manual side lock.  
Note the steel bent from inside to outside.



The two pictures below show the enlarged opening for the hooks of the manual side locks with the steel plating bent from inside to outside and the edges cracked.



On the right picture the not engaged mating part of the manual side lock is visible in the background. Furthermore a "soft" indentation can be seen on the inside of the substantially enlarged opening.

Next pictures follow which show the starboard lower aft bulkhead of the visor having been directly opposite to the corresponding parts of the starboard front bulkhead of the wreck. In comparison also the port lower aft bulkhead is shown.

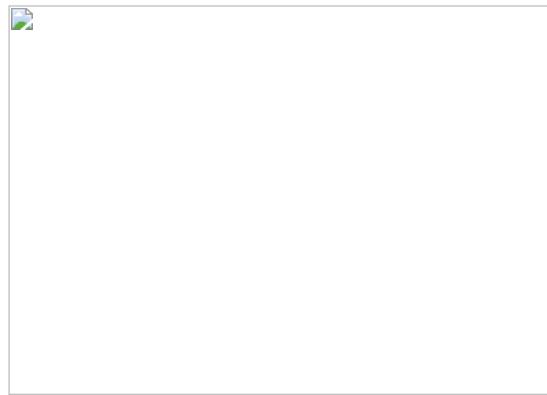


The picture on the right left shows the area of interest on the starboard side, the picture on the left shows the corresponding port side. It shows a completely different damage picture: no smoke marks, no steel tongue torn off the bulk-head and no twisted hooks.

Two of the following four pictures on the next page show those areas at the port and starboard aft bulkhead of the visor where the lugs of the side locks had been welded to and the hooks for the manual side locks were fitted. The other two are close-ups of the upper parts of the area where the lugs had been welded. The right side shows the part of the starboard visor bulkhead directly opposite the above explained damage area. The smoke marks are still clearly visible although the visor had been on the sea bottom for 7 weeks. The hooks are distorted in a way which is technically not explainable. The area is dark. The picture on the left shows the corresponding port side as comparison with a complete different damage picture, with no smoke marks, no steel tongue torn out of the bulkhead and no twisted hooks and a generally clean appearance. The two close-ups arranged below the above mentioned photos show the respective upper parts of those openings in the bulkhead. They do illustrate the difference very clearly. While the port side shows normal steel clean of corrosion, the starboard side shows steel which had obviously been exposed to heat and pressure force: The metal is distorted and pushed out, the stiffener is detached from the bulkhead. See also Chapters 30 and 32.



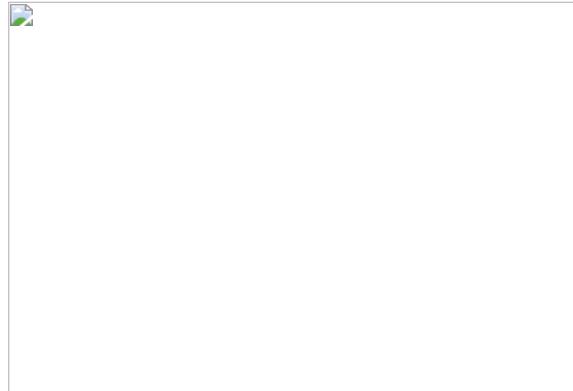
Area No. 4 concerns the lower part of the front bulkhead which evidently became bulged forward, with cracked welding seams and consequently cracked off the hull plating, the forepeak deck and the recess of the longitudinal bulkhead by forces explained in Chapter 32. Part of this considerable damage is shown by the image below and the adjacent drawing.



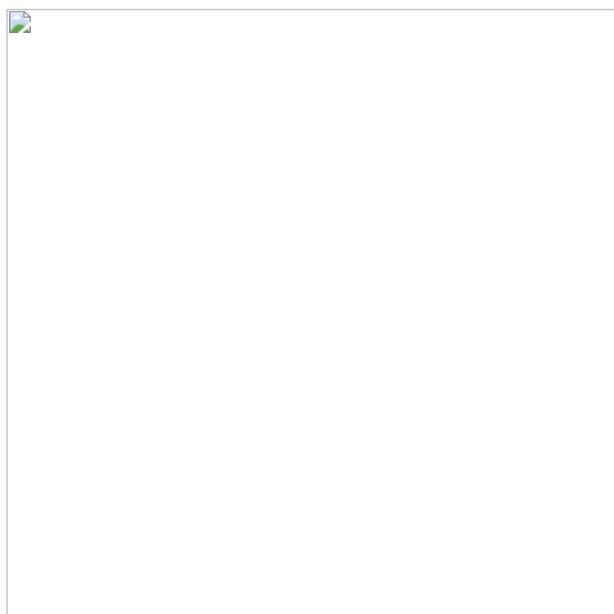
The above image is explained by 4 arrows, viz.

- No. 1 - lower part of the opening for the manual side lock
- No. 2 - transverse crack in the front bulkhead
- No. 3 - cracked open part in way of the flatbar channel for the rubber packing
- No. 4 - deep fold between front bulkhead and hull plating indicating that the bulkhead was bulged out.

The following two images show the area indicated by arrows 3 / 4 on the previous image in some more detail.



The two images on the next page show the condition of the lower parts of the port and starboard front bulkheads. The left one shows the lower part of the starboard front bulkhead - arrow 1 - the rubber packing channel - arrow 2 - and the hull plating in way of the change-over from white to blue - arrow 3. The lower white part indicated by arrow 4 was apparently cracked off the bulkhead. The right image shows the corresponding part of the port front bulkhead in apparently undamaged condition.



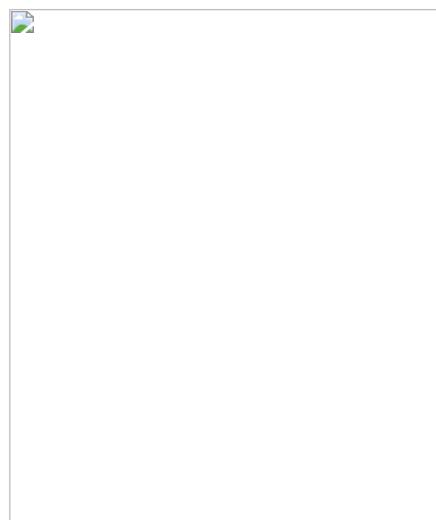
It is quite obvious that the starboard bulkhead is cracked off the forepeak deck, is extending further forward and downward and that a the white part - arrow 4 - as part of the bulkhead is totally misplaced.

**Note:** It is not possible to verify this very substantial damage further by means of the video footage available.

**Area No. 5** concerns the opening for the starboard bow ramp actuator which is directly below the severely damaged landing of the ramp with the fastenings for the actuator.

The left image below shows the upper part of the opening - see arrow - which is obviously undamaged.

The right image shows the lower part of this opening with the edges bent from inside to outside and the adjacent plating severely deformed to the effect that the initial shape is no more recognisable.

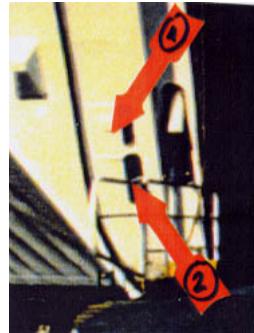


**arrow 1** points into the centre of the opening

**arrow 2** points to the bow ramp

**arrow 3** points to the longitudinal part of the recess in the front bulkhead

The picture below shows the intact starboard front bulkhead in July 1994. Note that in way of the opening for the lug of the hydraulic side lock a plate had been inserted with a doubler in the middle (arrow 1). The background of this repair is unknown, could mean, however, that the lug once had smashed into the bulkhead, when the visor was misaligned, e.g. due to lifting cylinders working asymmetrically.

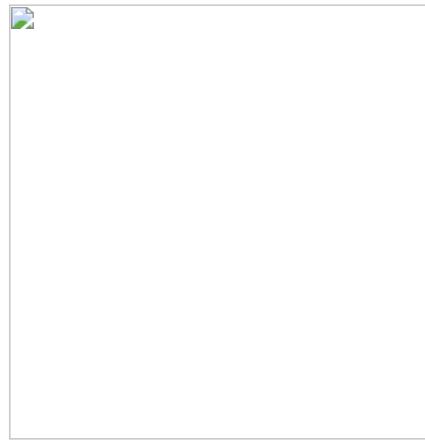


Arrow 2 points to an indentation at the rail of the movable forward section of the bow ramp. A similar indentation also exists on the corresponding port side. This means that the visor was lowered down to that level for work to the bottom and hull side, e.g. to repair and paint ice damage, although the bow ramp was open. This means that the electric blockage installed at newbuilding had been bypassed. It had been installed to prevent that the visor could be closed when the bow ramp was still open, respectively that the bow ramp could be opened (to a certain extent) when the visor was still closed. See also the von Tell Manual - Enclosure 2.4.2.31 and the statement of Lars Karlsson - Enclosure 2.4.5.60.

**Area No. 6** concerns damage to the longitudinal car deck bulkhead which will be explained in Chapter 32.

#### P 4 - Port Front Bulkhead

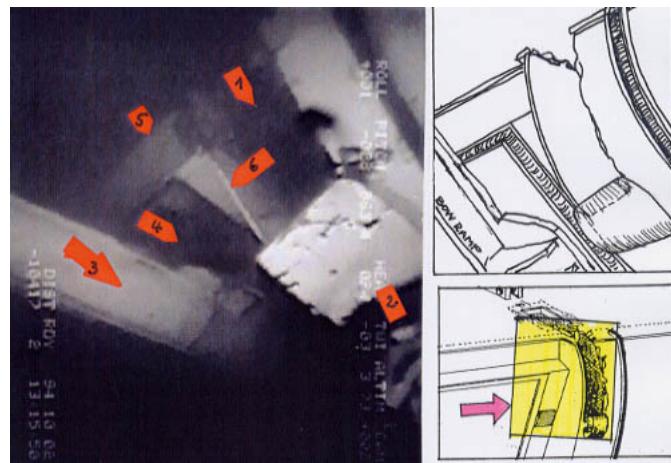
The area under investigation is restricted to the port front bulkhead of the wreck as shown on the drawing below. For easier reference the explanations will be given by photos/video images incorporated into the following text. The numbers on the drawing indicate the damage area, which shall be explained and illustrated as follows:



#### Area No. 1:

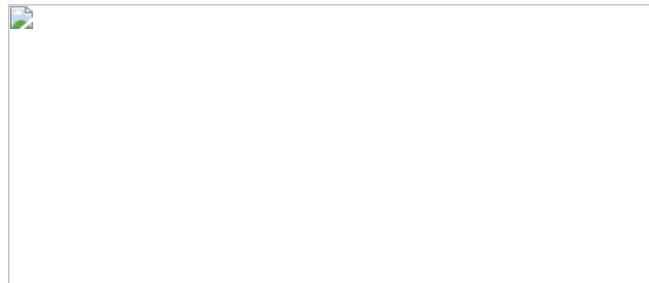
The following picture shows the upper part of the cut in the front bulkhead - arrow 1 - caused by piston rod and lifting cylinder, the lower part and the folded together steel strip torn out of the bulkhead - arrow 2.

Generally the damage appearance is totally different on this side compared to the starboard side. Whereas the cut at port side looks as if having been cleanly made in one go by a large can opener, the damage picture on starboard side demonstrates violent movements, heavy distortion to the starboard side, etc.



Arrow 3 points to the slightly open bow ramp, arrow 4 to the car deck opening and arrow 5 to the forecastle deck.  
Arrow 6 points to a wire running from forecastle deck down beside the bow ramp, which was no more there when the divers came.

The next images show the lower part of the cut with the rolled up steel strip and with a rope around it rising up at both sides.



#### Area No. 2

- concerns the opening in the recess of the front bulkhead for the ramp hook. The hook has been identified inside this opening. The red arrow on the image below is pointing to the hook which is obviously intact and in locked condition.



The image above is a view into the opening in the front bulkhead recess inside of which the port ramp hook should have engaged the mating lug at the ramp during the closing procedure which it evidently did not do during the last voyage. This has already been explained under P 3 - Port Forecastle deck.

**Note:** The damage at the lower part of the port front bulkhead adjacent to the port outer hinge of the bow ramp shall be discussed under 6 - Bow Ramp.

The image below was made when the ROV looked into the opening in the forecastle deck for the port visor actuator. The actuator of the ramp hook with part of the hook arrangement and the remains of the cut through deck beam - see arrow - are clearly visible.



**Note:** When the ROV looked into the corresponding deck opening for the starboard visor actuator only the remains of the cut through deck beam were visible. The ramp hook arrangement was obviously no more in place.

#### Area No. 3:

The following image shows transverse contact marks above the opening for the hydraulic side lock - see arrow 1 - which presumably resulted from the visor moving forward/aft during the time it took the visor arm lugs to cut through the deck beam.



Arrow 2 on the above image points to a wire running across the front bulkhead and the bow ramp to the starboard side and apparently from the port fair leads of the forecastle deck (there is no other possibility where a wire could come from). The image was made from the video tape produced by ROV on 02.10.94 - see Subchapter 25.1 - because on subsequent videos the wire is no more visible.

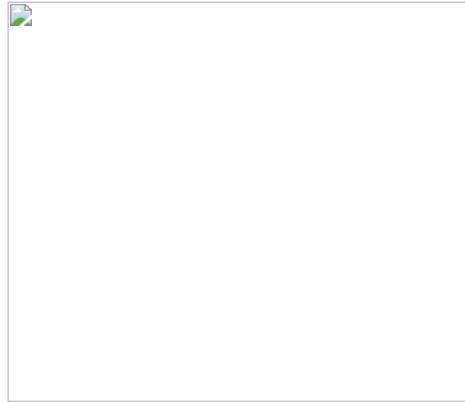
The next image - made from the same video tape - shows the same area, but slightly further down (in normal condition). Arrow 1 points to a double rope coming up from the gap between bulkhead/ramp and rising up due to its floatability.



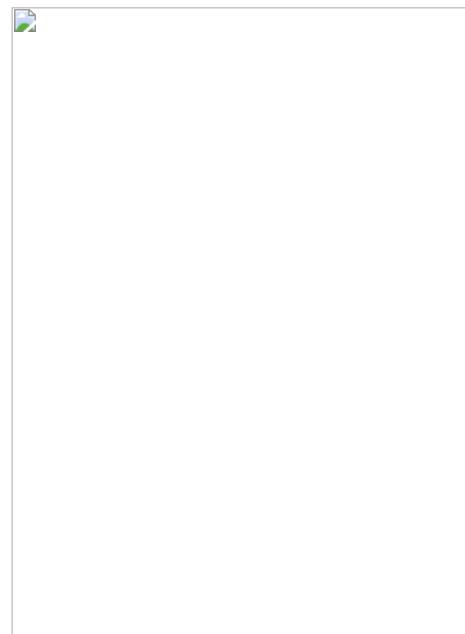
Arrow 2 points to a damage area in way of the rubber packings which is better visible on the right image below made from the 1996 video tape. The double rope was then still there because it is jammed in, though in slightly changed position. The damage area is more clearly visible - see arrow.



The left image above was taken from diver video B40c and is a close up of the same damage area. It shows that the rubber packing including flat bar channel has been pressed flat on a distance of about 200 mm. This could have been caused by a single wire or wire running from the bow ramp around the edge of bulkhead/hull plating up to the fair leads on the forecastle deck and further to one of the winches. Alternatively the damage could have been caused by the port aft edge of the visor bottom in the final stage of the visor separating from the vessel - see Chapter 31 - or it could have been an old damage because the corresponding area on the aft bulkhead of the visor does not show rubbing marks from the rubber packing. See the picture on the next page. A similar damage does not exist at the starboard front bulkhead.

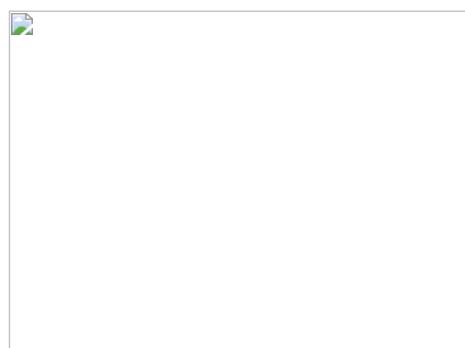


The next image shows the lug of the hydraulic side lock still attached to the locking bolt with a little part of the visor bulkhead (white) - see arrow - and visible welding seams. The lug is - contrary to the starboard side - inside the bulkhead and was only subsequently pulled out by the diver.



It revealed that this lug had similar thick welding seams - same as the starboard one according to the diver and that also here only a small piece of the visor bulkhead was pulled out - see arrow.

The next image shows the locking bolt with nut of the manual side lock resting inside the vessel evidently also not having been engaged during the casualty voyage.



#### Area No. 4

concerns the opening for the bow ramp actuator in the recess of the front bulkhead. This is explained in detail under - The Bow Ramp - in this chapter further aft.

#### Area No. 5

concerns a lug welded adjacent to the broken port outer visor hinge and through which a wire was found running. Also this will be explained in detail under - The Bow Ramp - in this chapter further aft.

**Area No. 6**

concerns damage in way of the port car deck bulkhead which will be explained and documented in detail in Chapter 32.



(click for full page images)

**S 5 and P 5 - Foundation of the Port and Starboard Lifting Cylinders (Actuators) on B-Deck**

The area under investigation is restricted to the foundations of the two actuators on B-deck as indicated on the overview drawing.

**Pictures:**

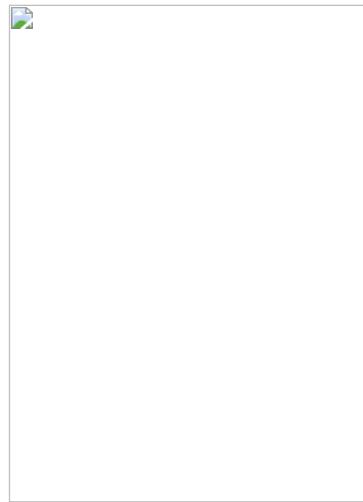
No. 1 shows the foundation of the starboard actuator of the visor, which only broke loose at a late stage as it is evident from the damage visible;

No. 2 shows the foundation of the port actuator which looks totally different from the starboard one and which had been repair-welded before. It is evident that this foundation separated from B-deck quite easily due to pre-damaged and badly repaired welding seams.

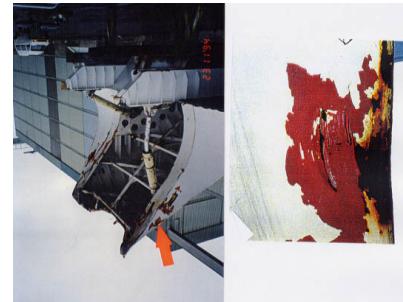
port + starboard



The port actuator was found jammed inside the port longitudinal bulkhead as can be seen on the photo below. It was completely pulled together.



The starboard actuator, to the contrary, was found to be fully extended with the piston rod bent. It had apparently been the last connection between the vessel and the visor except for the bow ramp, the fore-castle deck and bulbous bow.



The area indicated by the arrow and the close up was probably struck by the foundation of the starboard actuator after the actuator had moved out of the front bulkhead of the vessel. - See also Chapter 30 - The Visor.

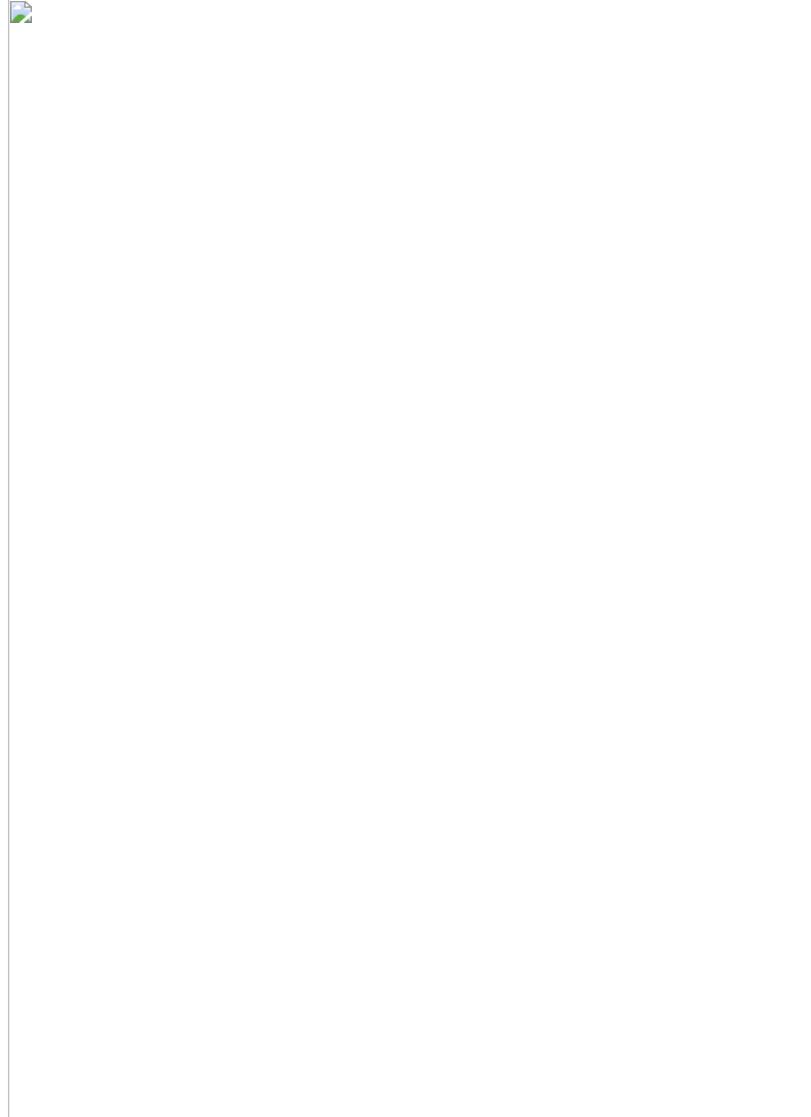
#### 6.The Bow Ramp

The area under investigation is restricted to the bow ramp and the adjacent plating of forecastle deck and forepeak deck as well as the front bulkheads on both sides, as can be seen on the picture below showing the area in question, (photo was taken on 25.03.94 in Tallinn when it was snowing) and indicated on the overview drawing.



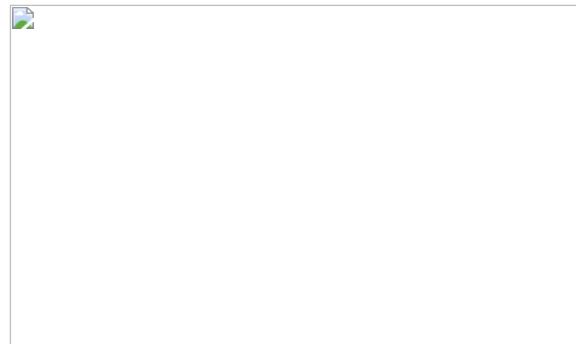
The following diagram is part of drawing 49111-330 which shows the bow ramp in open and closed condition. The areas of interest are divided into 6 parts, viz.

- (1) The locking devices
- (2) The actuators
- (3) The hinges
- (4) Damage to the construction
- (5) The rails
- (6) Other observations

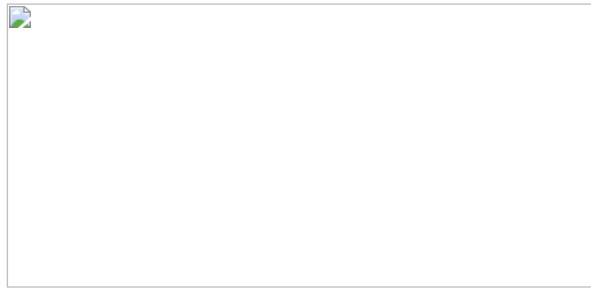
**29.2 The Bow Area**  
**part 2**

The following damage description and evaluation is based on the video footage made by the ROVs and divers as described in the previous Chapters 25, 27 and 28.

**In detail:**  
**(1) - The locking devices**

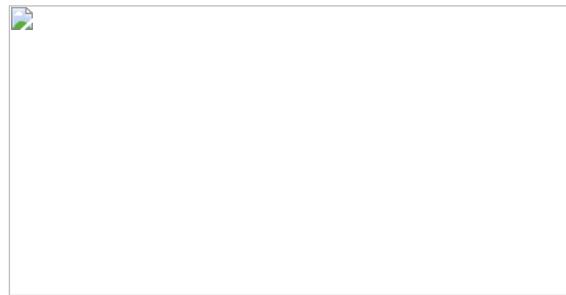


No. 1.1.1 - The picture below shows the mating lug for the **starboard ramp hook** severely twisted to starboard and downwards (looking from the ramp in normal condition), but the bolt apparently intact.

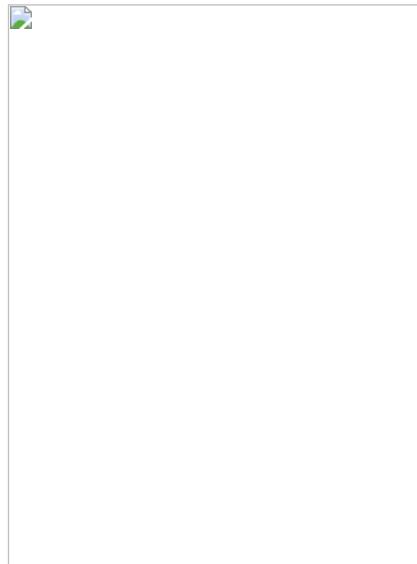


On the video footage available to this 'Group of Experts' the starboard ramp hook is not visible in full length, it is, however, accessible and the diver has been very close! It would be very surprising if this hook as well as the port one had not been inspected during the first diving inspection, when the first diver lost his wristwatch in the bow ramp which was found during the second inspection by diver 2. The video for the second inspection is available, however, not for the first one.

No. 1.1.2 - The picture shows the area of the **port mating lug for the ramp hook**, which is evidently intact with the bolt not affected. Since also the ramp hook was neither stretched nor broken - see page 778 - it had not been engaged before the casualty.

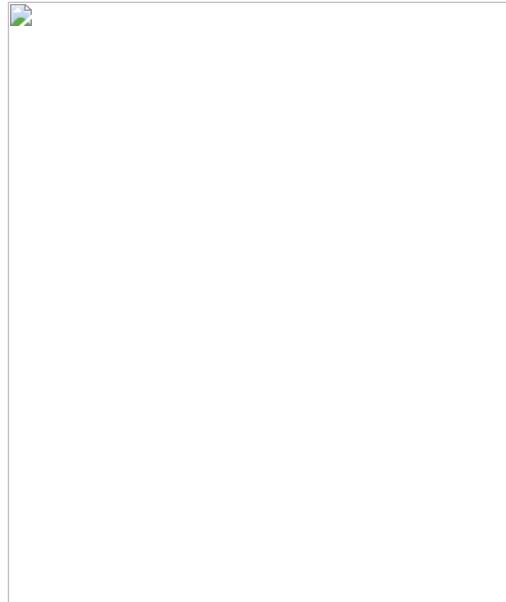


The next picture shows the intact ramp hook. The diver - when seeing it - said: "There is a latching mechanism" pointing to it (see his hand on the picture).

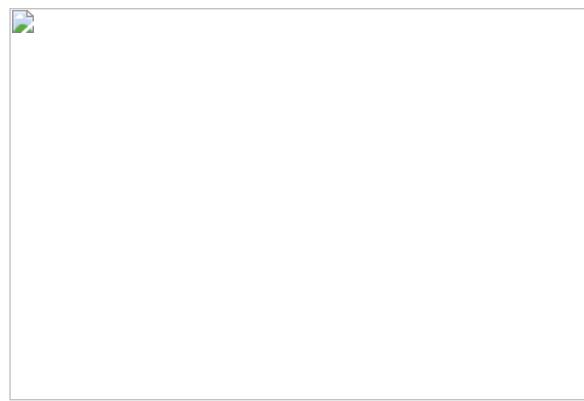


No. 1.2.1 - The **upper mating pocket on starboard side** with the top plate completely missing. There are two possibilities:

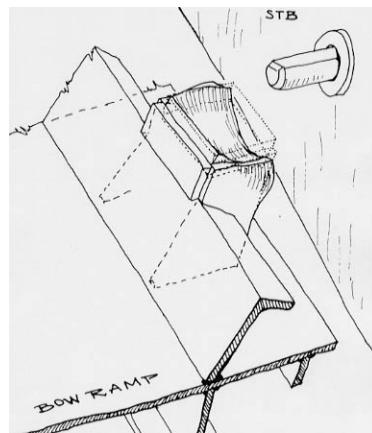
- (a) The top plate was completely torn off by the fully extended bolt, or
- (b) the top plate was not in place, because it had been cut off by crew members in the morning of 27 September 1994 after arrival in Tallinn as witnessed and reported by a truck driver.



No. 1.2.2 - **The lower mating pocket on starboard side** is crushed, i.e. the top plate and the longitudinal side plate were pushed in, the upper and lower side plates were still in position, but bent inwards. The damage picture is actually opposite to what it should be if the bolt would have engaged an intact pocket and the bow ramp would have been forced open. Then the top plate would have been pushed by the bolt from inside to the outside and probably broken.



Unfortunately the video quality is extremely poor because when the diver saw the pushed in condition of the pocket he started to rub it with his glove and the picture became totally foggy as can be seen. Nevertheless, the contours of the mating box are visible and are made more clear by the drawing next to the image below.



The diver started to explain this unusual and unexpected damage in this location, but was stopped by the supervisor who said: "They are just interested whether the bolt is fully extended." The diver, turning away from the crushed pocket: "The bolt is fully extended."

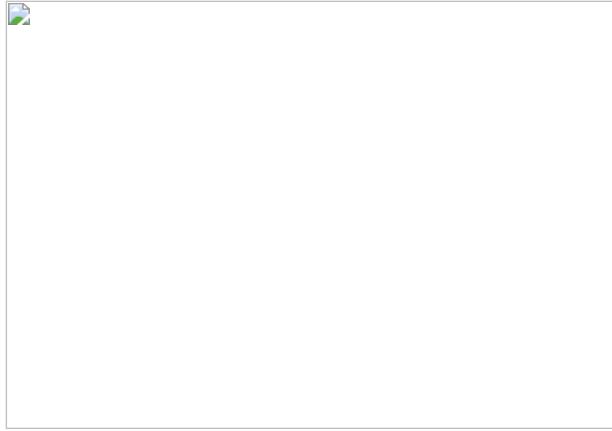
The only possibility of such damage being caused in such a location was by closing the ramp by force when the bolt was already extended. Therefore, it has been assumed that the bolt had been extended when the ramp was closed some time before the casualty and the top plate and the adjacent longitudinal plate were pushed in, as visible. Never since this occurrence was it possible to close and lock the ramp properly.

No. 1.2.3 - **The port upper mating pocket** was found to be intact and undamaged, just the metal of the side plates was slightly cracked according to the diver. There are two pictures available showing the pocket and the extended bolt (according to the diver fully extended) which can be seen below.

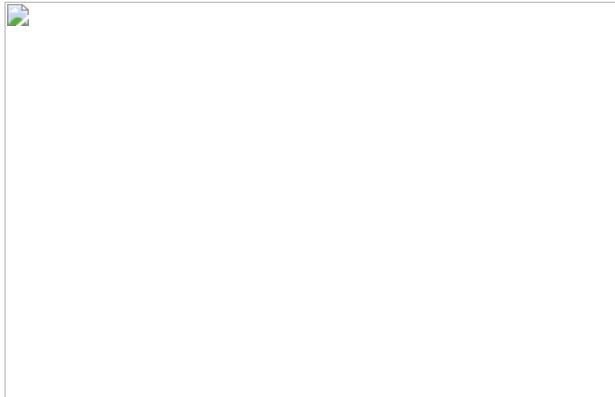


Both pictures clearly indicate the misalignment between bolt and pocket which is - according to the diver - about 4 inches or 100 mm, i.e. the pockets were about 100 mm above the bolts (when the vessel was in upright condition).

No. 1.2.4 - The **port lower mating pocket** was completely undamaged. The diver found a rope turned around the pocket which had obviously been done by somebody prior to the sinking. The rope runs up between ramp/bulkhead where it is jammed in and still visible on the 1996 video tape.

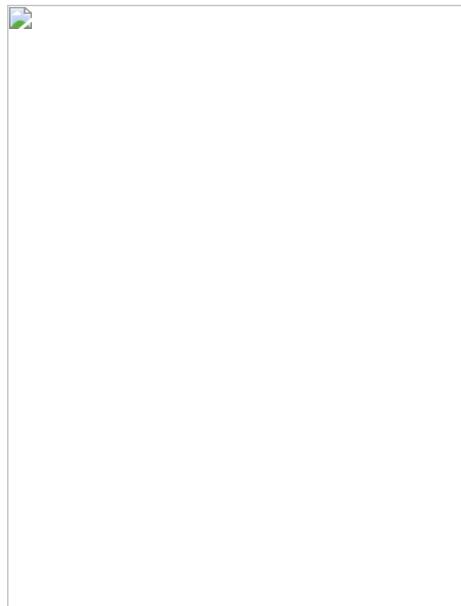


The same misalignment between pocket and bolt as observed already at the upper pocket/bolt is apparent from the picture below, which also shows that the securing bolt was only slightly extended - about 1 inch = 25 mm according to the diver - and that some rags were hanging out of the opening next to the bolt.



No. 1.3 - Lifting eye pads respectively the attachments for the ramp actuators are no more existing on both sides. This will be explained when the ramp actuators are discussed.

No. 1.4 - The starboard lug for the preventer wire is completely undamaged and intact. (See following image.)

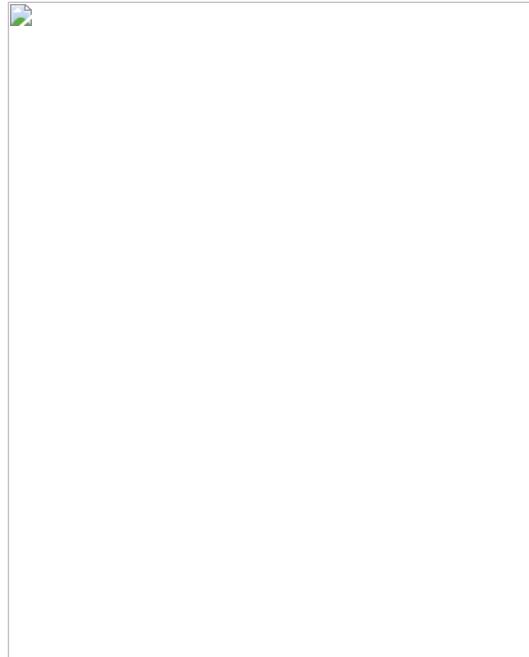


The preventer wire which should have been attached to this lug by shackle is hanging in full length up and down with the shackle still attached to the lug of the lower end - see the two pictures below from the ROV inspection on 09.10.94.



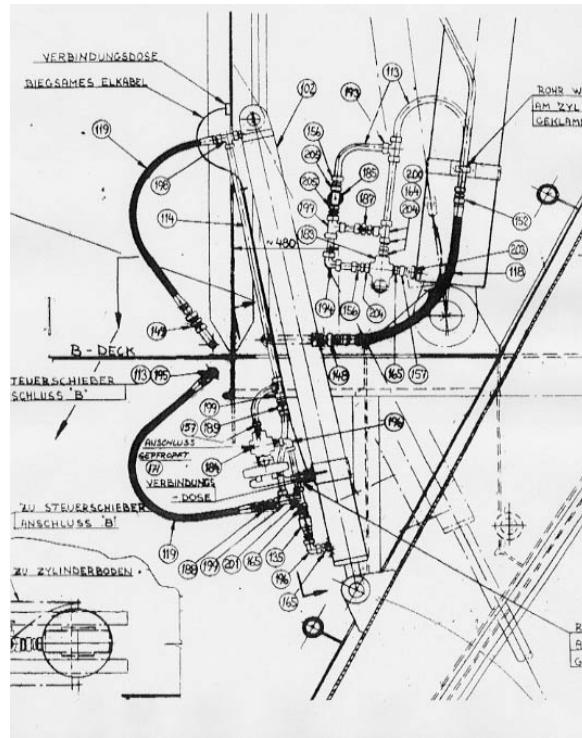
The apparently unbroken bolt is still attached to the shackle. - See also Chapter 27 - pages 722 ff.

No. 1.4 - The lug for the port preventer wire at the bow ramp is unbroken and intact - see the right image. The port preventer wire is still shackled to the lug at the port side of the car deck opening - see left image - but cannot be followed the full length on the available video footage, thus it is not possible to ascertain whether the wire is broken or not.

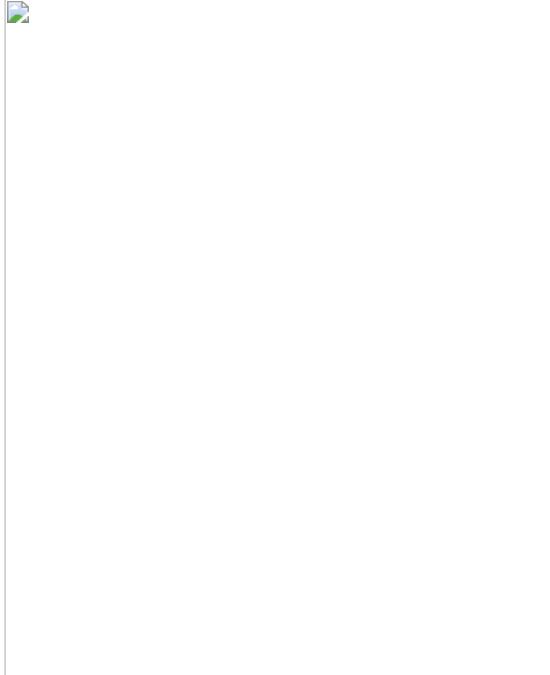


## (2) The actuators

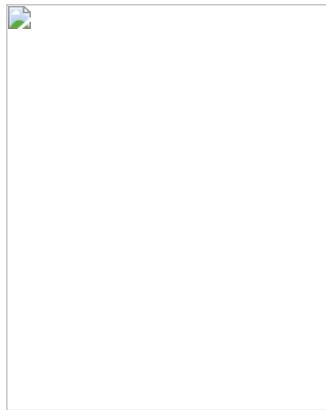
The attachment points in side view are shown on part of drawing 49111-387 below with the ramp in closed condition.



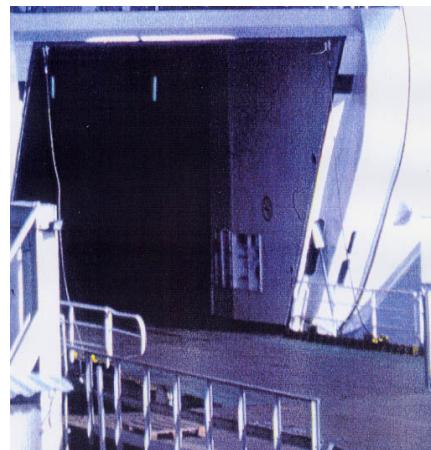
The left drawing shows the cross-section of the retracted actuator with both attachment points. The lower one consisted of two lugs welded to the landing extending over the side of the ramp as can be seen from the drawings below.



The lower end of the piston rod was mating between the two lugs connected by a strong bolt to the ramp. The landings at both sides were of rather strong construction similar to those for the two mating lugs for the ramp hooks. The drawing on the next page shows the ferry with open visor and closed bow ramp. The two landings on each side extending the ramp sides are clearly visible (see arrows).



The picture below shows the port actuator extending out of its opening in the recess of the front bulkhead.

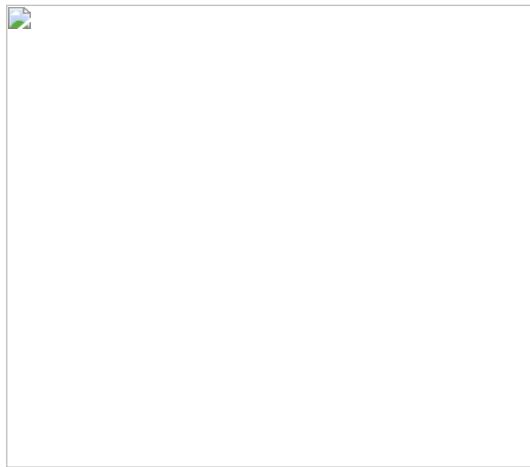


#### **The port actuator and its fastening.**

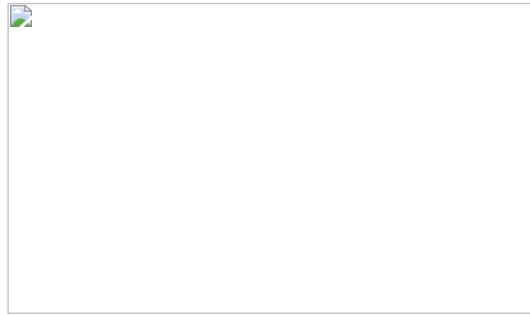
Due to the ramp being pressed to starboard the port recess of the front bulkhead is visible with the opening of the actuator.

The following images of 02.10.94 show the area of interest with the ramp in the foreground, the extended landing for the fastening of the actuator to the right, 3 Teco lines rising

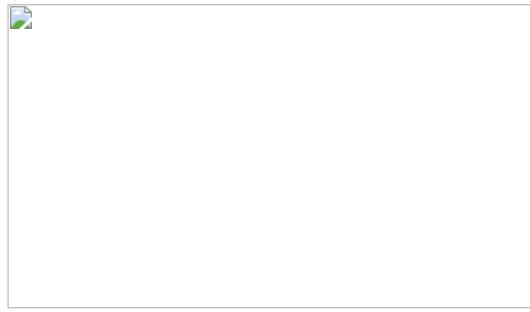
up and the openings for the hydraulic and manual lock in the front bulkhead. The recess with the opening for the actuator and the actuator are not visible. The ramp appears to be more or less in normal closed condition.



The next image made **from the video taken on 09.10.94** shows the gap between ramp and the longitudinal part of the recess to be much wider, i.e. the ramp was now shifted more to starboard compared to **the situation on 02.10.94**.

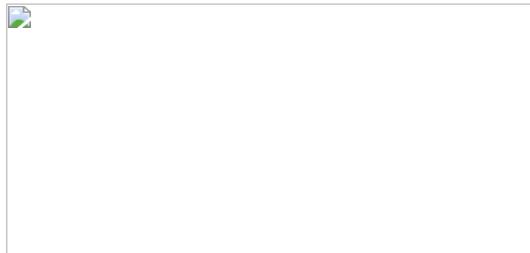


The following image from the same video also shows changed rope positions and a box attached to the longitudinal part of the recess of the front bulkhead directly above the opening with the ramp actuator fastening (when the ramp was in closed condition). This box is visible on the videos made on 02.10.99 only as a shadow but apparently it was there already. The reason for this difficulty is the much smaller gap between bulkhead and bow ramp at that time. The box will be explained further in Chapter 32.



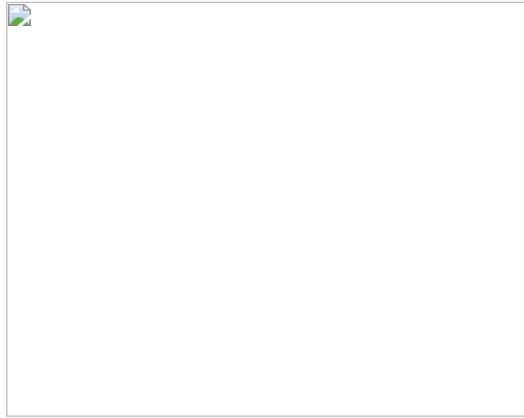
Not only did the gap increase between 02. and 09.10.94, but also more Teco lines (floatable mooring lines) were rising up between ramp and bulkhead. One of them appears to be turned around the box which must have been manmade. This is surprising because at that time "officially" no divers had been down to the wreck.

The next available images are made from the **ROV and diver videos of 01. to 04.12.94** and show the same area, however, again with remarkable changes.

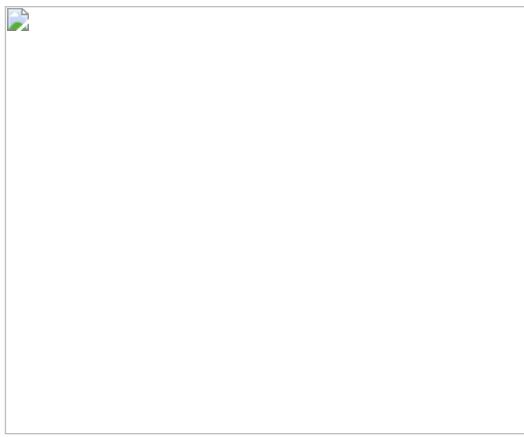


The box and all the hawsers but one have disappeared, the gap appears to be wider.

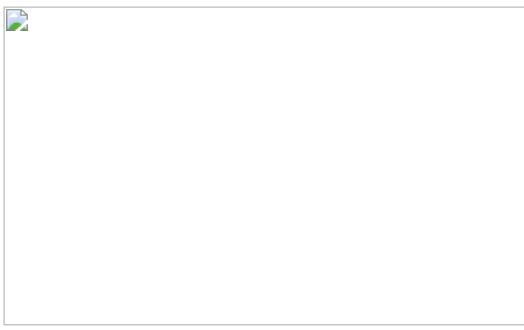
Close ups made from the diver videos of the one hawser left proved it to be jammed in between the extended landing for the actuator fastenings and the bulkhead - see the image below. To the left is the ramp landing and to the right the bulkhead. It is obvious that such jamming can only occur when the ramp was moved open/closed which must have been the case between **09.10.94** and **02.-04.12.94**.



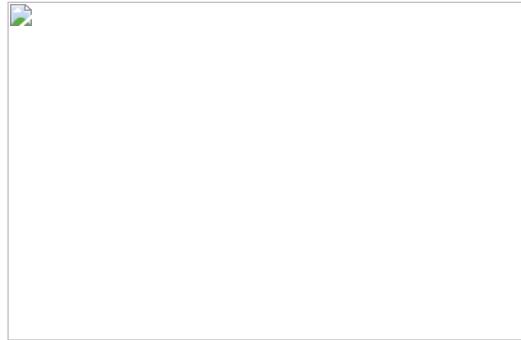
The following images - also made from the diver video B40c - show the lower part of the opening for the actuator with the actuator inside and above the lower part of the landing for the fastenings of the actuator extending the side of the bow ramp. **Underneath this landing the rather massive construction of the fastenings of the actuators should be visible, but there is obviously nothing.**



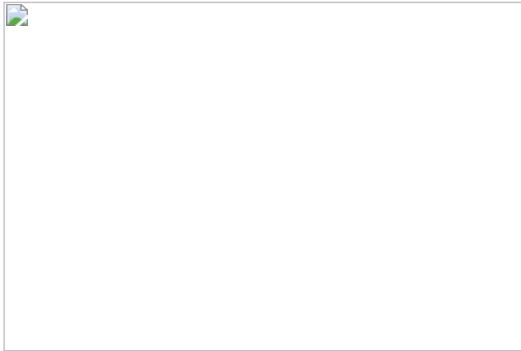
**The actuator** can be seen on the following image inside the opening in slightly extended condition with the lug at the bottom end of the piston rod broken. The slight extension of the actuator corresponds to a ramp opening of some 10-15 cm at the top.



The following image shows the complete lower part of the opening looking from upside down (in normal condition). The actuator with the broken lug of the piston rod (bright spot) is visible and - behind the actuator - in almost upright condition some object which upon a very detailed video evaluation turned out to be an angle iron. The two dark areas in the white paint of the bulkhead proved to be two deep indentations obviously caused by the angle iron under pressure.

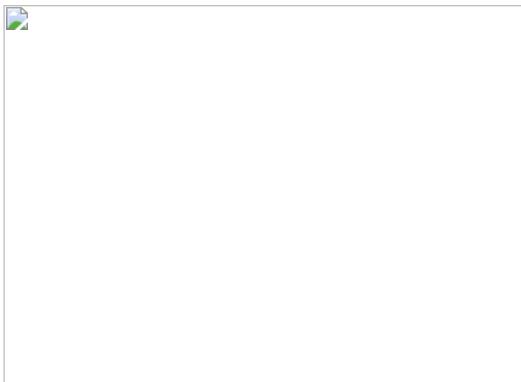


The enhancement of the image showing the affected area reveals two deeply pressed in parts at the edge of the opening with an unaffected part in between.

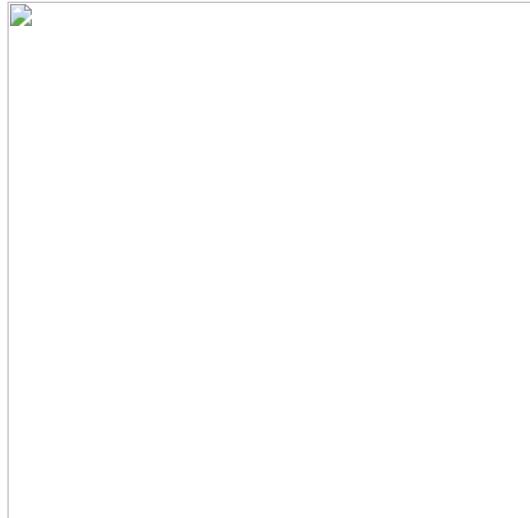


As stated before in Chapter 27 it has to be assumed that the crew fitted the angle iron in place to support the closing operation, i.e. to ensure smooth closing of the port side of the ramp which was detached from the vessel due to the broken hinges and which was considerably pressed down during opening and closing of the ramp.

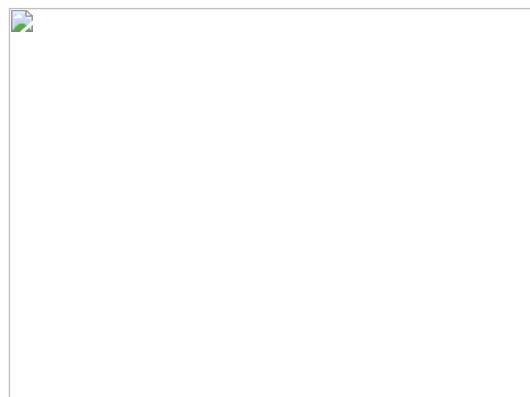
**The starboard actuator** area looks totally different compared to the port one because there is very heavy damage, the probable cause of which shall be explained in Chapter 32. Among other things also the fastening of the starboard actuator to the bow ramp was affected. All available images from this part of the ramp are made from the ROV video of 09.10.94, thus show the ramp pressed against the starboard longitudinal bulkhead part of the recess. For orientation purposes the first image below shows the transverse girder at the bottom in the middle which runs up diagonally to the left where a large crack is visible. The strong girder running from left middle to right up is the starboard outside longitudinal girder. At the port side of the mentioned transverse the landing for the fastenings of the port actuator were fitted, at its starboard side the fastenings for the starboard actuator were fitted.



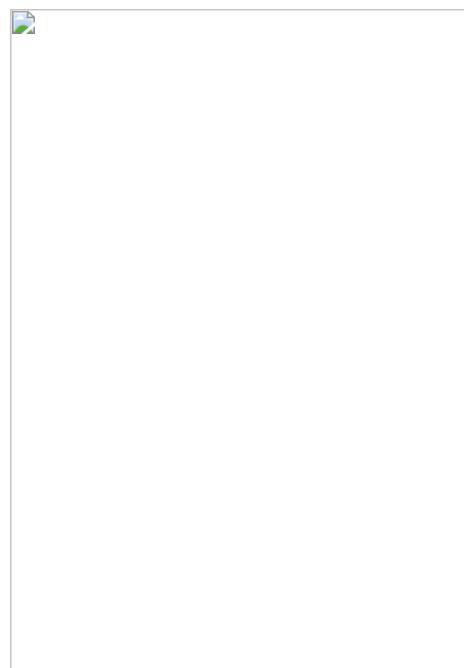
The next image shows the underside of the burst open landing. At the left side of the picture the longitudinal part of the recess is visible with the extended opening for the manual side lock.



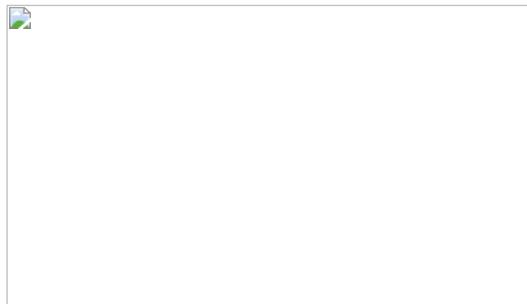
The next image is a close-up looking slightly more from below (in normal condition) which clearly shows the full extent of damage to the burst open landing. The landing was pushed upwards and the steel structure burst open. Behind the two triangle-shaped brackets below the damage the broken piston rod is visibly jammed in (see arrow). It broke in the lug at the bottom end of the piston rod approximately in the same way as the bottom end of the piston rod of the port actuator had broken.



A further close up of the very small gap between the ramp (below) and the recess respectively front bulkhead (above) shows deep scoring marks indicating an opening movement of the ramp and - obviously - closing thereafter as assumed already from the indications at the port side.



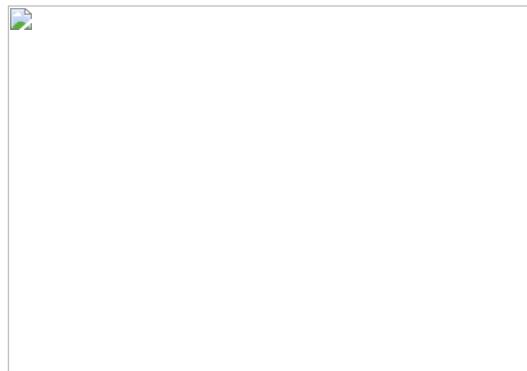
The following image shows the area of the damaged landing at the right top side and then to the left edge of the ramp with the recess and a piece of the front bulkhead behind respectively above, but the strong outside girder very severely bent to the inside of the ramp with both ends cracked off the transverse girders.



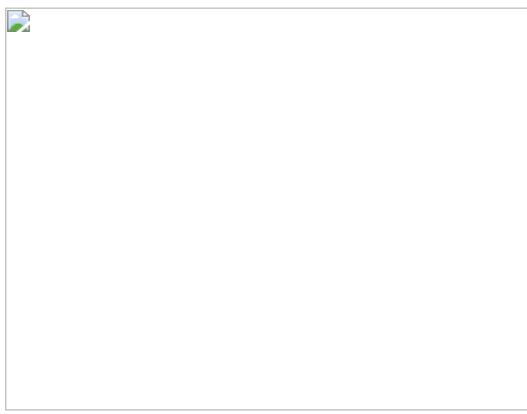
The bottom (right) side of the girder was attached to the lowest transverse girder of the bow ramp to which at the bottom side of the hinges are fitted. For clarification purposes the important details on this image have been numbered as follows:

1. broken and jammed piston rod of actuator
2. burst open landing
3. front bulkhead
4. outside edge of bow ramp
5. triangle bracket of landing
6. upper side of cracked off girder
7. lower side of cracked off girder

As the ramp mainly covers the opening for the actuator only a small part of the lower area is visible together with the broken part of the piston rod with the lug of the actuator as can be seen from the image below made from the diver video.



The dark area at the top (arrow 1) is the opening for the actuator, the broken part of the piston rod can be seen at the right below the big bright spot (arrow 2). The bent steel to the right are parts of the landing blown open (arrow 3). As it is quite obvious that the broken piston rod is some distance away from the opening, it must have been broken twice, viz. first in the lug of the piston rod the same way as on the port side and subsequently, and again when the ramp was forced into closed condition, after the 02.10.94. The following image was made from the same video tape B40c when the diver was looking between ramp and bulkhead. It shows the lower part of the opening for the ramp actuator with the steel at the edges bent from inside to outside and partly cracked.



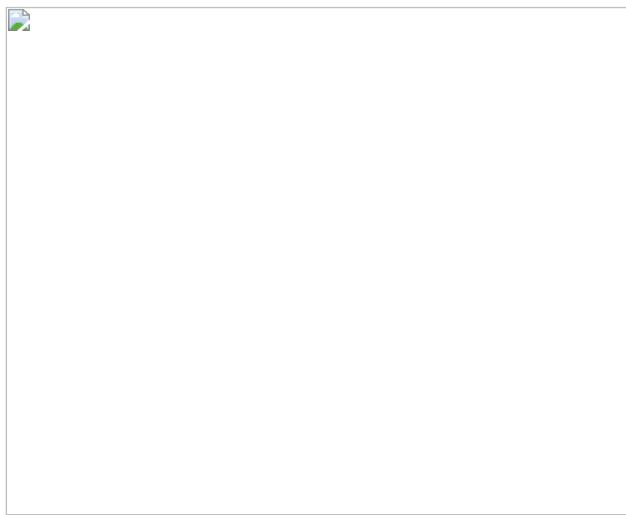
The images show that the lower part of the starboard front bulkhead - below the opening for the manual side lock - was cracked at various locations and apparently torn off the forepeak deck. It could not be deformed outwards, i.e. forward because the visor was there, thus the pressure escaped to both sides, which cracked open. On the starboard side there was just water, but on the port (inside) there was the ramp and the result is visible by

- (a) the extremely bent and distorted lower part of the outer vertical girder being cracked off upside and downside from the respective transverse girders to an effect which cannot be explained by mechanical impact, and
- (c) the burst open and severely distorted landing to which at the lower side (looking from the then position of the ramp) the fastening of the ramp actuator had been located.

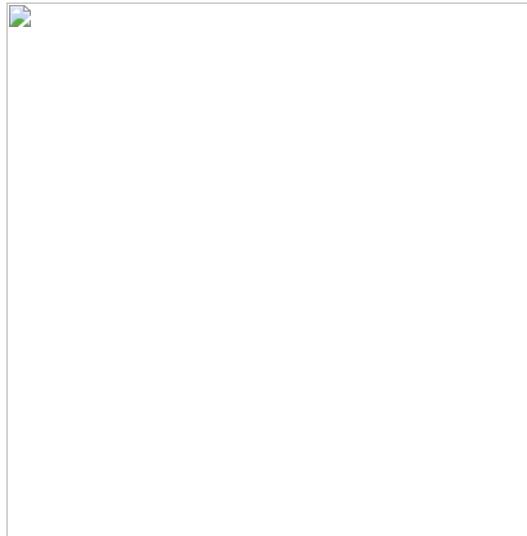
**(3) The hinges were found damaged to varying extent.**

The port outer hinge was already damaged a long time before the casualty, actually to a certain extent already when the vessel was taken over by N&T from Wasa Line. See Subchapter 6.5. The then already existing damage deteriorated with each opening/closing. Due to the misaligned ramp the bolt of the hinge apparently turned itself further and further to starboard out of the bearing, the securing plate broke and finally the outer lug slipped off the bolt and the inner one broke either simultaneously or subsequently. The port side of the ramp was detached from the vessel for a considerable time before the casualty.

The following image taken from the 02.10.94 ROV video shows the totally misaligned bolt much too far to starboard leading through the bearing bushing inside the strong lug fitted to the forepeak deck. At the bottom of the picture in the middle is the undamaged complete outer lug of the ramp visible and on the right side the upper part of the broken inner one.

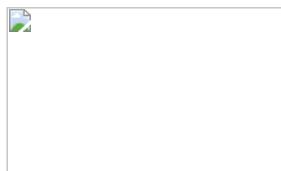


The following image taken more from the starboard side shows the bolt far extended to starboard with two steel pieces underneath. In the left lower corner the broken inner lug of the ramp can be seen.



arrow 1 = steel pieces  
arrow 2 = bolt  
arrow 3 = broken inner lug

The drawing below explains the damage condition of the port outer ramp hinge.



The following image taken from the 02.10.94 video shows the location of the port outer hinge with slipped off, intact outer lug some distance away from its original position because evidently a gap had opened and the ramp became detached from the vessel in this area and through this gap between forepeak deck and bottom of ramp water could freely penetrate on to the car deck from the visor which was always water-filled at sea.

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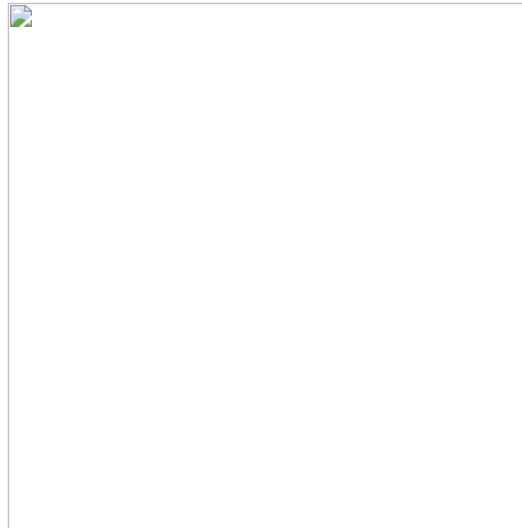
This gap was plugged by mattresses - see the blue transverse one above the hinge remains - the vertical plastic sheet to the right of the blue mattresses, the red/white bedding next to the plastic sheeting. The videos from 02. and 09.10.94 are showing blankets and rags further up in the gap between ramp and bulkhead.



Also the following image shows the same area, but slightly further to starboard. The rubbing marks on the bedding indicate that it had been in place during several openings/closings of the bow ramp.



In December 1994, when the divers came this "sealing material" was gone with exception of one red piece of bedding or the like apparently sticking in a hole in the damage area of the lower part of the port front bulkhead as can be seen on the following image also from the 02.10.94 video. The area in question is between the ramp at the left and the pipe with the hydraulic line for the Atlantic lock at the right.



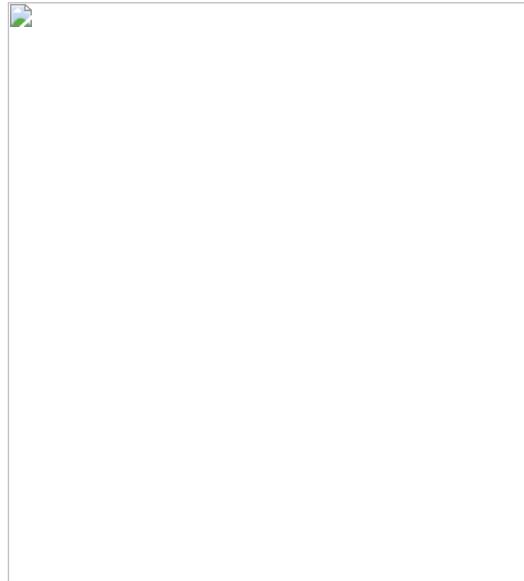
The following image originates from a video made during an ROV inspection of the wreck on 19.06.96, i.e. 11/2 years later. The ROV also had a look at exactly the same area which is shown by the previous image, however, next to the hydraulic pipe to the Atlantic lock there is now a strong lug visible welded to the bulkhead which could not be seen on

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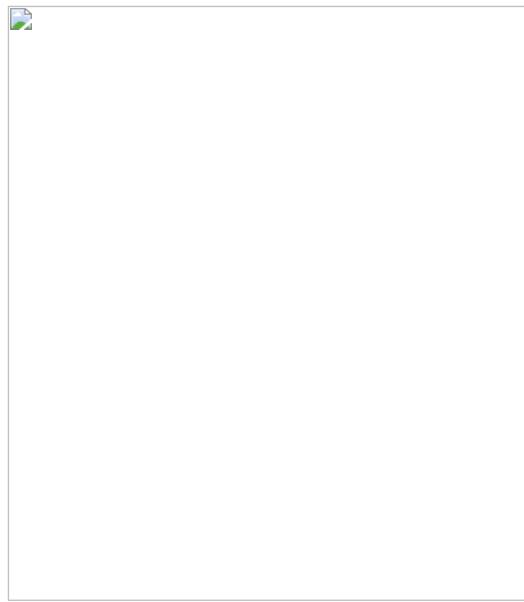
## contents

the previously made videos due to the presence of the "sealing material". According to the yard the wire steering of the upper bow ramp flaps had been fastened to this lug (arrow 1).

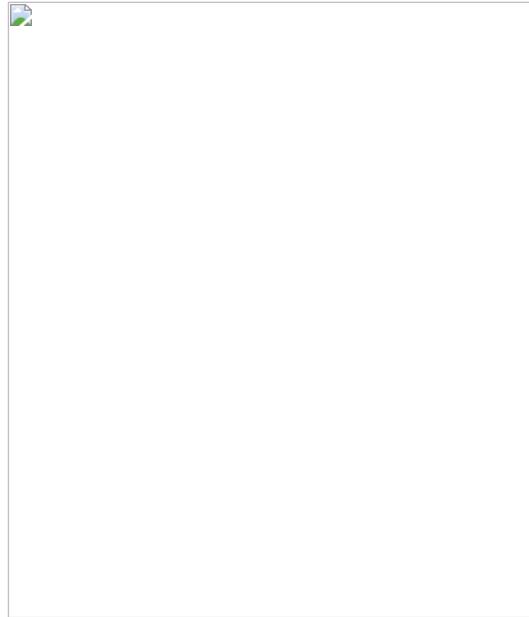
Arrow 2 points to some damage in the bulkhead which was previously also not visible due to the "sealing material".



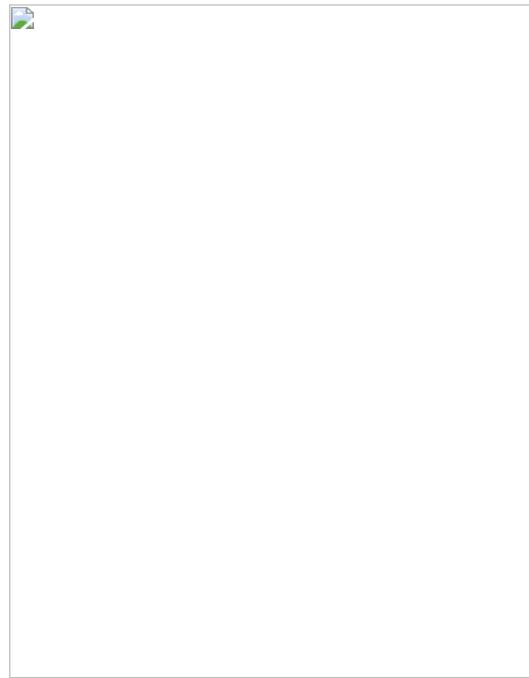
The port inner hinge was also broken prior to the casualty, probably shortly or immediately after the outer hinge had become detached from the vessel. The image below shows the broken parts.



The inner starboard hinge was found to be intact by the diver with the lugs elongated. See the images below.

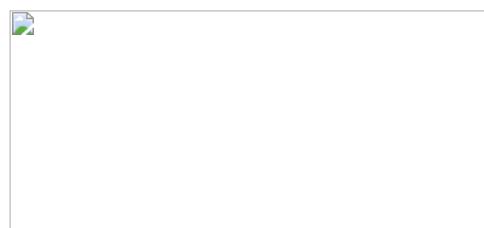


The outer starboard hinge was found to be intact but also elongated according to the diver. The following two images show the condition from inside and outside.



In summary the pictures/images/drawings shown and explained on the previous pages 847-855 demonstrate the following condition of the bow ramp hinges:

- Each hinge consisted of two lugs - one inner, one outer lug - connected to the ramp, one lug connected to the vessel, one hinge bolt and one bearing/bushing. The bolt was secured by one plate at each side which were bolted to the bushing.
- Evidently the bolt of the port outer hinge had moved inside the bearing/bushing and had broken the securing plates which were missing at both sides. The reader is reminded that already the last Finnish crew had demanded the renewal of this hinge. See also Subchapter 3.4 and 6.5.1. Apparently due to the misaligned ramp the bolt worked itself to starboard until the outer lug shipped off the bolt, which apparently caused the inner lug to fail. See right the drawing below (PS outside).



The additional load caused also the port inner hinge - see the left drawing (PS inside) above - to fail after some time leaving the bow ramp detached from the vessel at the entire port side.

- The detachment of the complete port side of the ramp from the vessel resulted in

- (a) an increasing misalignment of the whole ramp, and
- (b) an increasing gap between the ramp and the ramp opening of the car deck.

- Furthermore the bow ramp in its function as part of the upper extension of the collision bulkhead above bulkhead deck was no more weathertight, i.e. the car deck was open to the sea as the visor was always quickly water-filled at sea.

- The gap between bow ramp and car deck ramp opening at the port lower corner extended from the corner to the centre line and upwards to about B-deck level.

- In way of this gap mattresses, plastic sheets, plastic covered bedding, blankets and rags were found, obviously serving as "sealing material".

- As a result of the port ramp side being detached from the vessel there was also a vertical misalignment between the port ramp side and the adjacent plating of the car deck opening, i.e. the mating lug for the ramp hook and the mating pockets for the securing bolts extending from the adjacent plating were about 100 mm higher up now and could no more be reached by the hook respectively by the bolts already for some time before the casualty, i.e. the port side of the bow ramp could not be secured at all for some time before the casualty.

- It follows that the entire port side of the bow ramp was not locked/secured upon departure from Tallinn on 27.09.94.

- The starboard inner hinge was still intact, but the ramp lugs were subsequently elongated, i.e. worn, and they would have been the next ones to fail.

- Also the strong outer starboard hinge showed signs of wear and elongation and hence had lost its initial load-carrying capacity.

- This means that at the time of the casualty the bow ramp was merely connected to the vessel by the weaker inner and the stronger outer starboard hinges, both of which, however, were substantially worn and hence their load-carrying capacity was reduced correspondingly.

#### **(4) Damage to the construction - (See drawing page 869)**

**The inside of the bow ramp** is only briefly visible when the diver climbs up the starboard side to the flaps at car deck level, pulls himself up along these flaps to the port side hinges and further to the lower securing bolt with mating pocket. On the ramp plating there are two areas with burnt and/or damaged paint, i.e.:

- There is an area of ca. 1 m<sup>2</sup> located between the upper flaps and the level of the car deck opening where the paint is burnt and the plating is severely distorted. The area is inside the ramp house when the ramp is closed.

- The lower area is located in the 3rd row of steel profiles, looking from starboard, which are welded to the ramp plating and the 6th or 7th profile from car deck level as indicated on the picture below by the dark spot. The paint of the plating as well as the two flaps below looks reddish/brown. The plating otherwise does not look affected, but the two flaps are bent and distorted and the car deck plating in way appears to be affected.

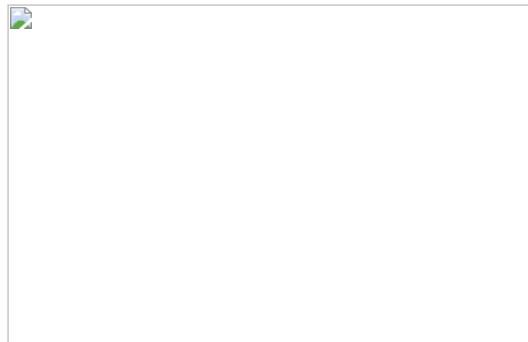


Otherwise the ramp plating appears to be intact as far as visible. The rails are completely missing on both sides. - See Subchapter 27.6 and further below in this chapter.

The flaps on the lower side of the ramp normally covering the gap between car deck and ramp were found to be as follows (from starboard to port):

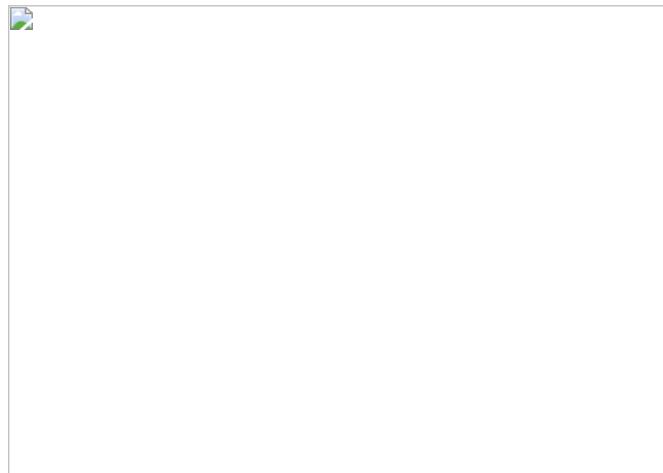
- the flap Nos. 1 and 2 were green and intact and upright;
- No. 3 looked brownish/red, was also upright with the upper edge bent;
- No. 4 looked intact, brownish/red and upright;
- No. 5 was green, upright and intact;
- Nos. 6/7 was bent towards the car deck and looked brownish/red;
- Nos. 8/9 looked new and green, were upright and undamaged except for a bent edge of the No. 8.

Through the gap between the last flap and the car deck, something big and red, probably bedding in plastic, is visible which is sticking in a big hole in the longitudinal car deck bulkhead. See the following image and drawing:



**Note:** The drawing does not show the bow ramp with bottom flaps.  
This part of the damage will be explained in detail in Chapter 32.

- Otherwise the **raised edge along the starboard side of the ramp** (tire-protection bar) with rail, lug for preventer wire and welded pocket for securing bolts, was noted to be torn off of the girders in way at the forward end as visible from the image below (see arrow).



- The corresponding **raised edge along the port side of the ramp** is not detached from the ramp anywhere, but buckled and smashed at its forward part as well as the complete forward part of the ramp including the bell crank for the flaps. It was noted when the diver moved down (up) along the port side of the ramp from the port lower pocket of the securing bolt to the upper side that the upper part of the raised edge (tire-protection bar) with lug for the preventer wire and upper pocket for the securing bolt were bent towards the inside, i.e. centre line, of the ramp. This bending under force is presumably the cause for the cracked metal between the upper pocket and ramp edge as explained further above under "locking devices".

- The lugs for both preventer wires are completely intact and undamaged and the conditions of the four pockets for the securing bolts have already been explained under "locking devices" further forward in this chapter.

- The upper flaps were found to be in the following positions on the first (known) ROV inspection on 02.10.94:

- From starboard to port Nos. 1 - 4 were hanging upside down and the lower parts moved to the deep starboard side partly over-lapping each other with no apparent damage;

- Nos. 5 and 6 were obviously forced apart and were now standing approximately horizontally with damage in between;

- Nos. 7 and 8 were hanging down in undamaged condition with the lower parts slightly moved to port.

The bell crank on port side was bent and broken with the wire controlling the flaps also broken. The starboard side bell crank is apparently intact.

Behind the first and fourth flap port side **a rope is visible**.

Between the upper transverse girder of the ramp and the second flap from starboard a **wooden plank** was found to be sticking.

- The mating lugs for the ramp hooks and its fastenings have already been explained under "locking devices" and the fastening landings of the ramp actuators have been explained under "ramp actuators" further forward in this chapter.

- The port outer ramp edge between the flap hinges and the raised edge was found to be buckled, deformed and bent.

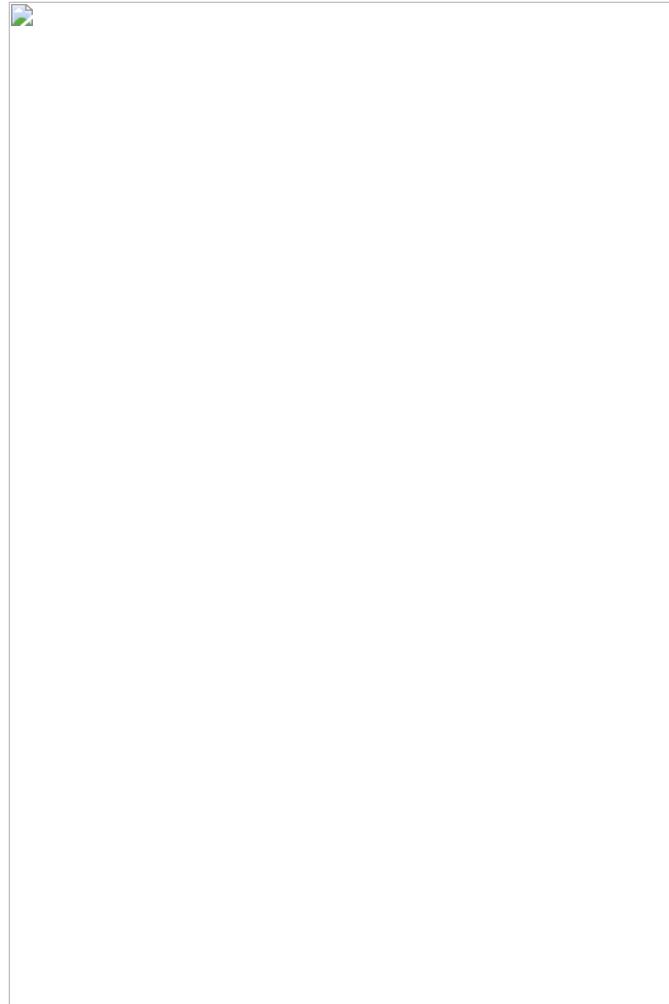
- The corresponding part on starboard side was apparently undamaged with exception of about 1/2 m forward of the raised edge (tire-protection bar) which was apparently "tied in". The same bending due to "tightening in" was noted on the corresponding port side of the ramp.

Otherwise there is no more apparent damage to the inside of the bow ramp.

The **outside of the bow ramp** was found to be damaged very substantially and the damaged areas, according to the ROV inspections on 02. and 09.10.94 compared to the results of the diving investigation on 03.12.94, are demonstrated by the drawing on the following page. It has to be borne in mind that the green shaded area containing the really heavy damage at the centre line of the transverse girders Nos. 3, 4, 5 as counted from the lower side of the ramp is not visible on the videos made on 02. and 09.10.94. This does not mean that it had not been there, but this particular area cannot be seen on the publicly available video footage, because these parts were cut and deleted from the respective videos handed over to this 'Group of Experts' by the members of the Finnish Commission in March 1995 as "raw material". - See Subchapter 34.6.

#### In detail:

The red shaded area represents the contours of the forepeak deck and it is obvious that the damage to the 2nd transverse girder as well as to the two inner vertical girders appears to have been caused by contact with the corresponding parts of the forepeak deck. Also the type of the deep and sharp indentations of the transverse and vertical girders, with local deformations to the adjacent structure, could confirm this. On the other hand the damage to the port vertical girder is comparatively weak, while the most heavy damage to the starboard vertical girder cannot have been caused by contact with the forepeak deck because the two ramp hinges on that side were to some extent intact. The doubts are further increased by the fact that the flatbar housings on the forepeak deck at the four contact areas should be pressed flat, which they were not, and that there should at least be heavy contact marks at the deck edges of the forepeak deck, which however are also missing.

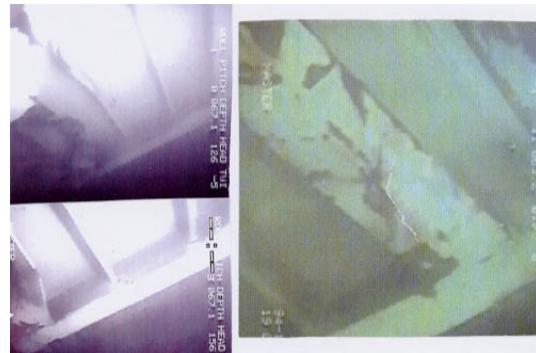


To allow the reader to form his own opinion the relevant damages shall be shown on photos and explained below.

**In detail:**

**(a) ROV inspection 02.10.94**

The two images below show on the left side the starboard lower port side with the outer vertical girder cracked off the bottom transverse girder, the ramp plating and the 2nd transverse girder and which is twisted by about 70° - No. 1 on drawing. The image on the right side shows the corresponding port girder with some scorings only and damage further up.



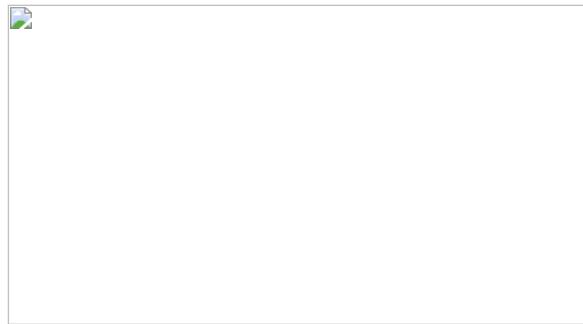
The dramatic damage to the starboard girder cannot have been caused by contact with the forepeak deck, because if the ramp would have smashed onto this deck also the port side should have been damaged. Also the nature and extent of this damage to the starboard girder does exclude that the damage was caused by impact on the forecastle deck.

The following image shows the port inner vertical girder - arrow 1 - and the 2nd transverse girder - arrow 2. The damage on the left is No. 9 on the drawing, the bent profile next to it is No. 8, the dark spot in the right lower corner is No. 7 and the two profiles bent to the outsides are No. 6 on the drawing.



During the **ROV inspection on 09.10.94** a better quality footage was produced and the images below show the area of relevance in much more detail.

The three images below show the damages Nos. 2, 3, 5 on the drawing.

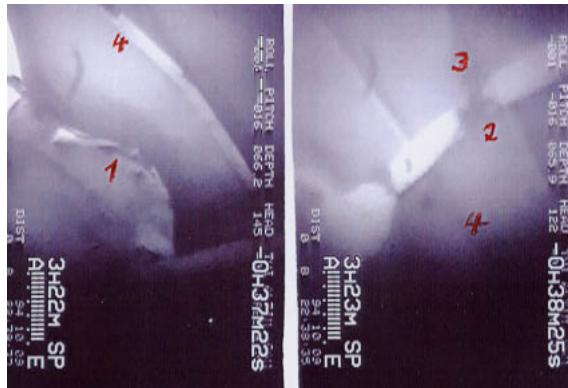


Obviously the transverse girder No. 2 between the outer and inner vertical girders on port side has been pushed upwards - damages Nos. 2 and 3 - which cannot have been caused by an up-and-down movement of the ramp and respective contact with the forepeak deck.

Also damage No. 5 is dubious because the area has obviously been damaged twice, viz.

- (1) at first horizontally (the black looking area) and
- (2) secondly diagonally.

which cannot have been caused in one occurrence.

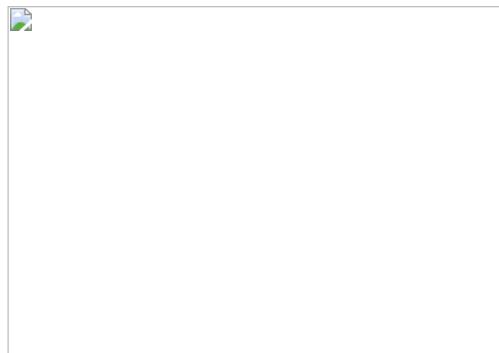


The left picture shows the lower part of the port outer vertical girder, cracked off above and below and twisted up to 70° - damage No. 1 on the drawing as well as damage No. 4. The right picture shows damages Nos. 2, 3, 4.

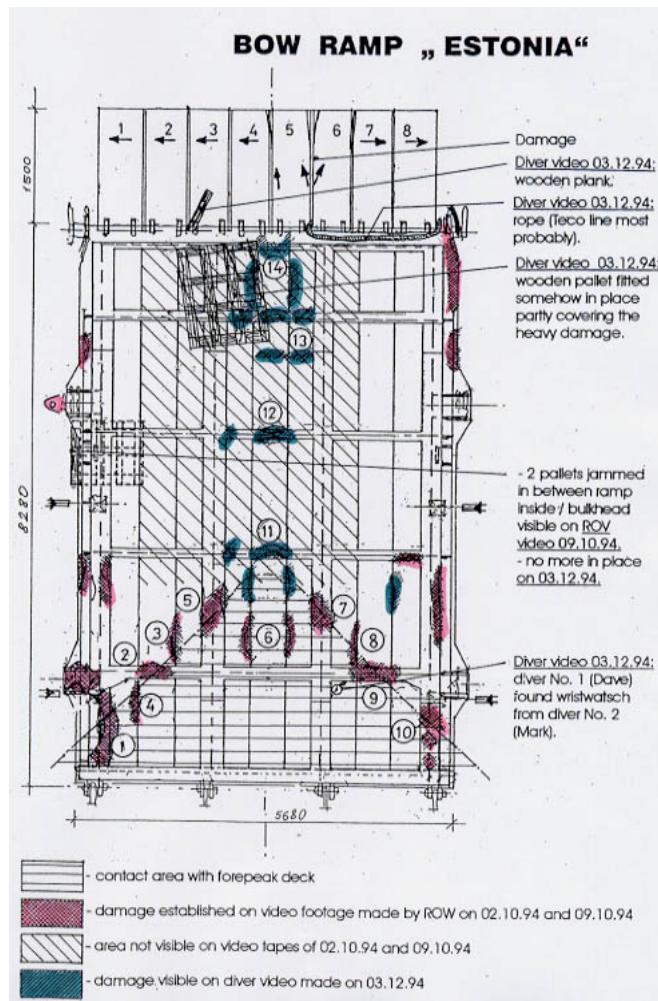
Below is an enlargement of damage No. 2.

**(b) ROV inspection 09.10.94**

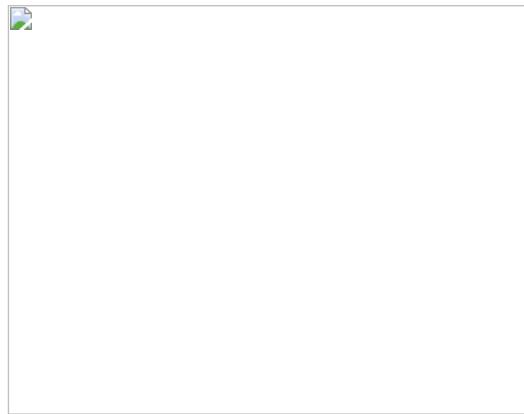
The available footage of 09.10.94 showing the lower port part of the ramp is no better than that of 02.10.94 with the exception of the damage to the lower part of the outer vertical girder. The left picture shows the damage - No.10 on the drawing - to be just below the 2nd transverse girder. The above visible extension to port is the landing for the fastenings of the port ramp actuator. There are two different indentations - arrow 1 and 2 - both run horizontally, thus cannot have been caused by contact with the forepeak deck. The right image is an enlargement of the damage area.



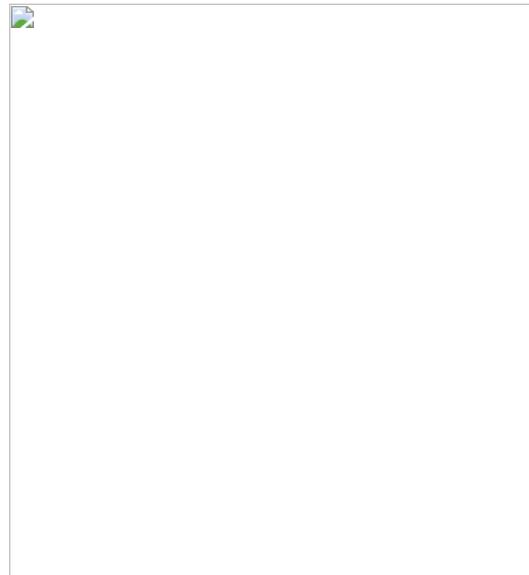
The damages 7 and 9 cannot be discussed because there is no appropriate footage available.



Had the ramp been smashing onto the forepeak deck the flatbars forming the housing of the rubber packings on the port side and starboard side of the Atlantic lock installation should have been pressed flat had the ramp sustained the damages 2 - 9 due to contact with the forepeak deck, which they are not, as can be seen from the following images. It has to be concluded that the damages 2 - 9 cannot have been sustained as a result of contact between the open ramp and the forepeak deck. The image below shows the empty housing for the rubber packings to starboard of the starboard lug of the Atlantic lock.



The following two images show the area to port and in front of the hydraulic cylinder of the Atlantic lock.



The diving investigation on 03.12.94 revealed very heavy additional damage to the ramp as can be seen from the drawing on page 869. The newly found damages are numbered 11 - 14 and are all in the centre line of the ramp in way of the 3rd, 4th and 5th transverse girders counting from the hinges. The upper transverse girder to which the flaps were fitted was apparently also affected. It is unknown whether these damages - mainly in the centre line of the ramp - were already in existence at the time of the ROV inspections on 02. and 09.10.94 and thus would have to be assumed related to the casualty.

**In detail:**

- No. 11 The images below show the very severe indentation and deformation of the 3rd transverse girder with the adjacent structure buckled and the upside of the girder twisted. The force direction was upwards.



- No. 12 concerns the 4th transverse girder which was apparently pushed in with the structure below buckled.



- No. 13 is a small damage in the centre line compartment between the 4th and 5th transverse girders running horizontally over two sections and the indentations are from inside to outside.



- No. 14 is by far the largest and heaviest damage which was partly covered by a pallet attached to the ramp - see image below left.



After some difficulties the diver was able to pull off the pallet and the full extent of the damage extending over three sections in way of the 5th transverse girder became visible. The heaviest damage was noted in way of the centre line where the girder was pressed together to the plating which was severely buckled. To port and starboard of this very heavy damage the girder was also indented, but to a lesser extent. Also the two vertical frames between the two inner girders above the damage explained before were noted to be bent to the outside and the uppermost transverse girder, to which the flaps were fitted, was also severely indented in way of the centre line.

The inside of this severely affected area is visibly distorted with the paint burnt over about 1 m<sup>2</sup>. See also further above: The inside of the bow ramp.

The left image below shows the adjacent damage to starboard and the right image to port of the big damage.



All these images were produced from diver video B40c which particularly in this part is much too light and very foggy. This is due to faulty copying of the original videos to the copies supplied to the 'German Group of Experts'.

The next image shows the deformations of one of the two vertical section profiles (frames) between the inner port and starboard vertical girders. The buckling and possibly pounding damage is extending up to the transverse girder No. 6. The other section profile looks similar.



The image below, though of very poor quality, shows the area of damages Nos. 7, 8, 9. The diver is standing between the port and starboard inner vertical girders next to the 3rd transverse girder and is looking to port. The respective numbers have been attached to the corresponding damage.

The enormous deformations, which are not visible to this extent on the videos of 02.10.94 and 09.10.94, indicate that this damage had been created by the twisting of the ramp when the heavy visor had been hanging on it for some time.



The image below showing damage No. 7 looking from starboard to port confirms the above.



So much for the main damage to the underside of the ramp, respectively to the severe longitudinal bending of the whole ramp structure which was most probably caused by a very heavy weight pressing down the ramp from port to starboard and by which the very heavy distortions to the vertical and transverse girders of the ramp structure were created.

This could explain all the damages to the ramp structure except for Nos. 1, 10 and part of damages 13/14 to which reference is made in Chapter 32. It is worth mentioning here that there was no chance for the ramp to crash on the bulbous bow as long as the starboard ramp hinges were intact, which they were.

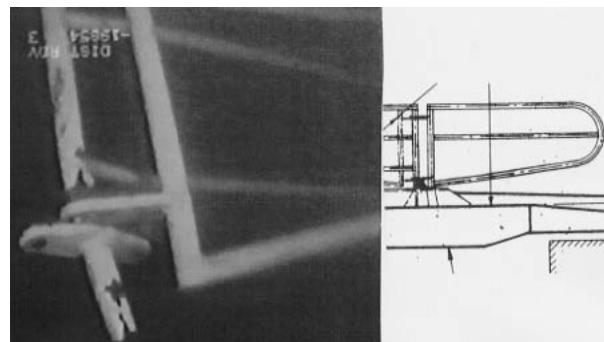
#### (5) The rails

The bow ramp is fitted with two rails on each side as can be seen on the photo below.



Each rail consisted of three fixed sections welded to the raised tire-protection bar, i.e. 4 vertical stanchions with three horizontal rail bars in between. A fifth moveable section was fitted to the most forward stanchion. When the ramp was open these movable sections were swung forward and secured in this position by two pins fitting in corresponding holes. Before the ramp was closed, the movable sections were swung backwards and secured by the pins as can be seen on the above picture and the rails remained in this position during the sea voyage. Thus it has to be assumed that this was also the case during the last voyage.

As parts of the starboard rail, the 4th section with the attached 5th moveable section, were found on the seabed already on 02.10.94 by ROV "Jutta II" - see the image on the next page - the available footage has been evaluated for indications of the bow ramp rails.



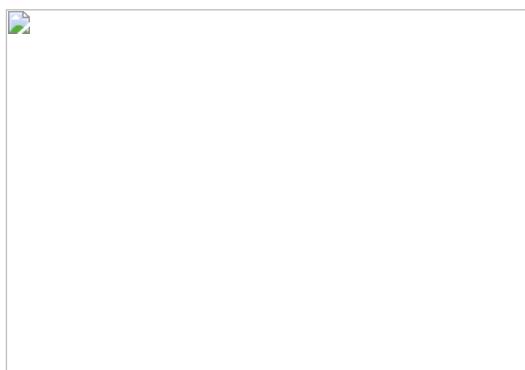
It is obvious that it is the starboard side because the movable part is always fixed at the inside of the fourth section if the ramp is open, as visible here and it is also obvious that the lower, bent part was the part attached to the ramp. It is further apparent that the vertical stanchion had been bent and finally cracked off by a force acting from port to starboard.

The image below shows the aft lower part of the movable fifth section which confirms the before said.



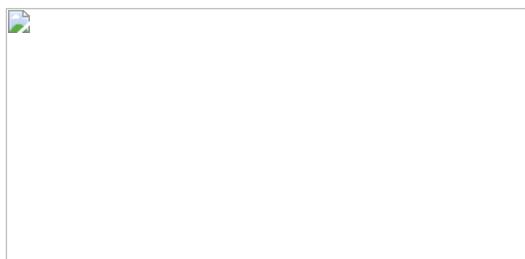
**Note:** A reconstruction of the track of the ROV which found the rail sections revealed that they are lying ca. 270 m to the South or SSW of the stern of the wreck, i.e. on the initial track of ESTONIA. According to the construction of the casualty sequence-of-events ESTONIA had passed this position at about 00.55/01.00 hours.

The evaluation of the available video footage made on **02.10.94 and 09.10.94** revealed possible parts of the starboard rail in the background - see arrow 1 on the image below - which is however very uncertain.



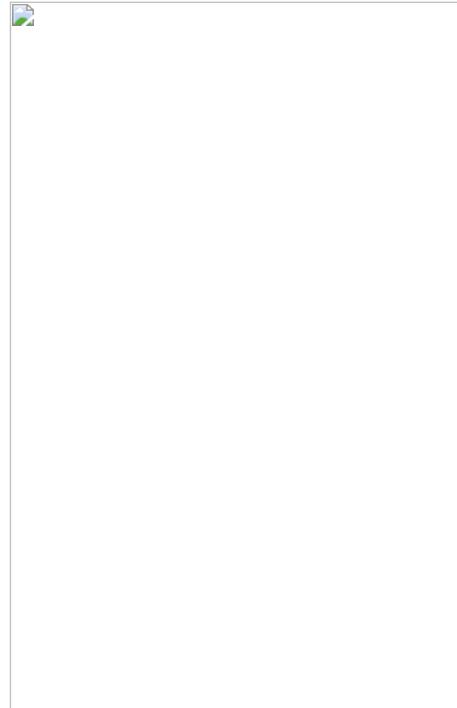
The image shows the starboard side of the ramp with the side torn upwards and the tire-protection bar obviously still attached to the ramp plating. One rectangular steel part - see arrow 2 - is extending from the opening for the starboard ramp hook. It is unknown where it belongs to and what pushed it out of the opening. - See in this respect also Chapter 32 - Unexplained Damage.

The following image shows the port side of the partly open ramp with the indication of a possible crushed rail - see arrow.

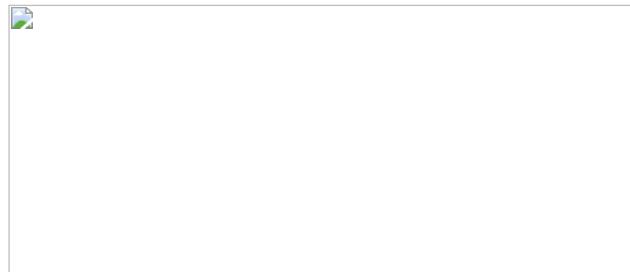


Otherwise there are no further indications of the rails on the footage from 02. and 09.10.94 because the ROVs did not go deeper inside the ramp.

**The diving investigation on 03.12.94** revealed that there was nothing left of both rails and that what has to be the 2nd stanchion from forward of the port rail was cleanly cut off at a level well below the adjacent mating pocket of the port upper securing bolt. Bending or cracking can be excluded due to the even surface of the stanchion which was actually a pipe. At the time of cutting the stanchion was bent to the starboard side. See image and drawings below.



The diver walked up (down) the starboard side of the ramp on the bulkhead, where among some pallets and other debris parts of the rail are visible. See the image below.

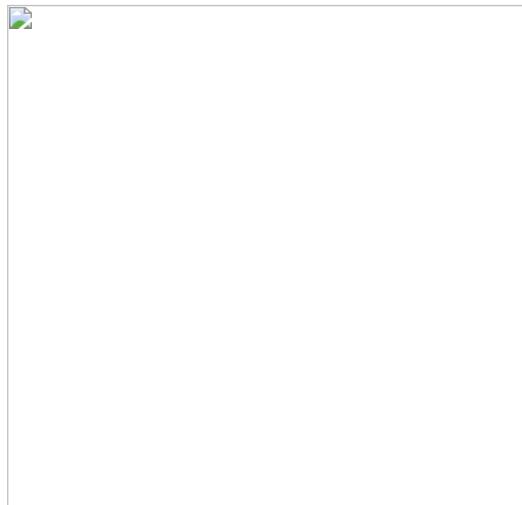


He later climbed down (up) the port inside of the ramp and only the two mating pockets and the lug for the preventer wire became visible, while the fastenings of the port bow ramp actuator could not be seen, which fact remained uncommented by the diver.

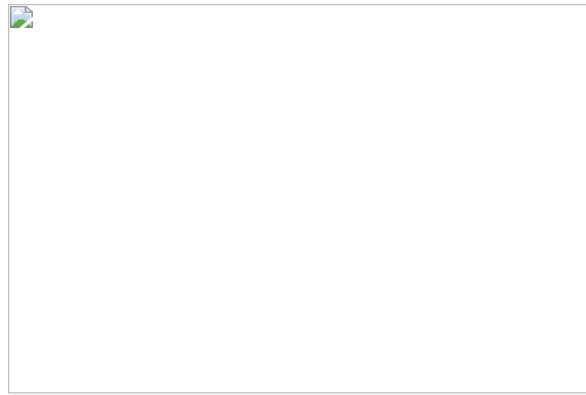
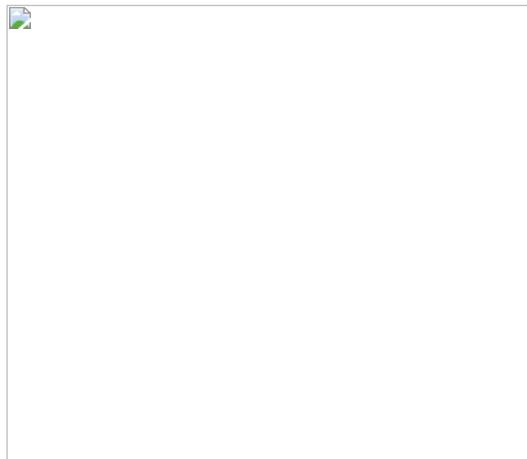
#### (6) Other observations

Also the following observations were made during evaluation of the available video footage:

- On the videos of 02.10.94 the ramp appears to be almost closed - the footage is partly brilliant and partly extremely bad. The image below shows the almost closed ramp.



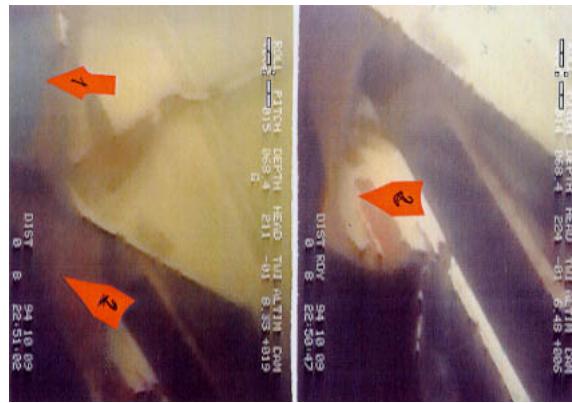
- On the one video tape available of 09/10.10.94 the ramp appears to be more open - see the image below - and deeply engraved scoring marks at the starboard recess in the front bulkhead in way of the fastenings for the starboard ramp actuator indicate that the ramp had been more open and was subsequently closed - see the image on the next page. Since this area is not visible on the footage of 02.10.94, it is not possible to verify whether this opening and subsequent closing occurred in course of the casualty sequence or later.



The arrow points to the scoring marks. The ramp in way of the landing for the starboard ramp actuator is obviously resting on the bulkhead.

- On the same video tape from 09/10.10.94 two wooden pallets are visibly jammed between the ramp and the recess of the starboard front bulkhead just below (above) the starboard mating lug for the ramp hook. The area is not visible in detail on the 02.10.94 footage, but when the diver inspected the area on 03.12.94 the pallets were definitely no more in place.

The 2 images following show the area in question. Arrow 1 on the left image, points to the landing to which the mating lug for the starboard ramp hook was fastened and which was apparently pushed upwards - see arrows 2 on both images.

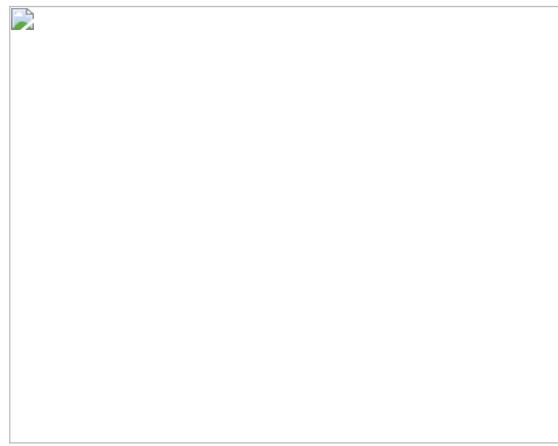


It can be excluded that these pallets floated into this position at the very moment when the ramp was pushed closed by the visor while the sinking vessel was already heeling to 130/140°. It has also to be excluded that the pallets floated out of the jammed-in condition by themselves as visible on the footage made on 09.10.94. This means that it has to be assumed that the pallets were manually put into position to avoid total closure of the ramp at some stage and, further, that they probably floated away when the ramp was also manually opened further at sometime after the 09.10.94 but before 03.12.94.

- When diver 1 (David) inspected the outside of the ramp on 03.12.94 he found a running wristwatch in the lower part of the ramp, i.e. in one compartment above the broken starboard hinges. It turned out that the watch belonged to diver 2 (Mark) indicating that he must have been there before apparently engaged in other activities not shown on the available video footage. See the ramp drawing on page 869.

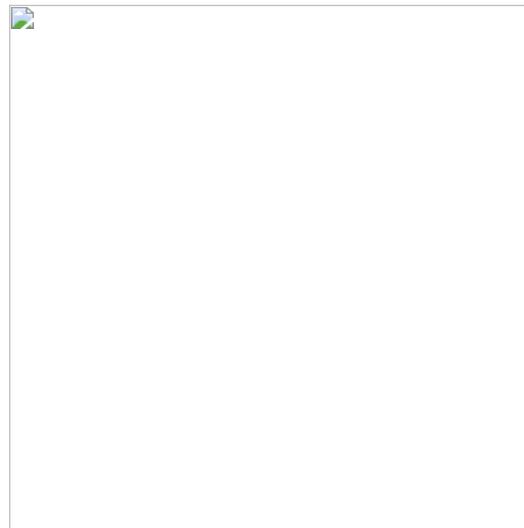


Attention has also to be drawn to the image below from the video made by the ROV Sprint on 03.12.94 - the day when the diver also inspected the bow ramp. The image shows a rope disappearing behind something solid, which is apparently not identical to the "sealing material", which had mostly disappeared by then. The rope can be seen coming back slightly deeper as if running through a lug. This is approximately the area where the lug was found on the 1996 video - see the image on the previous image.

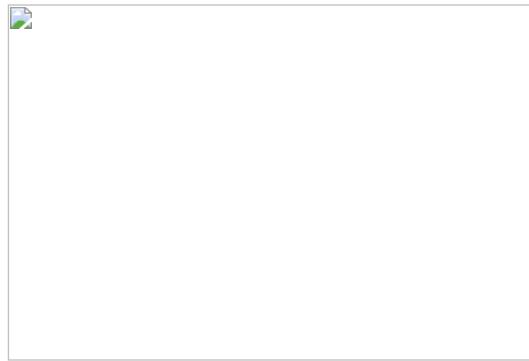


- Definitely neither this rope nor the solid looking object had been in this location during the ROV inspection on 09/10.10.94.

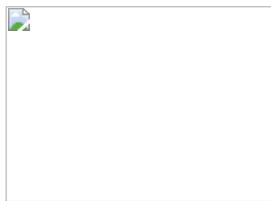
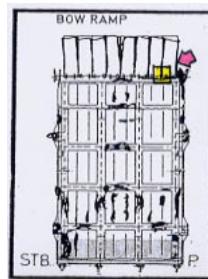
- Next two images made from diver video B40c are presented which show a frogman-type diver swimming into the beam of the diver's searchlight and then hastily withdrawing from it. This diver had no umbilical, thus was completely self-sustained. Diver Dave did not show any reaction.



- Finally it has to be mentioned that a rope was found tied around the flaps Nos. 6, 7, 8 - see ramp drawing and image with drawing below - and a pallet was fitted to the upper part of the ramp - outside in way of the starboard inner vertical - and the 5th transverse girders. Slightly further up the ramp between the 2nd and 3rd flaps from starboard a wooden plank was sticking all of which is indicated on the ramp drawing - see page 888.



The observations mentioned under (6) are reported here for completeness only and reference shall be made in the forthcoming explanations when cross connection might became understandable.

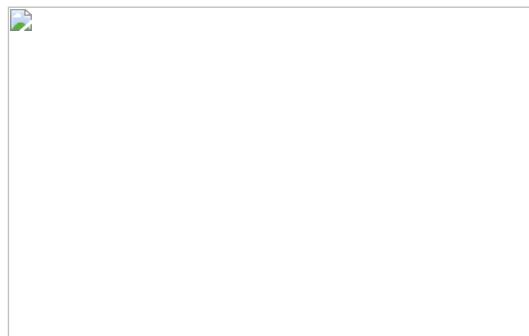


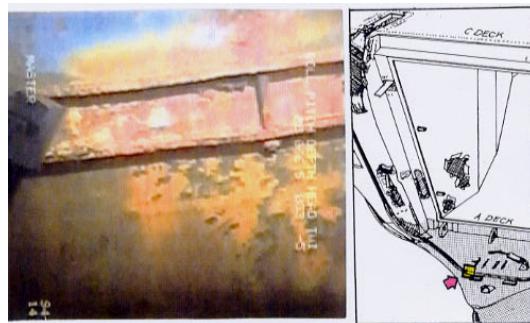
(click for full page images)

#### **(7) The Forepeak Deck**

The area under investigation is restricted to the forepeak deck as indicated on the overview drawing and the detailed drawing on sheet 7. The images 1-6 shall be explained as follows:

- No. 1 shows the hammered stempost of the wreck
- Nos. 2, 4, 5, 6 show either empty flatbar channels where the rubber packings were supposed to be - which is also confirmed by the image below - or show the rubber packing lying loosely on the flatbars into which they should be fitted and bolted. The evaluation of the video films - of which these 3 pictures are just a small selection - prove that the rubber packings were only in place at the starboard side from forward of the Atlantic lock to the "corner of the mouth" and these were in a rather poor condition. Along the whole port side up into the "corner of the mouth" there were no rubber packings. The diver followed the flatbar - channel for the rubber packings from the top of the starboard front bulkhead via the forepeak deck to the top of the port front bulkhead which is documented on video tape B40c. The two images below are just a confirmation of the findings explained above.





- No. 2 shows the hammered stempost which was evidently not just caused by the contacts with the visor in the course of the casualty sequence, but these quite extensive hammering marks were sustained over a longer period, viz. when the visor moved up and down in the sea state within the play of the locking devices, because the counter-pressure of the missing rubber packings was not existing to avoid such movements. The corresponding stempost of the visor was found to be full of fatigue cracks - see Chapter 30 and Subchapter 34.4.

- No. 3 shows the hammered and bent locating horn (pyramid) which had taken over a weight-carrying function before the casualty for which it was not designed and which was due to the misalignment of the visor. The pre-damaged condition of the pyramid was naturally increased by the heavy contacts with the visor bottom in the course of the casualty sequence-of-events. See Chapter 31.

- No. 2 shows one of the two steel pads welded to the forepeak deck in front of the rubber packings which were fitted to carry about 20% of the visor's weight. The second one has also been identified on the video tapes available.

- No. 3 shows the crushed pyramid, i.e. the locating horn on the forepeak deck supposed to guide the visor in transverse direction during closing.

In addition, the attention of the reader has to be drawn to two circumstances discovered only when the above-mentioned sheet had already been completed, viz.

(a) the lower part of the starboard front bulkhead being torn off the forepeak deck with severe distortions in way, and

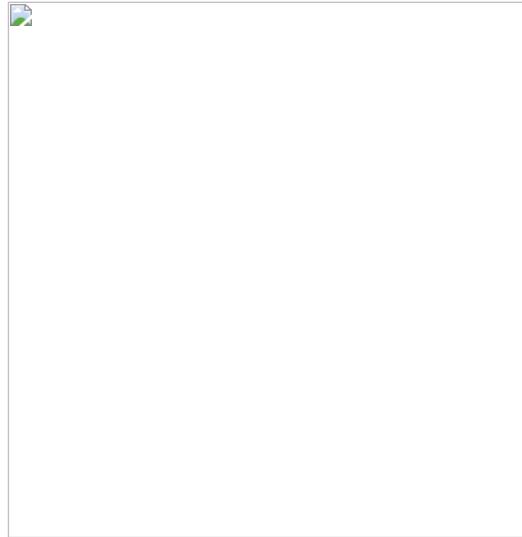
(b) the apparent fact that there is no corresponding damage to the flatbar channels of the rubber packings, deck edges, etc. on the forepeak deck, which mandatorily has to be there in case the bow ramp had been fully open and did smash on the forepeak deck.

#### as to (a):

The lower part of the starboard front bulkhead in way of the hydraulic and manual side locks - see also further forward in this chapter, the starboard front bulkhead - is shown on the following images. The first one shows the upper part of the opening for the manual side lock with the rubber packing to the left. Between opening and rubber packing the bulkhead is visibly bulged - see arrow - i.e. the bulkhead is pushed out around the opening for the manual hook and increasingly deeper down the bulkhead. This can be seen from the next image below - arrow 1. In addition, there is a very deep fold - see arrow 2 - as well as damage in way of the rubber packings - arrow 3.



Apparently the fold occurred between the rubber packing and the outer edge of the front bulk-head and extends down towards the forecastle deck where the front bulkhead was torn off the fore-peak deck plating and its inner side was twisted upwards. See the image below.

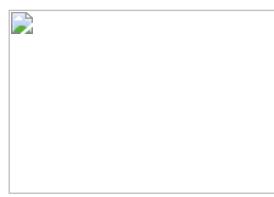
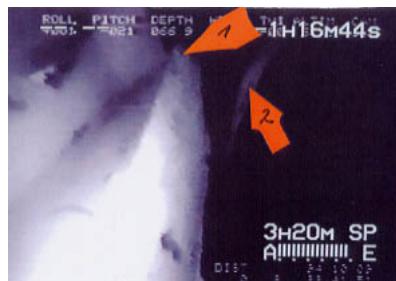


On the right image arrow 1 points to the change over from white to blue paint which should actually continue according to the red-dotted line, however, this is not the case due to the considerable distortion of the complete area which was apparently pushed forward where the visor was at the time.

The following two images show the area adjacent to this pushed-out lower part of the front bulkhead, the recess with the torn-off and severely bent lower part of the outer vertical girder of the bow ramp. Apparently the deck/bulkhead is open in way of these severe distortions which also extends downwards.



The next image looking from upside down shows the lower part of the front bulkhead twisted to port - see arrow 1 - while the initially lowest part of the bulkhead having been welded to the forepeak deck was cracked off and bent to starboard against the deck edge - see arrow 2 on this and the above image.



(click for full page images)

#### **(8) The Atlantic Lock**

On the forepeak deck also the **Atlantic lock** was installed which is the next "area under investigation" as indicated on sheet 8, respectively the overview - and detail drawings on this sheet.

The Atlantic Lock has been the bottom lock of the visor and its design and construction is explained in Subchapter 2.4.6 whereas its integration into the locking system of the visor and the monitoring is explained in Subchapter 2.6.6. The "as-found" condition is demonstrated by 15 images and 2 photographs which shall be explained as follows:

- Image No. 1 shows the starboard and centre logs while images Nos. 2 and 3 show the centre - and the port lugs. The latter one was subsequently destroyed upon instructions of the JAIC for testing purposes.
- The 3 images were taken from the ROV video made on 9 October 1994, i.e. 12 days after the casualty. All fracture surfaces are heavily corroded. This is even more evident from the image below made from the ROV video from 02.10.94, i.e. only 4 days after the sinking, which shows the same corrosion to the fracture surfaces of all 3 lugs.



The pictures Nos. 4 and 5 show the starboard and the centre lugs in the Royal Technical University in Stockholm (KTH) in February 1995. They had been cut off the forepeak deck and were recovered by divers on 4th December 1994 and subsequently examined by the KTH. Below a photo of the starboard and centre lugs taken at the KTH, Stockholm in February 1995 is shown in order to illustrate to the reader the actual condition. Particular attention is drawn to the lower fracture area of the starboard lug.



- The photo below shows the starboard lug looking from forward to aft. Attention is drawn to the lower fracture area and the bending of the lug.



- Next an enlargement of the support bracket attached to the outside of the starboard lug is shown.



These pictures need to be commented as follows:

- The support bracket at the outer side of the lug (arrow 1) is larger than the original, which is evident because it overlaps the end of the welding seam (arrow 2) which marks the end of the bushing. The support bracket is about 12 mm larger compared to the original one made according to the von Tell drawing No. 49111-373.
- The oblique end of the bracket is just burnt, not grinded (arrow 3). It is considered impossible that the bracket would have left blacksmith's shop of the Meyer Werft in such a condition - see also Subchapter 2.4.6;
- The remains of the welding seams at the outer side of the lug were made very unprofessionally when the lug was upright which allows the conclusion that the lug was fixed to the vessel as otherwise the welder would have laid the lug flat. This would have permitted easier welding and would have produced a qualified welding seam.

**Note:** Qualified welders are able to identify if a welding seam was made when the components were lying flat or were standing upright. The starboard and the centre lugs were shown to one of the very qualified welders of Meyer Werft who identified the welding seams at the support bracket and on the outside of the starboard lug to be rather poor repair welds made when the lug was upright, i.e. fitted to the forepeak deck. See also Subchapter 2.4.6. - As the welds had been made when the lug was upright, i.e. welded to the vessel, it is excluded that they could have been made by Meyer Werft because the bushings were welded to the lugs in the workshop, i.e. the lugs had been lying flat. - See Subchapter 2.4.6.

- The welds are thin and interrupted, respectively cracked, because they are so thin, which is demonstrated by the corroded surface of the inner side of the lug normally covered by the bushing. As long as the welding seams are intact the space between bushing/lug is airtight, i.e. without oxygen, which was burnt by the heat of the welding process. This was obviously no more the case since some time before the bushing was torn off, because substantial corrosion was able to develop.
- The forward and aft welding seams between bushing and support bracket are not connected at the outer end (or closed, as the welders say), thus water could penetrate. This confirms the unprofessionalism of the welder who did these repair welds.
- Although the welding seams of the inside of the starboard lug and of both sides of the centre lug look much better, they have to be considered fill-up welds according to the Meyer Werft welders, because the welds are higher than the inside of the lug, i.e. the bushing was not resting in the lug, either because the bore was too big from the beginning and/or the lug became elongated as time went by. Therefore the welding seams were mainly used to cover the space between the lug and the bushing at the bottom side of the lugs and thus had only a reduced load-carrying capacity compared to the original as-built condition.

**Note:** On 26 June 1994 a passenger observed welding work being carried out underneath the open bow ramp while ESTONIA was in Stockholm. It is possible that the repair weldings explained above to starboard lug of the Atlantic lock were carried out then. See also Subchapter 12.5.

The explanation of the photos on sheet 8 - The Atlantic Lock - shall be continued with images

- Nos. 10/11 showing **the bolt of the Atlantic lock**, which had been brought up by the divers on 3 December 1994, but was subsequently thrown back into the sea by Börje Stenström, because allegedly the helicopter taking the Swedes back home could not carry the weight ashore of both the bolt and the ship's bell. Apparently no one onboard had the idea of simply leaving the bolt on board the big diving support vessel SEMI I subsequently proceeding to Stavanger/Norway from where excellent mail connections do exist to Stockholm.

In any event, one of the most important pieces of evidence for the JAIC casualty scenario, then determined already with certainty, was destroyed forever without even taking a couple of good photographs of it. Nevertheless the available video footage is sufficiently clear to establish the condition of the bolt, which explains why Stenström threw it back into the sea.

The evaluation of the relevant videos revealed the following and for easy reference the Atlantic lock installation is shown again on one drawing looking from aft to forward and on the other one looking from starboard to port.

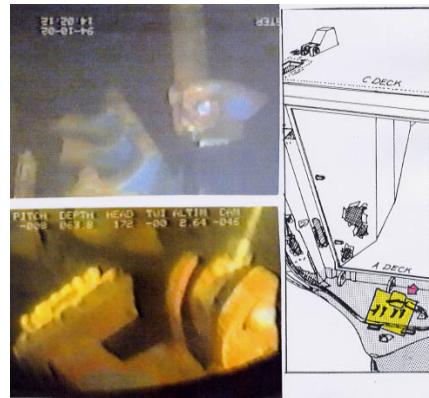
- 1 - indicates the contact plate for the sensors
- 2 - points to the bolt being in open condition
- 3 - indicates the actuator for the bolt.



The drawing previously, is explained in detail as follows:

- The contact plate (Arrow 1) had originally been straight as can be seen from the above drawing which is copied from the original von Tell drawing 4911-373 dated 09.10.79. It has been confirmed by the von Tell representative G.Todsen (Enclosure 2.4.2.21 - Statement G.Todsen) as well as by the BV-surveyor G.Lohmann in a personal discussion that the Atlantic lock had been installed as per approved drawings. Consequently the contact plate was originally straight.

- This was no more the case at the time of the casualty as can be seen from images 13/15 and from the image below made from the ROV videos of 02.10.94 and 09.10.94, because evidently the contact plate was bent from starboard to port when the bolt was in original condition.



- The explanation for the bent contact plate of the bolt was presented by the last chairman of the JAIC and its Estonian part, Uno Laur, already at a meeting on 17.01.95 in his office in Tallinn when also a member of this 'Group of Experts' was present. He was asked whether he had an explanation for the many fresh footprints on the 2nd and 3rd stringers inside the visor and he replied as follows:

- The inside of the visor was not tight and filled quickly with seawater up to outboard level when the vessel was on full speed at sea.
- All hydraulic installations, i.e. also the actuators of the Atlantic lock, the bow ramp and the visor were leaking. This caused hydraulic oil to float on the water surface inside the visor.
- As soon as the vessel reduced speed and consequently the bow wave became smaller, the water streamed out of the visor and the hydraulic oil settled on the stringers, bottom, etc. - as explained in Chapter 30.
- As the Atlantic lock could no longer be closed hydraulically already since some time before the casualty (probably since the ice winter, March/April 1994) crew members had to go down inside the visor each time before arrival and after departure Tallinn and hammer the bolt open respectively closed through the deformed lugs of the Atlantic lock. Thus they walked from forward to aft and back over the stringers through the freshly settled oil which caused the footprints as can be seen on the next pictures.
- The above was confirmed by another participant of the meeting, Captain Arvi Myyryläinen, then Hull Manager of The Pohjola Insurance Group, Helsinki. His statement is attached as Enclosure 12.5.175.

- The photograph on the next page was made mid January 1995. It shows a view into the visor with the partly oil stained 2nd stringer (arrow 1) and the completely oil covered stringer 3 (arrow 2).



- Also the picture on the next page shows in detail that the footprints were so fresh and clear that even the size of the rubber boots could have been identified. It also demonstrates that there must have been quite some activities down in the visor before the last arrival and after the last departure from Tallinn which cannot just be explained with one or two men going down to hammer the bolt of the Atlantic lock open and closed. There were certainly also other activities going on as will be explained later.

**Note:** The last time the hydraulic oil settled down on stringer 3 has been before arrival Tallinn in the morning of 27.09.94 when the speed was reduced, the bow wave became small and the water streamed out of the visor. Thereafter the crew entered the visor to hammer open the Atlantic Lock and possibly to carry out other activities. The crew went again inside the visor after departure to hammer the bolt into the Atlantic Lock lugs and to carry out other activities. Subsequently the vessel picked up speed, the bow wave was raising again and the inside of the visor filled within the following hours more or less completely with water, which only left with the lifting of the visor after the casualty. Consequently the fresh footsteps originate from before arrival and after departure on 27.09.94.



- The opening movement of the bolt was from starboard to port and the contact plate was bent from starboard to port. Therefore it has to be assumed that the crew hammered against the contact plate to open the bolt, because there is no other possibility of forcing the bolt open. The hammering marks on the plate are clearly visible. When closing the bolt they hammered directly against the bolt (which is not possible for opening), i.e. against the 2 lugs between which the piston rod of the hydraulic cylinder was fastened by a little bolt.

As can be seen by the next pictures both lugs were bent to the respective outsides and the piston rod of the hydraulic cylinder was also bent.



- Whilst the bending of the lugs is doubtless due to the powerful hammering by crew members when trying to force the bolt through the deformed lugs of the Atlantic lock, it is evident from the hammering marks on the contact plate, as visible on the next image, that they sometimes also hammered against this plate when trying to open the bolt. The following image, taken from the Part-Report of the JAIC, shows these lugs to be full of hammering marks, which are shining like new, without any traces of corrosion, although the fracture surfaces of the broken lugs are heavily corroded.



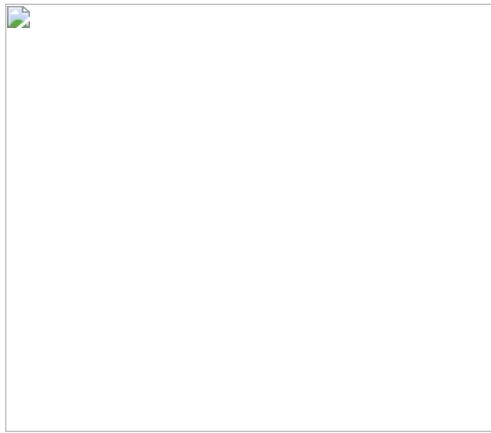
It appears strange that hammering marks, undoubtedly originating from hammering about 6 hours before the casualty, appear without any corrosion as can be seen on the above image, whilst fracture surfaces, which are said to originate from fracturing at the time of the casualty, i.e. were exposed to seawater only about 6 hours later, are severely corroded as can also be seen on the same image. This raises doubt whether the lugs of the Atlantic Lock really fractured only during the casualty or much earlier already.

**Note:** The metallurgists remain silent on these obvious discrepancies and the JAIC is apparently not interested. Images:

- No. 11 shows the actuator with piston rod bent upwards respectively due to the 120° list of the vessel now hanging down.
- No. 12 shows the fastening of the actuator to the forepeak deck. The arrow points to a welding seam, which was a repair weld.
- Nos. 8/9 is showing the sensor plate from forward (down) and from aft (up).
- Nos. 6/7 show enlargements of the cable ends initially supplying power to the sensors as long as they were fitted to the sensor plate. Evidently the cables were cut.

**- Further detailed explanations:**

A further consequence of the water-filled visor were repeated problems with the magnetic limit switches of the Atlantic lock which had replaced the mechanical sensors sometime in 1985/86 - see Subchapter 3.4 - and which controlled the red/green indicator lights of the control panel on the car deck (see Subchapter 2.6.4). These limit switches were most probably damaged by ice hacking inside the visor in winter 1994. When this was realised by those in charge and when it further turned out that the Atlantic lock could no more be operated hydraulically because the lugs were deformed also by ice hacking and the visor was misaligned, it was decided to dismount the damaged limit switches completely and the cables were cut off. The video prints below show the cut off cables and the empty sensor plate.



The motivation for not replacing the dismounted magnetic limit switches was primarily the rather high price for new ones and the apparent fact that crew members had to go down anyway after the closing respectively before the opening of the visor to close respectively open the bolt manually by hammering, thus there was a direct control and no remote control was required.

Neither B.V. nor the E.N.M.B. were informed about this severe violation of safety rules which rendered the vessel initially unseaworthy and should have caused B.V. to withdraw the class in hindsight.

**Note:** When the information outlined above was brought to the attention of B.V. they invited the owners, i.e. N&T, to comment on the dismounted limit switches and the obviously cut-off cables. Although the images from the underwater videos demonstrate quite clearly that the limit switches and cables were not torn off in the course of the casualty sequence-of-events, B.V. apparently finally believed the many crew witnesses stating that the installation had been complete and in proper working order only a few days before the catastrophe. Also the JAIC finally accepted the explanations by N&T/the crew, although earlier there had been different opinions.

#### Image

- Nos. 13/16 are showing the bent contact plate attached to the bolt on the piston rod side, and the two bent lugs between which the piston rod was fitted to the bolt by a steel pin, all of which has been commented above already.

#### Summary of Facts presented on the Atlantic Lock:

(1) All three lugs evidently failed in the forward/upward direction, which is only possible if the visor hinges were broken before - see Subchapter 34.2 - Results of the Finite Element Analysis of the Visor - because as long as the visor is attached to all five respectively seven fixing points the force direction is aft/upwards and the load on the Atlantic lock is only in the range of 50/60 ts.

(2) The lugs failed in their thinnest sections and the upper fracture surfaces of all 3 lugs look more or less the same while the fracture surfaces of the lower ones look totally different, viz.

- the starboard lug lower fracture runs obliquely from the upper point of the fracture towards the lower forward side of the lug and the fracture surface is severely corroded.
- The centre lug lower fracture looks completely different because the fracture runs horizontally from the point of fracture on the inside towards the outside or vice versa. Also this fracture surface is severely corroded.
- according to the available videos the port lug lower fracture has apparently been subject to pounding. The initial condition cannot be determined anymore because the lug was destroyed for testing purposes.

(3) The upper part of the starboard lug was found to be bent to starboard, while the upper parts of the centre and port lugs were straight. The lower part of the starboard lug was straight while the lower parts of the centre and port lugs were bent to port.

(4) The welding seams also show quite different pictures, viz.

- the starboard lug and the support bracket:  
The welding seams between the support bracket, which was much larger than the original and the support bushing as well as the welding seams at the outer side of the lug between the lug and the support bushing were obviously very unprofessionally made repair welds when the lug was in upright position which allows the conclusion that the lugs were fixed to the forepeak deck when being repair welded.  
The welding seams on the inner side between the lug and the support bushing look much better but are according to the professional welders of Meyer Werft so-called fill-up welds and are much thinner than the initial welds were, viz. only about 3 mm whereas the initial welds were 7-8 mm - see also Subchapter 2.4.6
- the centre lug has also fill-up welding seams on both sides of only about 3 mm thickness;
- the port lug could not be examined since it was destroyed for testing purposes on behalf of the JAIC.

(5) In summary of items (1) to (4) the following has to be considered established:

- The visible welding seams on the starboard and centre lugs and the support bracket of the starboard lug were not original, thus it has to be concluded that the lugs of the Atlantic lock were no more the original ones installed by Meyer Werft - see also Subchapter 3.3.
- The welding seams in way of the outer side of the starboard lug including support bracket/support bushing were poor quality repair welds made when the lug was in upright condition.
- The other welding seams between lugs/bushing were fill-up welds of just 3 mm instead of 7-8 mm in the original condition.
- In particular the lower fracture surface of the starboard lug showed severe corrosion even though blank metal without any corrosion could be seen on the insides of the lugs and on the upper part of the bolt despite these parts should have become exposed to seawater at the same time as the lower fracture surface of the starboard lug. This could indicate that the fracture - at least of the starboard lug - existed already before the casualty.
- Due to the above-explained changes compared to the original condition the load-carrying capacity of the complete installation had been considerably reduced.
- The locking bolt showed 2 areas of contact indicating that the bolt was sometimes fully extended and sometimes only partly when in locked position which indicates misalignment between the lugs on the vessel and/or between the lugs on the vessel and the visor lug.
- The steel plate attached to the bolt was hammered bent from starboard to port since this is the only way to move the bolt from closed to open position by means of a hammer which confirms the above.
- The lugs between which the piston rod was fitted to the bolt were hammered apart since hammering on these lugs was the most effective way to hammer the bolt from open to closed position which further confirms the above.
- Since the three lugs of the Atlantic lock were deformed and misaligned to such an extent that the Atlantic lock could no more be locked/unlocked by means of the hydraulic actuator remotely controlled from the control panel on the car deck, it had to be locked/unlocked by crew members by means of hammering. See Enclosure 12.5.175.
- The sensor plate was empty and there are no indications that the limit switches had been fitted to it at or shortly before the casualty. The inside of the drilled holes show corrosion indicating that the limit switches had been dismounted some time before the casualty when also the cables were cut.
- The scoring marks and removed paint at the upper forward side of the sensor plate do originate from hammering by crew members to bend the plate further aft, i.e. away from the hammering area of the bolt which is a further confirmation for the above.
- Since the bolt - after having been recovered by the divers - was thrown back into the sea by a member of the JAIC and the sensor plate - although having been burnt off by the diver - was thrown away and not brought to the surface, these important pieces of evidence could not be examined.

### 29.3 The Car Deck

Very little is known about the inside of the car deck except for the observations made when the diver went down (up) the starboard inner bulkhead, inside the ramp towards the car deck. A lot of pallets and dunnage were noted to be piled up to the left of his way, with other debris and what appeared to be parts of the ramp rails mixed between. Behind the debris at least one, probably two big holes in the bulkhead are visible which will be discussed in Chapter 32.

Although the upper part of the ramp opening was considerably damaged indicating that something big had smashed against it, no scoring marks are visible and the area of the inner bulkhead is covered by the above-mentioned debris. It is possible that this damage was caused by the visor - see Chapter 31 - during the casualty sequence-of-events.

The condition of the bow ramp flaps on the car deck side have already been explained in the previous Subchapter 29.2 - The Bow Area - and the big hole noted in the port inner bulkhead below the control panel and adjacent to the port outer ramp hinge will be discussed in Chapter 32. In spite of various attempts and although the supervisor frequently said so, the ROV was apparently never inside the car deck according to the evaluation of Disengage - see Disengage Report Subchapter 34.6 - and if the ROV actually should have been inside the car deck it definitely did not enter it via the opening at the bow ramp but then it must have been through such a big hole in the starboard shell plating that the edges were not visible while the ROV moved through. This is doubtful but cannot be excluded because the relevant part of the Sprint ROV video tape B40b has been cut several times. - See Subchapter 34.6. in any event on the uncensored part of this tape cement bags on pallets shrinked by plastic foil and other cargo parts, however no truck or trailers, can be seen which then has to be on the seabed.

This immediately raises the question of how they got there because it is most unlikely that this cargo originates from another vessel as it looks rather new and unaffected by sediments. It can also be excluded that the cargo fell out of the open bow ramp when the vessel was upside down because she was then down by the stern and it is physically impossible for pallets to move off some truck or trailer on to the car deck and then ahead on to the bow ramp and then to fall off the bow ramp. This leaves a sufficiently big hole in the shell plating in way of the forward starboard side of the car deck which indeed cannot be excluded and is - as a matter of fact - the only possibility. As the observations described above were made by the ROV on 3 December 1994, i.e. more than 2 months after the casualty, there are two possibilities, viz.:

- (a) heavy objects from inside the car deck crashed against the shell plating and broke through it either during the big heel, which is unlikely, and/or subsequently
- (b) a hole was blown or flame-cut from the outside into the car deck to get access after the casualty.

In order to be able to explain further observations on the car deck by survivors also the fire-fighting system installed here - a sprinkler system called Drencher system - has to be explained as follows:

On the car deck there were also heat-sensors installed, which activated control lights on the bridge indicating the particular area. By pushing a respective bottom the watch officer started the fire pump and activated one or more quick-opening valves of the sprinkler system installed underneath the car deck ceiling, i.e. below the 4th deck. This sprinkler fire protection system was spraying water out of nozzles under high pressure all over the area and the fire pump was continuously pumping water into the system. This sprinkler pump could also be activated from the ECR and from the sprinkler room (B-deck level in the aft part of the centre casing). It was connected to the emergency generator. This means that this pump has been running until the vessel was more or less on the side.

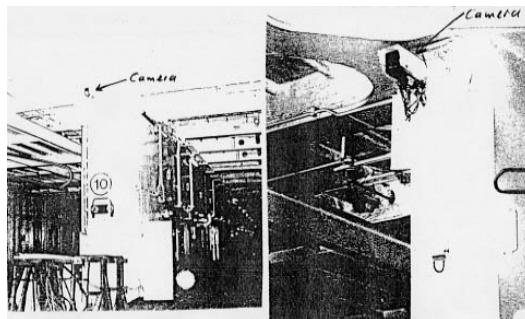
In this connection the observation of passenger Juuse Veljo is of importance who testified among others "*On my way down the port side in about the middle of the ship I reached the fender bar and heard the noise of pumps. While I was still sitting on the edge the light started to blink.*" - See his statement [Enclosure 20.245](#).

**Note:** The emergency generator then still running was supplying power to three pumps, viz.: the bilge pump, the fire pump and the sprinkler pump.

It is possible that the sprinkler pump was then still running together with the bilge pump, which according to Margus Treu, Henrik Sillaste and Hannes Kadak was also running already since or even before the big heel.

Furthermore there are some observations/indications which could point to a fire in the forward part of the car deck. These are

(1) the statement of the watch engineer Margus Treu that a jet of water hit the lens of the video camera transferring pictures from the partly open bow ramp to the monitor in the engine control room (ECR) where he was watching - see his statement dated 29.09.94 Turku - [Enclosure 21.2.3.263](#). Treu believed that this water jet came from the partly open bow ramp, which however is not possible because the camera is fitted at the forward part of the centre casing underneath the ceiling. The distance to the bow ramp is 25 m and the height above car deck is about 5 m - see the pictures below taken on board the near-sister DIANA II where the camera was installed as on ESTONIA.



It can thus be excluded that water penetrating the bow ramp at that relatively early stage could have reached the camera in such high position as much as the car deck between bow ramp and camera was full of trucks and cars.

It is much more likely that the camera lens was hit by a jet of water from the sprinkler installation which had been activated manually in the forward part of the car deck.

(2) It has been explained in the previous Subchapter 29.2 - The Bow Area - that the lower part of the ramp in way of the two flaps in the middle was noted to be reddish/brown with the flaps being bent and distorted and possible damage to car deck plating.

(3) The passenger Bengt Nilsson has testified that he saw white powder and foam inside the centre casing on car deck level next to the 4th car deck door from forward on starboard side. He rushed past this door on his way up when the vessel heeled abruptly to starboard and he had to hold with his hands against the wall when he noted the above. It was so fresh that the foam was still running down the wall.

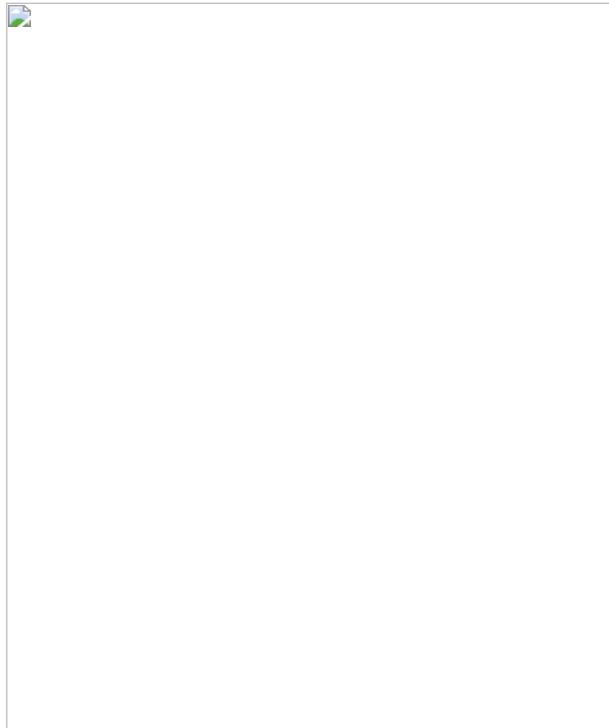
(4) The coded fire alarm for the crew "Mr. Skylight to No. 1 and 2" was heard from the loud speakers, though only after the big heel when there was already full panic. It meant that Fire Group No. 1 had to assemble below the starboard bridge wing on deck 8 and Fire Group No. 2 had to assemble on the car deck.

(5) There are indications that the crew had been active on the car deck before the big heel. See the statement of Altti Hakanpää - [Enclosure 21.3.3.333](#) and the different statements of Margus Treu in respect of his seeing Silver Linde on the car deck - [Enclosures 21.2.3.261 - 21.2.3.273](#).

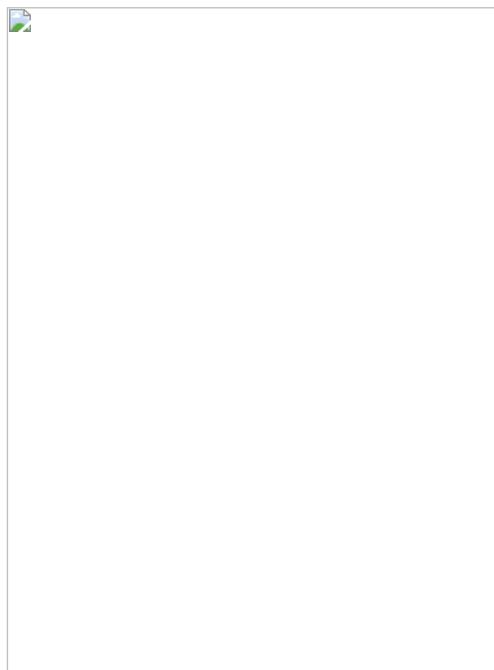
(6) It is certain that the crew knows much more about what happened on the car deck, but remain silent, so far. It has to be assumed that this knowledge relates to the circumstances described in Chapter 32 - Unexplained Damage.

**29.4  
The Bulbous Bow**

This most forward part of the vessel has been unusually carefully examined at least three times by ROVs and at least one time by divers. Numerous deep scoring marks with paint cracked off in way of the ice-knife on top of the bulbous bow and further forward were noted, which most probably were sustained when the forward part of the visor was in contact with these areas. Thus the bulbous bow and the ice-knife on top had been in contact with the visor and possibly something else which caused a number of scorings and an indentation to these very strong parts of the ferry. Nevertheless, they were examined quite closely by the ROV and divers, and the images below are just a small selection of the material available. They show on picture 1 the tip of the bulbous bow with some minor rubbing marks. Picture 2 shows the top slightly further aft with some scorings and picture 3 shows the top even further aft with the paint in the centre completely gone.



In addition, the image below showing white contact marks on the port lower side approximately 1.5 m aft of the tip of the bulbous bow.



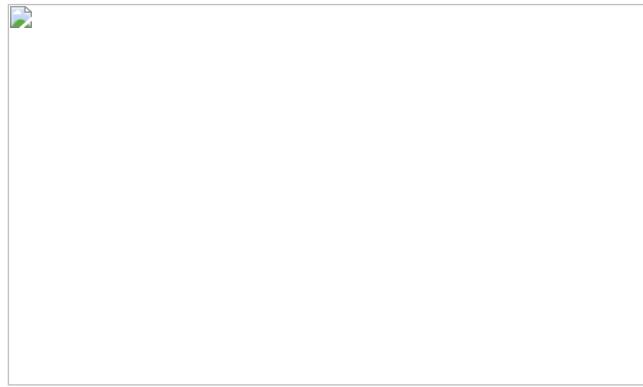
The following image shows white contact marks on the port side of the bulbous bow further aft than the previous one.



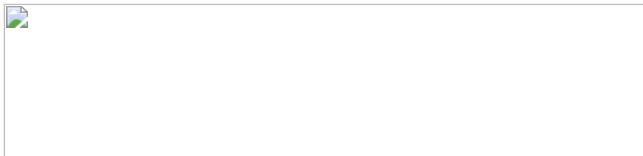
The pictures do confirm contact with some object which could have been quite strong considering the very strong construction of the bulbous bow, i.e. a weaker construction might have sustained heavy damage due to contact with the strong bulbous bow as indicated by the above paint and scoring marks.

#### 29.5 The Shell Plating and Bottom Plating

This particular area of the wreck above the mudline was carefully examined by divers and ROV because a surprisingly big part was accessible, much more than it could be assumed with a vessel lying on her starboard side. The reason is, as demonstrated by the drawings below taken from the Smit-Tak Report - [Enclosure 27.410](#) - that the superstructure was buried into the sea bottom. Therefore the wreck had a list of about 120° with the bottom up and a substantial part of the starboard hull side was accessible above the bilge strake partly up to car deck level.



This means that over the whole length of the wreck the starboard shell plating in way of the 0-deck is accessible which includes the heeling tank and stabiliser pocket areas. The same is true for the 1st deck which is accessible in most parts while the car deck can only be reached in way of section D, which is aft of the bridge. The drawing on the next page - also taken from the Smit-Tak Report - [Enclosure 27.410](#) - indicates the section areas A-E.



Incidentally the area at D - where the car deck is accessible - is most likely not the location where the cement bags on pallets and other cargo were observed. See Subchapter 29.3.

Also accessible is the Starboard Shell Plating in way of 0-deck between Frames 85-120, i.e. the area below the passenger accommodations on the 1st deck with exception of the most forward compartment which is located on top of three initially full freshwater tanks. Further aft there were the following watertight compartments on 0-deck:

**1. Compartment:**  
starboard:

saunas, dressing rooms, toilets

aft port:

void space

**2. Compartment:**

from port to starboard:

swimming pool with bar, this compartment is connected to the upper decks by lift and to the 1st deck by a spiral staircase

**3. Compartment:**

starboard:

sewage treatment installation (part of engine room)

port: 2

conference rooms with alleyway in front, 1 stairway was leading to upper decks which was probably only accessible for the crew

**4. Compartment:**

starboard:

empty heeling tank (183 ts capacity)

centre: 2

heavy fuel tanks with walkway around

port:

full heeling tank (183 ts capacity)

**Note:** Both heeling tanks were connected by a cross-flooding valve which could be operated from the bridge, the engine control room and a pump room located in the aft part of the car deck.

**5. Compartment:**

starboard:

stabiliser fin and installation space

centre: (same as 4th compartment)

port:

stabiliser fin and installation space.

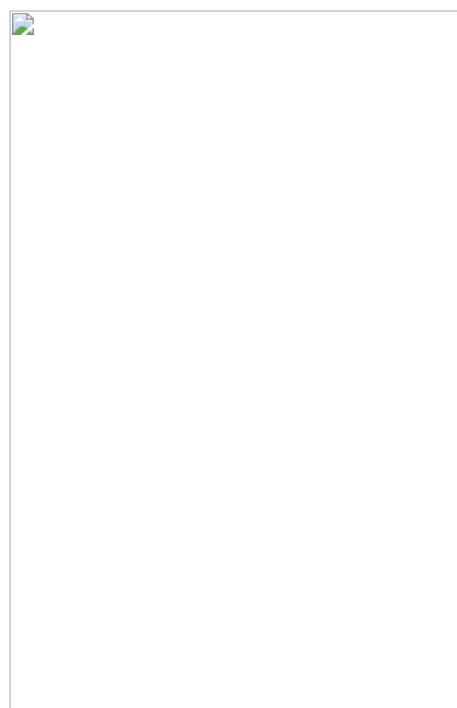
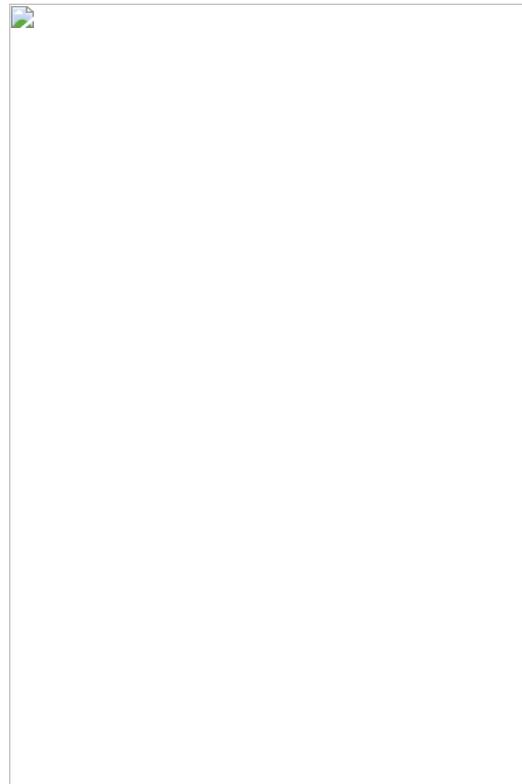
Based on the evidence of passengers from the cabins of the 1st, 3rd and 4th compartments, there had been a lot of water on the 1st deck already before the big starboard heel which escaped from 0-deck under pressure in way of the 4th compartment and probably also came up the spiral stairway and the lift casing in the 3rd compartment. - See the statement of Carl-Erik Reintamm attached as [Enclosure 21.3.1.289](#).

As the water coming up from 0-deck to deck 1 had been under pressure - see the statement of Carl Övberg - [Enclosure 12.4.2.151](#) - there must have been a connection to the outside. As the port side of the shell plating is apparently undamaged according to the ROV inspections on 02.10.94 and 09.10.94 it has to be assumed that there must be one or more holes in the starboard side.

**Note:** The existence of such a hole in way of the sauna and swimming pool compartments has been admitted by two Sjöfartsverket employees independently of each other.

Since the starboard shell plating in way of 0-deck is accessible over the whole length of the wreck - see the 2 drawings on the previous pages - and has been carefully examined by ROV and divers during the mudline surveys, it is certain that respective video material is available. The "official" mudline video is, however, censored, i.e. the relevant parts were deleted - see also the Disengage Report - [Enclosure 34.6.434](#). Nevertheless, careful evaluation of the available mudline video does reveal very substantial damage to the starboard shell plating and bottom plating above and below the bilge keel as demonstrated by the images below.

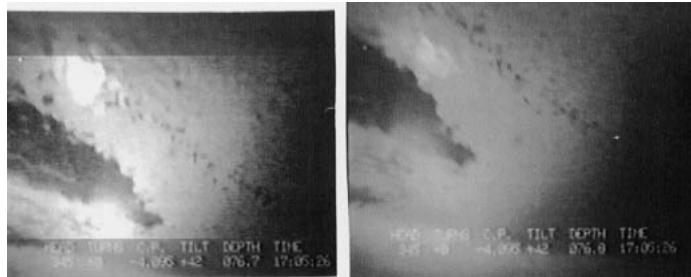




When looking at the images presented here it is difficult to assume that this vessel had been in drydock only 8 months before, because the starboard side is really in a very bad condition, actually much worse as it is possible to demonstrate by images. Very deep indentations between the frames and deep scoring marks, partly not even corroded, are the rule, however, in some particular areas the plating is even holed as e.g. can be seen from the image below.

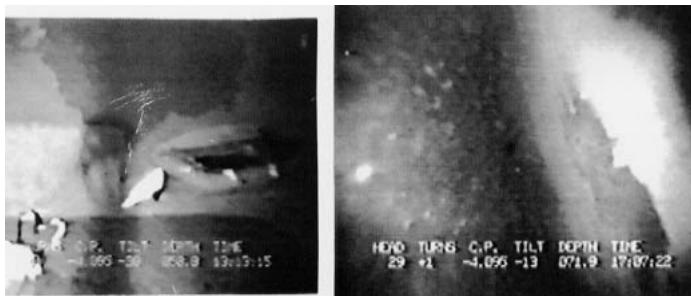


Enhancement by means of special equipment confirmed indeed that the plating is holed - See the enhancement below.



From the damage appearance it has to be concluded that the plate was severely corroded, i.e. the hole was neither caused by an impact of ex- or implosion but by corrosion. This is easily possible if the coating and/or anode protection of a ballast water tank, e.g. a heeling tank, was not in order.

The following two images show an area which is apparently also holed, but not by corrosion because the edges are too sharp.



In any event the ferry ESTONIA departed from Tallinn on her last voyage with one or more starboard ballast water tanks, possibly even the heeling tank, open to the sea. As stated above - see Chapter 17 - revised stability calculations showed that the vessel must have had about 200 ts additional weight on the starboard side which could not be pumped. The theoretical possibilities of unconfirmed flooding of compartments through holes to the outside was discussed as the reader may remember. The possibility now turns to a fact. The vessel had holes in her underwater shell plating. The obvious effect on the seaworthiness of the ferry needs not to be discussed. The fact that the JAIC, having worked on the interpretation of those videos, does not mention anything in this regard, is undeniable too.

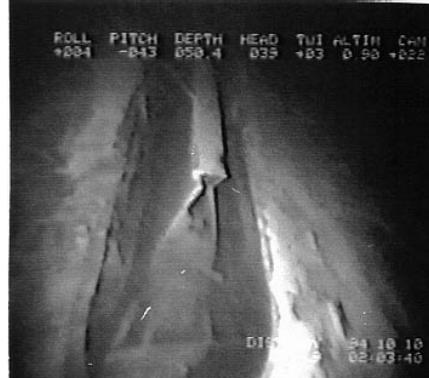
## 29.6 The Stabilisers

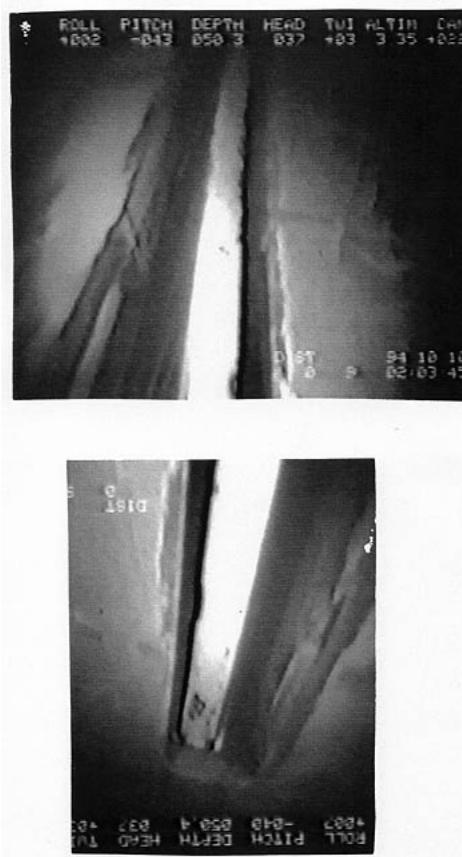
In January 1994 the ESTONIA was fitted with stabilisers of make Brown Brothers which had allegedly been in operation at the time of the casualty. According to 3rd engineer Margus Treu, the fins should retract automatically at speeds below 4 kn, therefore he does not believe that survivors could have seen the port stabiliser still out when the vessel was already almost on the side - see [Enclosure 21.2.3.271](#) - Protocol of Landvetter meeting on 31.03.95.

In all probability Margus Treu is right because only after proper questioning of the survivors Pierre Thiger, Tony Spuhl and Mats Hillerström did it turn out that what they believed to have been the stabiliser was much too much forward to assume it could have been the stabiliser. They saw something big, partly white, partly dark, vertically bigger than transverse, which was moving in/out and/or up/down, very far forward, almost at the bow. They saw it still when the vessel was on the side already. The statement of Pierre Thiger taken on 08.10.99 is attached as Enclosure 29.6.414 and the statement of Tony Spuhl taken on 10.10.99 is attached as Enclosure 29.6.415. The statement of Mats Hillerström is not yet available. The actual stabiliser, however, is installed in a pocket behind the heeling tank on 0-dek level, i.e. about midships. When the witnesses were informed accordingly they categorically denied having seen anything moving in this area. This leads to the conclusion that the survivors had seen the visor, then still hanging on the bow ramp with the bottom attached to the forepeak deck and ice-knife of the bulbous bow.

This leaves the trainee mate Einar Kukk who has stated - see [Enclosure 21.2.1.251](#) - that the stern was down to the stabiliser fin level. But he did not say that the fin was out. Therefore, it has to be assumed that the survivors actually meant the visor when they mentioned the stabiliser during the last stage before leaving the vessel.

In any event the port stabiliser fin was found to be in its pocket during the ROV inspection on 09/10.10.94 - see the images below.





The starboard stabiliser is not visible on the available footage - although the area was accessible and frequently inspected by ROVs and divers - because the respective parts in the available video films were deleted.

The only mention of the starboard stabiliser is made in the Video Tape Log concerning Video No. RW/SEMII/EST/R/94/001 - General Subject: Mudline Depth Survey by ROV UF0316 - on 04.12.94 - the mudline video - where it is stated:

»51.58 - Follow curve of hull at forward of **stabiliser** 1 mtr gap from hull to M/L (mudline) straight through.«

Due to the stated depth of 80.7 m before and 81.8 m after the above entry, it has to be concluded that it was the deep starboard side because above the port stabiliser there is only about 50 m of water.

If the stabiliser should be there in its pocket, why did the JAIC then censor the video? Probably it is not there because there have been and still are continuous rumours that the starboard stabiliser had not been installed properly in January 1994 - see Subchapter 12.5.5 - and ever since did malfunction from time to time and consequently might have broken off on the night of the casualty due to a too weak construction. In this connection the statement of the passenger from the 1st deck, Bengt Nilsson, recently taken in Stockholm - see Enclosure 29.6.416 - is of relevance, because he explains the metallic crack-ing/breaking noises heard by him when still lying in his bed as having come exactly from the direction where the starboard stabiliser fin had been installed. This indicates that the fin could have broken off.

Alternatively the stabiliser fin could have broken off by the object sliding against the vessel's starboard side by which the scraping noises were caused. The noise scenario for Bengt Nilsson would have been the same. Therefore the video footage showing the ROV inspection of the sea bottom was analysed and the following two images were found which could show parts of the stabiliser fin.



The following image is a single frame from a cut tape which vaguely shows something long on the seabed which the Finnish Commission did not want the public to see in detail.

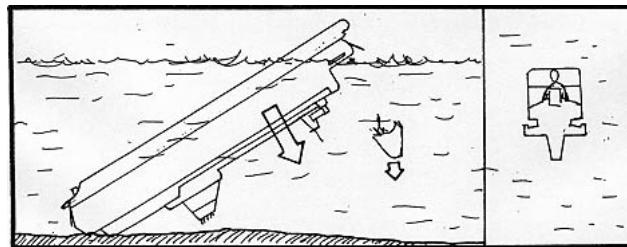


In summary it has to be concluded that the **port stabiliser** in all probability moved into its pocket when the speed dropped below 4 kn which had been the case already before the big heel. It has further to be concluded that the object seen by some of the survivors far forward on the port side, which was moving in/out or up/down, was most likely the visor. These observations were still being made when the vessel was already on her side, i.e. at 01.30 hours or later.

As to the **starboard stabiliser** there are strong indications that it broke off or was broken off and is resting on the sea bottom now. In both cases a substantial water ingress into the engine room - at least 2 watertight compartments were affected - would have been the result for which there are also indications, because Henrik Sillaste has testified that the bilge pumps were running and Margus Treu has stated they were trying to pump water out of the ship. As it is not possible to pump water from the car deck they can only have pumped from 1st deck and 0-deck.

### 29.7 The Stern Area

While the ferry was sinking in completely upside down condition the stern area had the first contact with the sea bottom. The bow was still above sea level at this time with the bulbous bow being the highest point. See the drawing below.



As the superstructure in way of the port side aft part of the 8th and 7th decks were found to be indented and bulged by the divers it has to be assumed that she was somewhat more heeled to port when touching the sea bottom as a result of which the above indentations were caused.



The ROV tape made on 02.10.94 indicates that the starboard stern ramp is slightly open as can be seen on the adjacent image. It shows the upper inner side. The explanation for this slight opening was given already in Subchapter 21.3.3 by the statement of Rolf Sörman - see [Enclosure 21.3.3.335.1](#) - who, as well as his seminar colleagues, were disturbed to such extent by hydraulic noises that they gave up their conference at 21.45 hours ET.

As the 2nd main hydraulic station was located at the starboard side aft on the car deck level directly below the conference area this is the only installation able to produce the explained disturbing noise level. It can furthermore be reasonably assumed that the hydraulic pumps had been started and kept running to open the starboard stern ramp slightly by means of the ice breaking cylinders and keep the ramp in this position by operating the control time and again in the closing mode to press the ramp against the ice breaking cylinders as it would otherwise more open/close due to the very hard pitching of the ferry. The slight opening of the starboard stern ramp allowed the excessive water on the car deck, continuously penetrating through the unclosed bow ramp from the water filled visor, to run out at the stern. This worked, of course, only as long as the ferry had a stern trim and a starboard list. Both was the case until about 23.30 hours when the visor was more or less full and the trim changed to down by head. For further details see Chapter 31 - The Casualty Scenario. The pictures below show the stern ramp arrangements in port.



It has to be assumed that the starboard stern ramp was completely unlocked as it otherwise could not be slightly open and that the reason for this slightly open condition is the almost upside down condition of the wreck. It has further to be assumed that the stern ramp has been much more open during casualty sequence-of-events because latest after the shut-down of the auxiliary diesels the hydraulic pumps stopped since not being connected to the emergency generator. This means that subsequently the starboard stern ramp slowly opened completely or more or less completely while the ferry heeled more and more to starboard which led to massive water ingress onto the car deck and through the big lift opening at the aft end of the centre casing also into the large provision area in the aft of deck 1 and so on. This is most probably the explanation for the ferry sinking by the stern.

#### 29.8 Further Evidence

There was no further evidence available at the time of closing this Report.

## CHAPTER 30

### THE CONDITION OF THE VISOR

This big steel construction - actually having been the bow of the ESTONIA - was standing ashore in Hangö in upside down condition and in the open air completely unprotected from November 1994 to November 1999.

It has been carefully examined, measured and photographed. Several steel parts were cut off and metallurgically examined by Prof. Dr. Hoffmeister from the University of the Armed Forces, Hamburg and the results are outlined in Subchapter 34.4.

A selection of the relevant photographs has been arranged on sheets in accordance with the following areas of interest:

- 1 = Outer hull
- 2 = Ramp house
- S 3 = Starboard visor arm
- P 3 = Port visor arm
- S 4 = Starboard actuator (visor lifting cylinder)
- P 4 = Port actuator (visor lifting cylinder)
- S 5 = Starboard aft bulkhead
- P 5 = Port aft bulkhead
- 6 = Visor bottom
- S 7 = Starboard inner longitudinal bulkhead
- P 7 = Port inner longitudinal bulkhead
- 8 = Internal structure
- 9 = The 3rd stringer

All sheets are arranged on a "General View".



(click for full page images)

Each item is explained by means of the numbered detail photos arranged on one or more sheets around an overview drawing and detail drawings showing the particular area with explanations. These sheets can be found at the beginning of the explanations and it is recommendable to look at them when reading the comments. In the following all pictures shall be explained and evaluated. Whenever considered appropriate additional pictures and/or drawings are added and explained as well.

The original design and construction of the visor is explained in Subchapter 2.6.2 and of the actuating, monitoring and control system in Subchapter 2.6.6.



(click for full page images)

In detail:

#### 1 - Outer Hull pictures:

1 and 2 - show the visor ashore at Hangö in the position as it had been attached to the ship.

3 - shows the large indentation at starboard side of which the larger, lower part was probably caused by contact with the bulbous bow. This larger indentation extends down to the gap at the stempost. There was already a rather deep vertical indentation from a previous occurrence.

4 - shows the upper part of the large indentation which looks completely different, although the indentation from below extends into this severely corroded and apparently previously indented area without any coating whatsoever.

5 - shows the collapsed stempost area. The stempost was found to have cracked four times - see drawing 6 - apparently by fatigue, of which the lower crack penetrated completely some time before the casualty and the lower part, F 3 on the drawing, had disappeared leaving a gap in the stempost respectively a hole in the bottom of the visor. The drawing No. 6 also shows that the INERTA ice paint - last applied in January 1994 - had penetrated the cracks F 1, F 3 and F 4 up to 50% of the thickness of the stempost. This means that the stempost had been cracked through up to 50% already in January 1994. See also Subchapters 12.5 and 34.4.

5.1 - shows the lower forward part of the visor with the deep vertical indentation (arrow 2) of old origin, the gap in the stempost area caused by the ice knife on top of the bulbous bow, the small indentation at the starboard side (new) which is apparently casualty related and the large deep indentation at port side (old) which is of old origin and was probably caused by contact with ice.

7 and 8 - show the bent-off starboard aft part of the bulwark. This damage occurred probably when the visor was hammering on the bow ramp and the ferry was severely heeled to starboard.

9 and 10 - with drawing (10) incorporated show the visor bottom and arrow 1 points to the indented stempost/bottom plating. The reason for this indentation was the misaligned visor as indicated on the drawing, i.e. the forepart of the visor overlapped the forepart of the forecastle deck to such an extent that the stempost of the visor was no more resting on the stempost of the forecastle deck, but that the stempost part of the forecastle deck was in contact with the bottom plating of the visor which was neither designed nor dimensioned to carry the weight of the visor. Therefore the bottom became firstly indented and subsequently holed.

#### Evaluation:

(1) There were 2 very heavy damages in the visor which were of old origin and which had led to a change of alignment and geometry of the visor when they occurred which increased during the subsequent time and which has contributed to the casualty.

(2) The large damage to the starboard shell plating was apparently sustained in two stages, viz. at first the corroded upper part occurred and subsequently the larger lower part, which extends into the upper part, occurred. Since it is already rather unlikely that the upper part of the damage did occur during the final stage of the casualty sequence-of-events by contact with the bulbous bow, it can be excluded that the 3 sharp and deep transverse indentations to the port side of the centre line were caused by contact with any part of the bulbous bow because there is no corresponding counter-piece. The picture below shows all the indentations in the forepart of the visor. The arrow indicates the 3 horizontal indentations of which the upper and lower ones are rather deep. It has thus to be assumed that the visor had been in contact with some other object either before the casualty scenario began or after it had ended, possibly during the attempts to raise the visor.

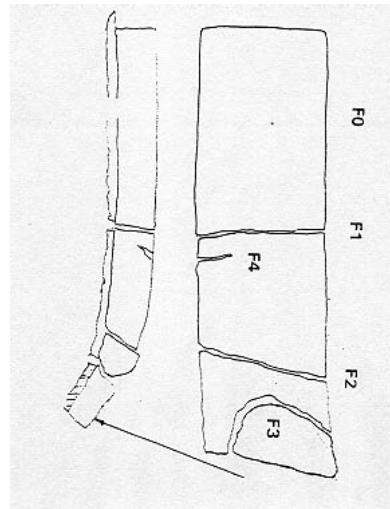


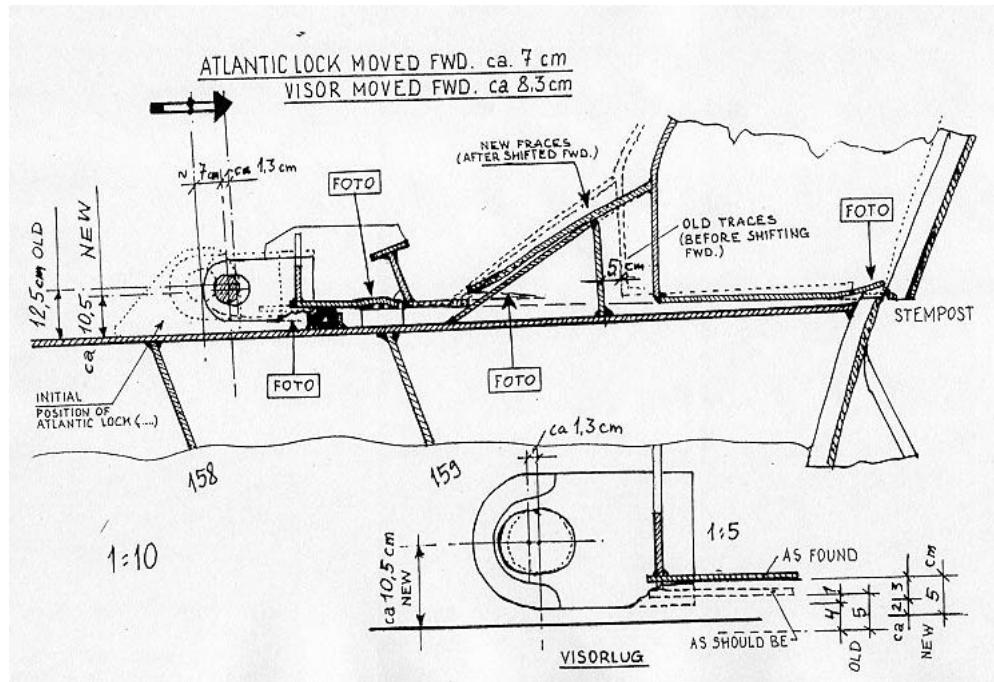
(3) At least 2 fatigue cracks had penetrated the stempost already by about 50% when ice paint was applied the last time which was between 10 and 14 January 1994 in the shipyard at Naantali. During the following nine months up to the casualty the cracks had to propagate further and the lowest one did fully penetrate the stempost which led to the breaking away of part F 3 (see drawing below) and the creation of a corresponding hole in the visor bottom and, consequently, the faster flooding of the visor inside at sea.

(4) The visor was misaligned to such an extent that its forepart was overlapping the stempost of the forepeak deck - see drawing behind this page and picture 9 on sheet 1 - which had serious consequences for all the relevant parts of the visor such as locking devices, hinges, rubber packings and, last but not least, the weather tightness of the visor. Nothing fitted anymore.

(5) The drawing behind this page summarizes the findings and indicates the condition of the forepeak deck and the lower part of the visor including the lug of the Atlantic lock before departure for the last voyage.

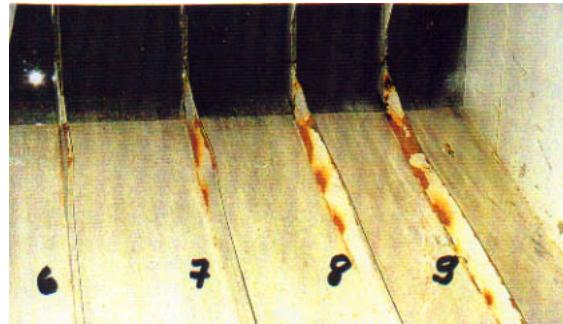
The drawing below shows the fatigue cracked stempost from the side and from forward.





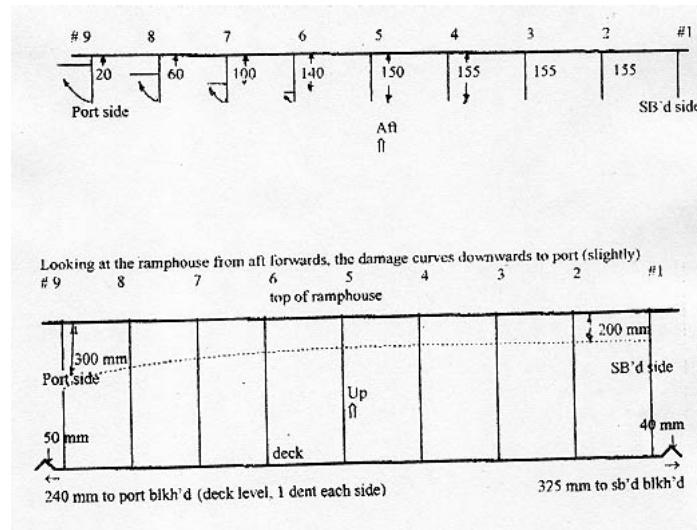
## 2 - Ramp House

There is no sheet available for this part of the visor. The pictures show the inside of the aft part of the ramp house with 9 vertical webs each at its forward- and aft-parts. The webs are of the hp profile-type and measure 160 x 7 mm. The 4 webs at the port side of the aft part - numbered 6 to 9 - were indented to varying extent as can be seen on the picture below. Web 6 was evidently just slightly touched while web 9 was pushed flat.



The report of the Finnish expert to this 'Group of Experts', Captain Peter Jansson, about the subject matter reads as follows:

»Undamaged webs are abt. 155 mm high. There are 9 pcs webs in all. Webs # 1 to 4 from the sb side are essentially undamaged, but the paint has been scraped off all of them in a line abt 20 mm down from the ramphouse upper horizontal surface plate (top). Web # 5 is already very slightly deflected towards port and measures at 150 mm (against 155, see above). Web # 6 is deflected so that 140 mm remains, # 7 has 100 mm, # 8 has 60 mm and # 9 has 20 mm standing, while the rest of that web has been deflected to port. The depth of damage (deflection) is thus quite linear between webs 6 and 9. However the point of max damaged paint at # 1 to max deflection at # 9 seems to follow a gentle curve dropping downwards as you look to port. The ramphouse after plate with the damaged webs below.«



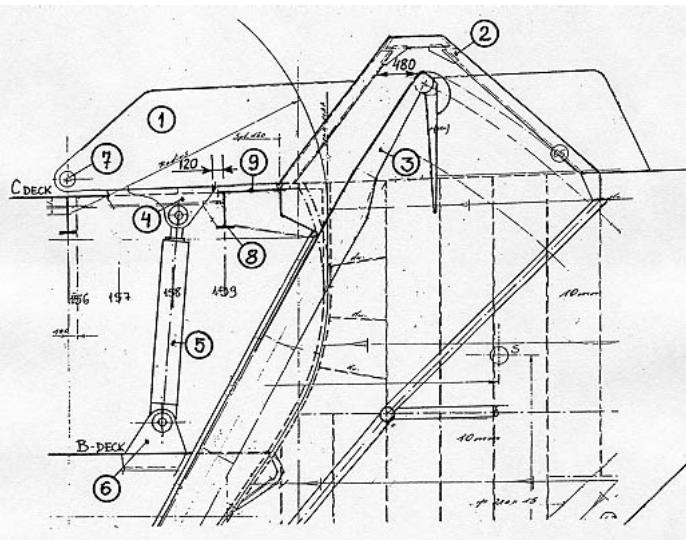
The damage configuration revealed by the above measurements indicates that the visor must have been misaligned by 4°-5° in forward/aft direction if the indentations should have occurred by contact with the bow ramp, i.e. the port side of the visor had to be about 300 mm further forward than the starboard side. In other words, the port side of the visor must have moved forward while the starboard side was held back. Before such forward movement of the visor is possible at all and contact between the aft part of the visor's ramp house and the upper part of the bow ramp is possible, several initially built in obstacles have to be overcome as demonstrated by the drawing on the following page.

These are:

- (a) the visor hinges have to break and the visor has to move forward;
- (b) the lugs for the actuators underneath the visor arms have to cut 120 mm through 8 mm forecastle deck plating until they will strike against the strong transverse deck beam at frame 159;
- (c) the lugs will have to cut through this transverse deck beam at frame 159, which is only possible after several forward/aft movements of the visor;

**Note:** The forces necessary for the lugs to cut through this frame have been calculated by the Technical University Hamburg-Harburg to have been about 200 ts. This means a point load of ca. 100 ts at the port side and a point load of ca. 100 ts at the starboard side. See Subchapter 34.12.

- (d) the visor has to move 360 mm forward before the aft webs of the ramp house (160 x 7 mm) can come in contact with the upper part of the bow ramp;
- (e) the (empty) visor weighing 55 ts, of which the main part is still absorbed by the forepeak deck, will then lean on the properly closed and locked bow ramp;
- (f) as the break-load of the 2 ramp hooks was 42 ts each, i.e. 84 ts, and the break-load of the 4 securing bolts was 25 ts each, i.e. in total the break-load of the bow ramp's locking devices was 184 ts, the visor will lean against the ramp and nothing will happen as it is proven by the MARIELLA incident described in Chapter 33.



- 1 - Visor arm
- 2 - Ramp house
- 3 - Bow ramp
- 4 - Lug underneath visor arm
- 5 - Actuator
- 6 - Actuator foundation on B - deck
- 7 - Visor Hinges
- 8 - Frame 159 =400x9mm  
deck beam = 160x22mm
- 9 - Forecastle deck (C-deck) = 8mm

This, however, was not the ESTONIA scenario because some of the initially built in obstacles were no more in existence, viz.

- (g) the visor was no more watertight but water-filled to the outside level which increased its weight to about 200 ts, and
- (h) the bow ramp was most probably not secured at all - see Subchapter 29.2 and
- (j) visor hinges and locking devices were considerably damaged/worn and their load-carrying capacity was reduced to a fraction of its original value.

Therefore, and due to other circumstances, a casualty scenario as described in Chapter 31 was able to develop which led to the sinking of the ESTONIA and which requires a detailed examination in order to find out what actually caused the indentations to webs 6 - 9 inside the ramp house of the visor.

The damage is most extensive at web 9 and then decreasing until web 5 which, as well as the starboard side webs 1 - 4, are not affected at all - see picture below. The visor must have been misaligned by ca. 4-5° in relation to the bow ramp being connected to the vessel.



The arrow indicates the point of contact on web 9. The next frame 5, which is the centre line, and the following frames to starboard have no marks at this level.

This means that when web 9 came in contact with the port side of the bow ramp and was pressed together from 160 mm to 20 mm the corresponding web 1 at the starboard side of the ramp house was 360 ./ 160 = 200 mm away from the starboard side of the bow ramp. Due to the narrow construction, such a misalignment of the visor is not possible as long as the visor lugs move within the forecastle deck area aft of the deck-beam at frame 159 and as long as both actuators are connected to the B-deck. As will be shown on sheet P 4 + S 4 this was no more the case with the foundation of the port actuator.

Also visible on the two pictures above are slight scorings inside the ramp house from web 1 through web 9 which could indicate a slight contact at another time, earlier or later (see red arrows on both pictures). The scoring marks are just below the brackets between vertical/horizontal webs which would be the areas of contact when visor and bow ramp are in normal condition as on the drawings.

Since the points of deepest indentation on webs 6 through 9 are, however, located about 300 mm deeper, this indicates that the visor was at its normal height at the time of this contact, but raised by about this distance in relation to the upper part of the bow ramp.

There is, however, the much more realistic possibility that the port side of the bow ramp came in contact with this particular area inside the ramp house when the visor was hanging on the ramp at a rather late stage of the casualty scenario. Then the vessel was on the side and the visor was close to sliding off the ramp due to the vessel heeling some 120°/130°. This will be explained in Chapter 31 - The Casualty Scenario.

Although the upper transverse crossbar inside the visor shows respective damage - see arrow 1 on the picture below - the corresponding part at the port outer longitudinal girder of the bow ramp does not. This is confirmed by the image further down,



taken from the ROV video made on 09.10.94 which shows the port outer girder underside of the bow ramp in way of the contact area with the above-mentioned crossbar. There is no damage, the paint is completely unaffected (the diagonally running stripe being a wire).



It is obvious that this quite heavy damage shown on the picture on page 961 was caused by impact - see close-up below - and that this impact did not happen too long ago because the cracked paint is still hanging loose. It cannot have been caused by the ramp, at least not at an early stage as explained before. The damage must have been caused when the visor was labouring on the ramp for more than 30 minutes until the heel of the vessel was sufficiently big to let the visor slide off the ramp. During this time, this and other damage to the



port side of the visor was created by heavy contact with the ramp.

The scoring marks - arrow 1 on the photo on page 961 - at the starboard side of the same crossbeam in way of the first stringer level are not casualty related because except for the middle one the respective areas cannot be reached by the bow ramp. It has to be assumed that these scorings were caused by other means before the casualty.



The indentations/scorings at the vertical beam are discussed in **Item 8 - Internal Structure**.

In summary of the before mentioned has been established:

(1) There may have been a previous however light contact between visor and bow ramp when both were in normal condition to each other. Such contact could not be explained by this 'Group of Experts', because contact between ramp and ramp house under normal conditions is only possible if the visor hinges are broken or disconnected.

(2) There has however been a stronger contact between the port side of the bow ramp and the port webs of the ramp house only when the visor was misaligned in relation to the bow ramp by ca. 4°, i.e. the port side of the visor was about 300 mm more forward than the starboard side, a condition which was only possible after the hinges had failed and the lugs under-neath the visor arms had broken through the deck beam at frame 159.

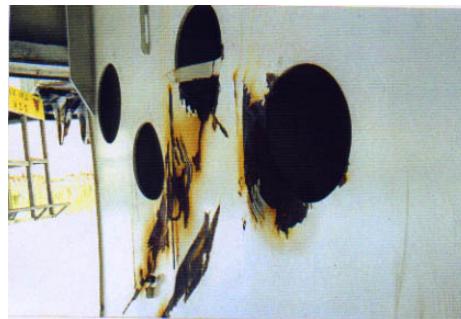
(3) This is supported by the apparent fact that the bow ramp was not locked and the visor was water-filled to the outboard level and was weighing about 200 ts, instead of 55 ts in empty condition.

(4) The bow ramp did not crash into the visor onto the cross-beam at 1st stringer level and did not cause the respective damage on port side because neither the corresponding part of the bow ramp nor the corresponding part of the starboard side of the same cross-beam do show any damage of similar nature.

(5) Consequently the bow ramp was not pulled open when the contact occurred which caused the indentations/scorings to the four port webs in the aft part of the ramp house.

(6) It has however to be assumed that this contact occurred in the final stage when the visor separated from the vessel and the bow ramp was kicked up by the port aft bottom part of the visor as it will be explained in Chapter 31 - The Casualty Scenario.

Finally attention has to be drawn to one indentation pushed at each side into the forward deck beam of the visor, i.e. the lower side of the forward part of the ramp house as indicated on the two pictures on the next page. According to drawing on page 956 the port indentation is 240 mm away from the inner bulkhead and the starboard one 325 m. This means that these indentations were most probably caused by the bell cranks being the most upwards extending parts of the bow ramp. This must have occurred at a time when the visor was hanging on the bow ramp already, i.e. the contact area having been the part inner bulkhead. Therefore the distance between bow ramp and port inner bulkhead has as small as possible - 240 mm - while the opposite distance between the bow ramp and the starboard inner bulkhead was as big as possible - 325 mm. This is also the explanation for the apparent fact that the port inner bulkhead was very severely distorted and partly cracked while the starboard inner bulkhead remained completely unaffected even without paint scratches. See also S 4 and P4 - The Inner Bulkheads - further down.



(click for full page images)

S 3 - Starboard Visor Arm - Sheet 1 The sheet shows the overview drawing indicating the area in question, 4 detail drawings demonstrating the damage to the broken hinge plates at the aft end of the visor arm and in total 15 photos which underline this disastrous condition of the starboard hinge arrangement.

In detail:

**Pictures:**

1 - shows the remains of the starboard hinge plates still attached to the visor (they were cut off upon the instructions of the JAIC in January 1995 and were transported to the Royal Technical Institute (KTH) in Stockholm for examination). The very bad condition, especially of the outer hinge plate is obvious. The deep burning marks and the missing metal are striking. All this is confirmed by the video film made by a passenger on 17.09.94 from the open forepart of deck 8 - see also Subchapter 12.5 - i.e. 10 days before the catastrophe. The image below shows a sequence of this video.



It demonstrates that,

- the whole hinge arrangement is severely misaligned;
- the outer bushing is extending too much to the outside and is twisted;
- the lower part of this bushing as well as the securing plate are missing;
- there is a big gap between the inner part of this bushing and the outer hinge plate fitted on the forecastle deck;

just to mention the main and most obvious deficiencies. The video tape was analysed in detail by the British Reconnaissance expert Bryan Roberts and his findings are discussed in Subchapters 12.5 and 34.9 and his report is attached as [Enclosure 12.5.180](#).

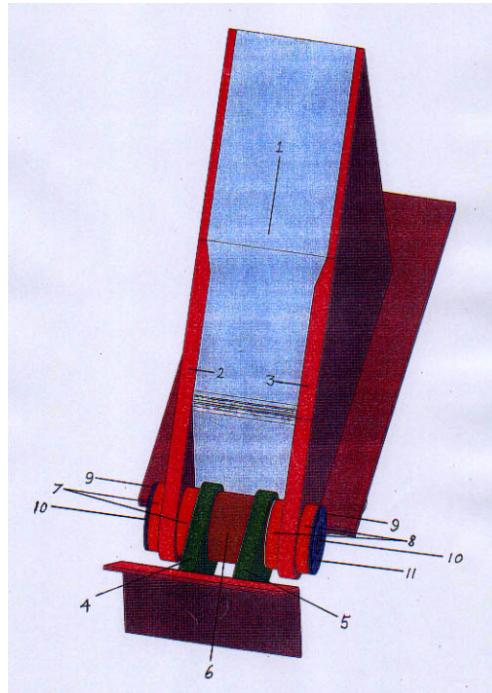
For easy reference of the reader a drawing with explanations showing one of the visor hinges is attached behind this page.

The numbers refer to the annotated parts on the drawing behind this page.

- 1 Visor Arm
- 2 Inner Visor Hinge Plate
- 3 Outer Visor Hinge Plate
- 4 Inner Vessel Hinge Plate
- 5 Outer Vessel Hinge Plate
- 6 Fixed Bushing
- 7 Inner Steel Bushing
- 8 Outer Steel Bushing
- 9 Securing Plates ( both sides )

- 10 Visor Arm Bolt and Bolt Axis
- 11 Securing Plate and 4 Bolts ( bolt sides )
- 12 Distance Ring ( both sides )

The drawing was taken from the report of Bryan Roberts.



The bushing, obviously having broken out of this inner hinge plate, was recovered by divers and was thus available for examination also by the metallurgical expert on behalf of this 'Group of Experts' and reference is made to the Report of Prof. Dr. Hoffmeister - see Subchapter 34.4 - Enclosure 30.417. Further, the recovered bushing is shown in detail on Sheet 3 and shall be discussed subsequently.

The explanation of Sheet 1 continues:

**Pictures:**

2, 3, 4 - show the upper part of the starboard inner hinge plate with very deep burning marks. Each burning mark is a crack starter as can be seen e.g. on pictures 3 and 4 where the hinge plate could have broken as well. The burning marks and its fatal consequences for strength and load carrying capacity were among others examined and analysed by Prof. Dr. Hoffmeister of the University of the Armed Forces, Hamburg - See Subchapter 34.4.

5 - shows the starboard inner hinge plate, respectively it remains still attached to the visor.

**Note:** Upon instruction of the JAIC both the port and the starboard hinge plates were cut off the visor in January 1995 and transported to the Royal Technical University in Stockholm. They should now be in the possession of N&T.

6 - shows a cut through the part shown on pictures 1 - 4.

7 - shows the deep indentation in the base plate (visor arm lower closing plate) of the visor arm caused by repeated heavy contacts with the hinge parts on the forecastle deck during the visor's forward/aft movements.

8 - shows the cut-off starboard hinge remains.

9 - shows the upper end of this hinge plate which - same as the inner one - had not been exposed to hammering.

10 - shows the outer hinge plate with the broken lower part hammered flat.

11 - shows the deep burning marks at the inside of the hinge plate.

12 - shows the lower, heavily hammered part.

**Note:** The condition of the corresponding parts on the forecastle deck is explained in Subchapter 29.2 - Sheets S 1 / P 1.

The damage having been caused to these starboard visor hinges sometime before the casualty is well documented by the report of the reconnaissance expert Bryan Roberts - see Subchapters 12.5/34.9 and Enclosure 12.5.180. Therefore the following facts are considered to be established:

(1) The hinges were gross negligently repaired by burning out the old bushings and replacing them with new ones (see sheet 3), i.e.

- the steel bushing
- the bronze bushing
- the securing plate

(2) The repairers were obviously unable to re-install the previous condition because

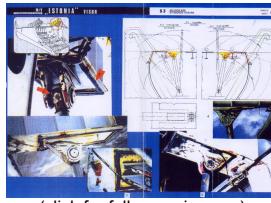
- the steel bushing was inside the visor hinge plate only by about 1/3 (should be 50%) while about 2/3 were outside the hinge plate;
- the steel bushing with the bronze bushing inside was twisted anti-clockwise;
- the lower parts of the steel bushing and apparently also of the bronze bushing were cut off;
- the securing plate was missing;
- the bolt was not visible although it should have been.

(3) There were gaps of up to 25 mm between hinge plate and steel bushing.

(4) The hinge plates inside were covered by deep burning marks from which cracks had propagated the material very deeply. Thereby the load carrying capacity was reduced to 20% or less of the original strength. See also Subchapter 34.4.

(5) Due to the extent of crack propagation the hinges could practically have failed at any time in port or at sea.

(6) During the casualty scenario only the lower part of the outer hinge plate had been exposed to hammering.



(click for full page images)

### S 3 - Starboard Visor Arm - Sheet 2

The overview drawing indicates the area in question and 2 detail drawings demonstrate the forward/aft movement of the visor whereby the inner side and the outer side of the lug plates below the visor arms were deeply scored / scraped. 5 photographs show the conditions of these lug plates, which evidently had cut through the deck beam of the vessel located at frame 159.

In detail:

#### Pictures:

1 - shows the inner and outer lug plates underneath the visor arm by which the actuator is connected to the visor looking from forward to aft. These are the parts of the plates which did first cut through the deck plating and then through the deck beam at frame 159. The rubber packing - arrow 1 - to seal the opening in the forecastle deck for the actuator is apparently unaffected and intact. The spherical bearing between the lug plates and the actuator is clearly visible - see arrow 2;

2 - shows the starboard inner lug plate with one rather deeply engraved area of scraping marks indicating arc type movements of the visor and some smaller contact marks.

3 - shows the area of the visor arm between the lug plates and the aft bulkhead of the visor with some contact marks, however, basically undamaged paint which is also visible on the following picture 4, although - according to the JAIC - this part of the visor arm had been resting on the forecastle deck thereby creating the leverage effect which allegedly broke the hinges. This was obviously not the case.

4 / 5 - show the starboard outer lug plate with more and deeper scraping marks indicating the way the visor had moved as long as the lugs were inside the forecastle deck. Contrary to the arc type marks on the inner lug plate these marks are deeper and straight indicating longer and more heavy contact.

The following facts are considered to be established:

(1) The intact rubber packing underneath the visor arm indicates that this side of the visor had been slightly raised during the time when the visor was moving forward/aft in the process of cutting through the deck beam at frame 159 (contrary to the port side).

(2) The deep scorings at both the outer and the inner lug plates indicate that the starboard hinge broke earlier, i.e. when the vessel either - was only slightly heeling to starboard as it had been the case for the last hour, or - was already rolling to both sides - though more to starboard than to port - about 1 or 2 minutes before the big heel to starboard.

(3) The scorings at the outer plate are, however, deeper and more extensive indicating that there has been heavier and longer contact between this plate and the steel parts cut through which was most probably caused by the increasing heel to starboard.



(click for full page images)

### S 3 = Starboard Visor Arm - Sheet 3

The overview drawing indicates the area in question and 3 detail drawings demonstrate the original location of the recovered bushing. 12 photographs show the condition of this bushing and its components.

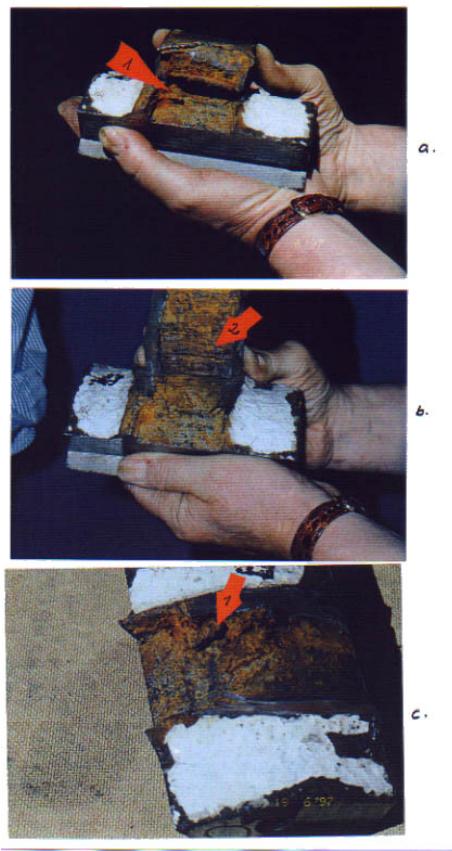
In detail:

#### Pictures:

1 - shows the recovered bushing fitted into the starboard inner visor hinge remains. Since this is the only one of the 4 hinge remains into which the bushing fits in respect of roughness of the surfaces and broken parts of welding seams, it has to be assumed that the bushing recovered originates from the starboard inner hinge plate of the visor.

2, 3, 6 - show part of this bushing with part of the fractured visor hinge plate still attached to it. This part is shown in more detail after the hinge-plate part had been cut off on the following page (pictures a - c). The pictures reveal the following:

- The welding seams between bushing and hinge plate are of poor quality and only 7-8 mm thick whereas the originals were about 15 mm thick.
- The same welding seams apparently cracked frequently and it had been attempted to close the cracks by welding which resulted in welding material penetrating through the cracks into the gap between the hinge plate and bushing. See arrows 1 on pictures a and c.
- The surface of the bushing in way of the hinge plate shows corrosion which indicates that the space between bushing/hinge plate, which should be sealed airtight by the welding seams, had not been airtight anymore for some time already obviously due to the crack propagation in the too thin welding seams and/or due to unprofessional welding.



- The inside of the hinge plates were damaged by deep burning marks (see arrow 2 on picture b) from which crack propagation into the material of the hinge plates started and after the cracks had penetrated 50-60% of the material the remaining part of the hinge plate failed in the shear mode.
- The surface of the bushing, corresponding to the inside of the hinge plate with the burning marks explained above, does not show burning marks, therefore it has to be assumed that the original bushing was burned out some time before the casualty and replaced by the present one.
- The gap between bushing and hinge plate in way of the fracture area was about 25 mm indicating that the bushing did not fit into the hole of the hinge plate because the bushing was too small.

**Note:** At newbuilding the bushings were shrunked into the bores of the visor hinge plates, thus there had been no gap at all. See Subchapters 2.4.3 / 2.4.6 and [Enclosure 2.4.2.21](#).

10 - shows the bronze bushing having been inserted into the recovered steel bushing. The bronze bushing looks quite new, definitely not 141/2 years old because this bushing is the wear and tear component in the hinge system and should be exchanged after 10-12 years.

7 - shows part of the inside of the bronze bushing with deep scorings. Upon inspection it was ascertained that these scorings were extending over about 180°, although the bolt should move inside the (shranked) fixed bushing only over 90° in accordance with the movement of the visor. This means that the bronze bushing which should be fixed inside the steel bushing had been turning, i.e. had not been sufficiently fixed inside the steel bushing during the installation of new steel and bronze bushings.

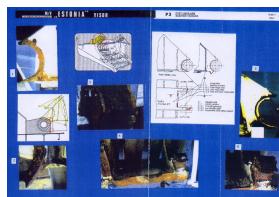
11/12 - show parts of the steel bushing with one of two fitting keys which were obviously installed to connect the bronze bushing and steel bushing - which confirms the above. This means that the fitting keys were installed to prevent the bronze bushing from turning inside the steel bushing, what it actually did - see photograph 7.

8/9 - show the outside and the inside of the securing plate which was found attached to the steel bushing. Measurements of the 4 holes drilled into the securing plate for the screws revealed that the diameter was smaller than the diameter of the holes drilled at newbuilding.

4/5 - show cuts of the starboard outer visor hinge plate of DIANA II for comparison purposes.

The following facts are considered to be established:

- (1) The recovered steel and bronze bushings as well as the securing plate are not original.
- (2) The welding seams between visor hinge plate and steel bushing are consequently also not original which is also confirmed by the weak dimensions.
- (3) The welding seams were cracked and an attempt had been made to close the cracks by welding which resulted in welding material penetrating through the crack into the much too big gap between the hinge plate and steel bushing.
- (4) The space between the hinge plate and steel bushing shows heavy corrosion which indicates that the welding seams had been cracked and penetrated some considerable time before the casualty and, consequently, the much too big space between hinge plate and steel bushing was exposed to the outside air and wetness.
- (5) The inside of the hinge plate was covered by deep burning marks whereas the outer surface of the steel bushing was unaffected. Consequently the old steel bushing had been burned out by flame-cutting. Each burning mark is a crack starter from where cracks propagated into the hinge plate material to various depth. This led to further weakening of the hinges and to a considerable reduction of the load carrying capacity.
- (6) Also the bronze bushing was installed rather unprofessionally and not shrunk in as it was done at newbuilding. - See the statements of G.Todsen - [Enclosure 2.4.2.21](#). After it was noted that the bronze bushing turned inside the steel bushing, fitting keys were installed - see further Subchapter 34.4.



(click for full page images)

**P 3 - Port Visor Arm - Sheet 1**

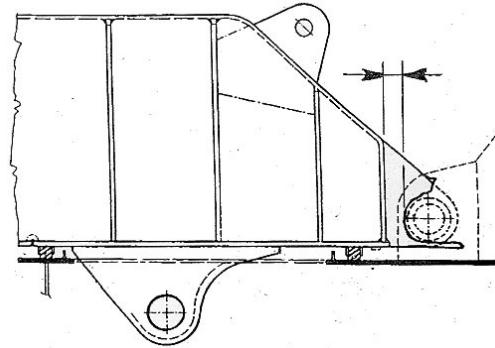
The overview drawing shows the area in question and 3 detail drawings demonstrate the damaged hinge plates. A further detail drawing shows the contact areas between the broken hinge plates and the hinge parts on the forecastle deck during the casualty sequence-of-events. Photographs 1-6 indicate the condition of the broken hinge plates.

In detail:

**Pictures:**

- 1 - shows the port outer hinge plate without any hammering marks at the upper and lower fracture areas, the inside without burning marks but still showing the circumferential drilling marks because at newbuilding the holes in the hinge plates were drilled by Meyer Werft - see Subchapters 2.4.2 and 2.4.6.
- 2 - shows the lower fractured part of the outer hinge plate which is evidently bent to starboard (this according to the metallurgist Prof. Hoffmeister was the last hinge part to break) - see Subchapter 34.4.
- 3 - shows the inner upper fracture area which evidently had been exposed to hammering.
- 4 - shows the lower part of the vertical face plate of the visor arm (visor arm lower closing plate) to which the hinge plates are welded. The lower parts of the outer and inner hinge plates can be seen as well. The hammering marks correspond to respective marks on the hinge parts on the forepeak deck - see Subchapter 29.2 - Sheet S 1 / P 1.
- 5 - shows both hinge plates looking from port to starboard, evidently the inner lower part was severely crushed together and bent downwards by heavy hammering.

**Note:** When measuring the distances from the vertical welding seams between face plates and hinge plates and the inside of the bores through the hinge plates it becomes evident that at the starboard hinge plates there is about 15 mm less material than at the port hinge plates. This means that the visor was misaligned at least by this distance of 15 mm in the forward / aft direction. See the drawing below.



This means that the distance between the 2 arrows above was 15 mm smaller at the starboard hinges compared to the port hinges. This was certainly one of the reasons why the starboard hinges broke first and the port hinges were holding for some time longer.

Consequently the following facts are considered to be established:

- (1) The port hinge plates were in a considerably better condition than the starboard ones. The outer one showed no burning but drilling marks, the inner one showed only slight indications of burning.
- (2) The inner hinge plate upper part showed minor, the lower part heavy hammering marks. The damage indicates several impacts.
- (3) The face plate showed two areas of hammering. The distance between both areas does not coincide with the distance between the hinge plates fitted on the forecastle deck. The port hammering mark is directly adjacent to the outer hinge plate indicating that the visor and vessel were heeled to starboard at time of contact.
- (4) The port outer hinge plate was the last one to fail.
- (5) The visor was misaligned in forward/aft direction by at least 15 mm.



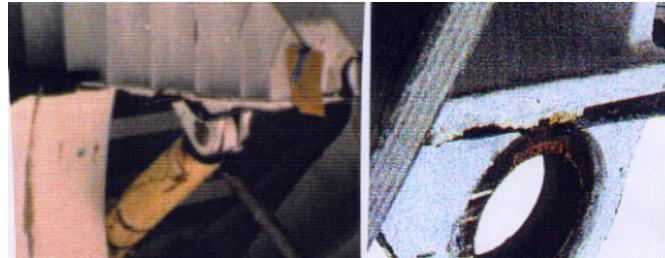
(click for full page images)

**P 3 - Port Visor Arm - Sheet 2**

The overview drawing shows the area in question. 2 detail drawings demonstrate the forward/aft movements of the visor after the hinges had failed and the resulting scoring/scraping marks at the lug plates, which are also indicated on 5 photographs.

**Pictures:**

1/2 - show the outer lug plate of the actuator underneath the visor arm which is evidently completely undamaged with the white paint untouched, which is confirmed by the two pictures below.



3/4/5 - show the opposite inner lug plate with very deeply engraved scraping marks, furthermore all three pictures show that the rubber packing, which is supposed to seal the opening for the actuator in the forecastle deck, is - contrary to the starboard side - torn and damaged.

This picture on the next page shows the damaged and torn rubber packing indicating movement of the visor without this side having been raised up.



The following facts are considered to be established:

(1) The outer lug plate is completely untouched while the inner lug plate shows very deeply engraved scraping marks. This means that at the time when the lug plates were cutting through the deck plating and the deck beam the vessel must have heeled already considerably to starboard. Therefore the centre of gravity of the visor had shifted from forward to starboard and the force direction was no more to forward/downwards but starboard/downwards. Thus the weight of the visor in athwartships direction was now carried by the inner port and the outer starboard lug plates because the locating horns gave no more transverse support as the visor had moved too much forward.

(2) As the lug plates underneath the starboard visor arm were both badly affected, the outside more than the inside, it must be assumed that the starboard hinges failed first. At that time the vessel was only slightly heeling to starboard but rolling and consequently both the inner and the outer hinge plates were affected. The port hinges remained intact for the time being. The starboard side of the visor moved - in slightly raised condition - forward/aft a couple of times when the vessel was still only slightly heeling to starboard and was rolling, whereafter the starboard heel increased considerably and also the port hinges broke. Only thereafter also the port lug plate started to cut first through the deck plating and then through the deck beams. At that time the heel to starboard must have been that big already that the outer port lug plate did not come in contact with the steel parts cut through by the forward parts of both lug plates - see the picture above.



(click for full page images)

**P 4 + S 4 - Port and Starboard Actuators (lifting cylinders)**

The overview drawing shows both actuators in as-found condition attached to the visor. 7 photographs demonstrate the condition of the actuators and its foundations, further photos are shown on the following pages.

In detail:

**Pictures:**

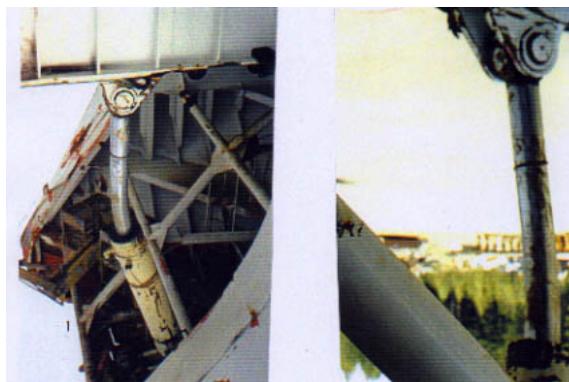
1 - shows the port actuator in jammed condition inside the inner longitudinal bulkhead of the visor. The spherical bearing of the actuator allows a 15° deviation to both sides. The actuator evidently swung into this jammed position after the visor had moved enough forward and after the bow ramp inside the visor was low enough. Thereafter the actuator remained in this position until being dismounted by MacGregor, Turku, in February 1995. The picture below shows the port inner bulkhead after the actuator had been removed.



Measurements revealed and photos confirm that the foundation of the actuator has not been in contact with the plating of the inner longitudinal bulkhead of the visor. Therefore the above visible indentations, scraping and scoring marks have been caused when the visor was hanging on the bow ramp. See also Subchapter 29.2 - The Bow Area - and P 7 further down in this subchapter.

1.1 - shows the piston rod of the port actuator which is deeply scored on the starboard side at a distance of 520-600 mm from the lug plates underneath the visor arm.

**Note:** The starboard actuator which the JAIC did not consider worthwhile for examination shows less scoring on the piston rod as can be seen on the pictures below.



from starboard side & from port side

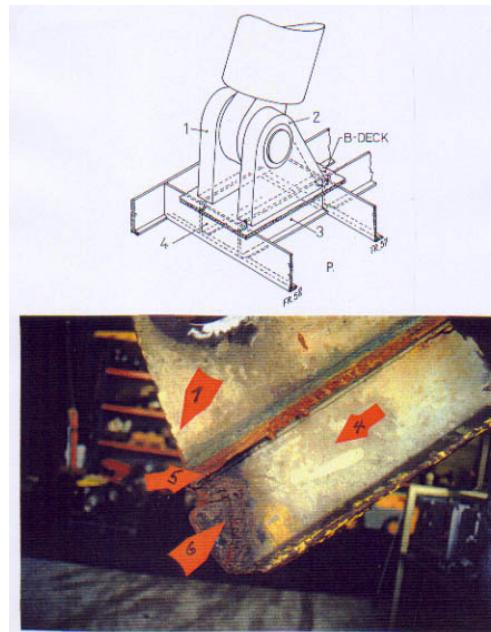
1.2 / 1.3 / 1.4 - show the foundation by which the port actuator should have been connected to B-deck. The pictures demonstrate that the foundation had been temporarily repaired and that the welding connection to B-deck had failed already before the casualty since parts of the welding seam were found to be cracked with oil inside the cracks. According to the observations of truck driver Per-Arne Persson this actuator had been burnt off by flame cutting completely sometime before the casualty and was reportedly not or only rather weakly rewelded to B-deck. See also Subchapter 12.5.

In consequence of this statement the photos showing the damage condition of this foundation have been analysed in detail and the result is outlined below: The foundation of the visor actuators did consist of two strong lugs welded to the B-deck and which were supported by two longitudinal and two transverse stiffeners. The picture below shows the port foundation with actuator still attached to the recovered visor. The arrows indicate the different components.



- arrow 1 = port outer lug plate of actuator foundation
- arrow 2 = port inner lug plate of actuator foundation
- arrow 3 = port inner stiffener (deformed)
- arrow 4 = port outer stiffener

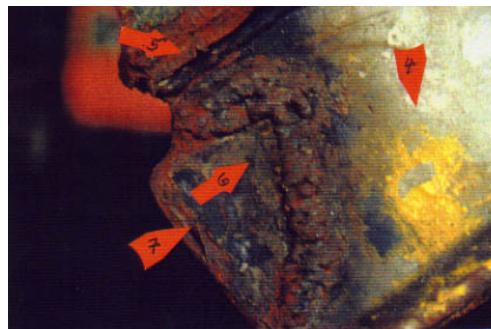
In undamaged condition the arrangement looks as indicated by the drawing below looking from aft to forward, whereby the numbers refer to the previous photo and to the photo below:



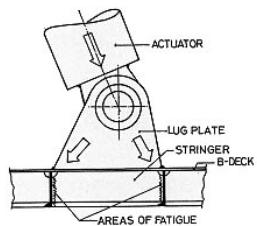
On the above photograph the reader looks on the lower part of the port outer lug plate (arrow 1), i.e. from port to starboard. Arrow 5 points to the remains of the B-deck, to which the port outer stiffener (arrow 4) is still welded. In the forward part of that stiffener an old temporary repair with very poor welding seams is visible (arrow 6). A close-up is shown below.



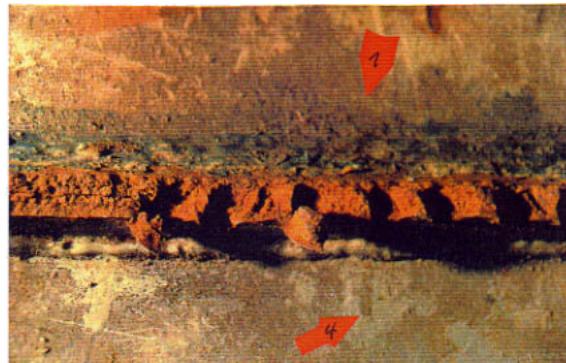
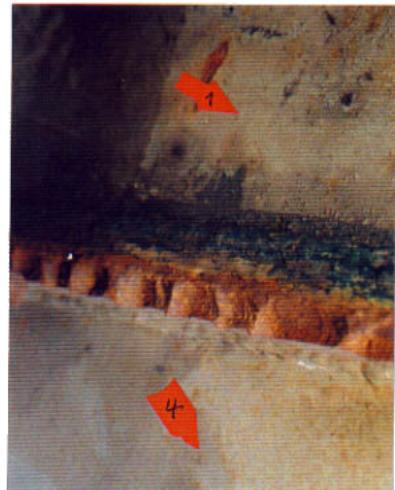
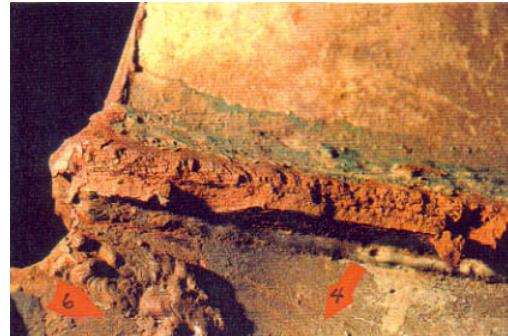
The lug plate (1) was obviously only partly connected to the B-deck as can be seen from the above photo when it was ripped off the B-deck (5) and only a small part connected by the welding seams (green paint) remained with the actuator foundation. The deck as well as the stiffener were pre-damaged - see Subchapter 34.4 - [Enclosure 30.417](#) - which is indicated by the damage repair, but also by the more or less straight cracking of the stiffener forward and aft of the lug plate, as can be seen on the following photograph.



Due to the relatively straight cracks (7) directly below the forward and aft parts of the lug plates, it has to be assumed that the stiffeners in way were affected by fatigue cracks. The cracks had developed during some considerable time before the casualty due to load changes during opening/closing of the visor and did most probably propagate more quickly during the last month before the casualty because of the increasing difficulties with the visor, especially with the port side. See Subchapter 12.4 / 12.5. The following drawing demonstrates the above.



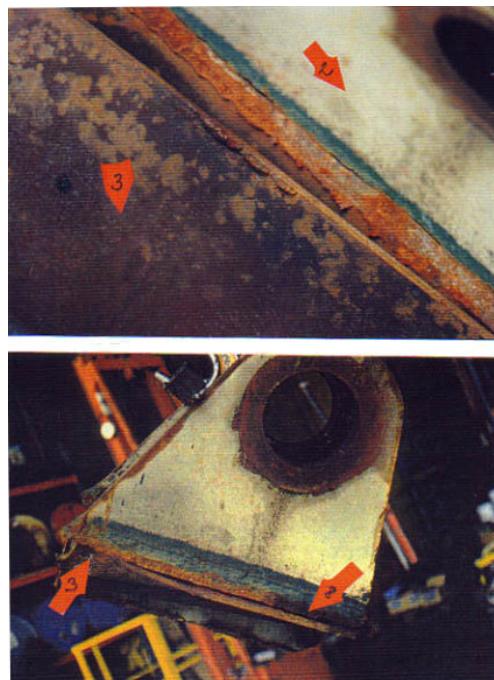
The following photographs indicate the condition of the B-deck in way of the port visor actuator foundation. The reader looks to the port outer lug plate and follows on the next 4 photos the ripped off B-deck remains from forward to aft of the outer lug plate. For easy reference the photographs are marked with the previously used arrow numbers.



The following photograph shows the actuator foundation after it was removed and taken to the workshop of MacGregor, Turku for examination/testing on behalf of the JAIC. The arrows show the same numbers as used above.



As it is obvious from the close-ups below, the stiffener (3) was hardly spot-welded and thus only slightly connected with the B-deck. As this part of the stiffener is not painted at all - see the next photo to which the reader looks on the port inner lug plate from starboard to port - it is no more original, i.e. has been installed subsequently when the vessel was trading already.



The following photograph shows the port visor actuator foundation after parts had been cut out for testing purposes. The foundation lies on its port outer lug plate. In the front the port outer stiffener (4) is visible, which is fully welded to the B-deck (5). Further at the forward right corner the old temporary repair with the very poor welding seams (6) is visible from inside. For cutting purposes the port inner stiffener (3) had been removed.



The apparent fact that this stiffener (3) had been disconnected from the B-deck (5) respectively since the last repair was never really fitted to it, is further confirmed by a part of the welding seam - see arrow 8 - on the previous two photos - apparently being soaked with oil while the stiffener below is unaffected. This means that this stiffener was not welded to the B-deck.

Consequently the following facts are considered to be established:

## contents

(1) The outer stiffener of the port actuator foundation shows an old temporary repair with very poor welding seems in its forward part. Due to the corrosion visible on the previous photos it has to be assumed that this improper repair was carried out already some considerable time before the casualty.

(2) The stiffeners show relatively straight cracks directly below the forward and the aft ends of the lug plates. Therefore it can be reasonably assumed that the stiffeners were affected by fatigue cracks and thus pre-damaged. The cracks had developed during some considerable time before the casualty due to load changes during the opening and closing of the visor.

(3) The B-deck was also affected by fatigue as already explained for the stiffeners. This fact is indicated by the condition of the ripped off deck remains.

(4) The port inner stiffener was no more the original one since firstly it did not show any protecting coating and secondly was only spot welded to the deck - if at all. All stiffeners were however fully welded to the deck by the shipyard during new-building, as it can still be seen on the starboard actuator foundation.

(5) The load carrying capacity of the port visor actuator was considerably reduced.

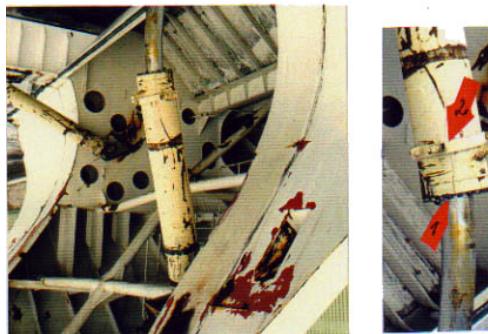
There is, however, another remarkable difference between the condition of the port and starboard actuators, viz.  
- MacGregor, Turku has examined the port actuator upon instructions of the JAIC and found among other things that

*"... it was noticed that there were heavy damages at the distance when the piston rod is about 400 mm open. The damages were on the starboard side of the piston rod. Damages were also noticed on the piston cover's fixing screws. The ends of these hexagon screws were like hammered." (See [Enclosure 29.413](#))*

The picture below demonstrates the above.



This is different at the starboard actuator as can be seen from the pictures on the next page with close-up of the area of interest. The arrow 1 points to the hexagon screws looking absolutely identical and which are evidently not hammered at all. Arrow 2 points to a clamping ring in apparently undamaged condition which had obviously not been exposed to hammering or otherwise heavy contacts. The differences between the external conditions including the hexagon screws of the port and starboard actuators can be explained as follows:



- **The port actuator:** Cover and hexagon screws on the piston rod side are severely hammered. The clamping ring is missing. The outside of the actuator shows heavy longitudinal scoring marks. The piston rod shows heavy damage on starboard side at a opening stage of ca. 400 mm.

The MacGregor Report - see [Enclosure 29.413](#) - concludes:

*"By the a.m. report we can see that the lifting cylinder has been opened at least about 400 mm and there has been very high pressure on the piston rod side."*

This means that it was tried manually to hold the visor down by hydraulic pressure on the piston rod side.

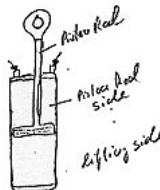
- **The starboard actuator:** Cover and hexagon screw on the piston rod side were not affected at all. The clamping ring was still attached to the piston and apparently completely unaffected. The actuator shows only very few external scoring marks - see picture above. The piston rod shows some scoring marks but no particular damage, certainly no heavy damages on the starboard side as can be seen on the piston rod of the port actuator. The scoring marks on the piston rod may have been caused at any time during the long process of separation from the vessel. This does not allow the conclusion that the lifting cylinder had been opened when the actuator was still attached to B-deck, i.e. that the visor opened to some extent, although this has to be assumed because of the unaffected rubber packings around the actuator opening - see above.

Consequently the following facts are considered to be established:

(1) The port actuator was found in subtracted condition although having been pulled off B-deck and through the front bulkhead by the forward moving visor. Thus it must have been under pressure at or just before the time of the casualty, most likely because the crew was trying to hold down the visor by the actuators but the port one broke off due to the poor connection to B-deck.

(2) This was confirmed when the port actuator was dismounted and examined by MacGregor, Turku who found that "the lifting cylinder had been opened at least 400 mm and that there had been very high pressure on the piston rod side".

This means pressure from upside to downside, which would be used to hold the visor down hydraulically.



(3) The port actuator was obviously pulled through the port front bulkhead of the vessel when it was still intact - see also Chapter 29 - P 4 - by the forward moving visor, the cylinder cover with hexagon screws on the piston rod side being the thickest part with direct contact to bulkhead and internals during the breaking through process. Therefore cover and screws show severe hammering marks and the clamping ring is missing which was probably stripped off the piston when it was pulled through the bulkhead. Also the damage picture of the port front bulkhead - see P 4 in Chapter 29 - does confirm the above because only a metal strip with the approximate breadth of the actuator was clearly cut out of the bulkhead plating and rolled together at the lower end.

(4) Evidently all this was not the case with the starboard actuator, viz. piston cover and hexagon screws show no sign of hammering or any other damage, the clamping ring is in place, the actuator hardly scored. Obviously this piston had not been pulled through the starboard front bulkhead when it was still intact, but when the actuator was pulled through the front bulkhead by the forward moving visor this bulkhead was already open - see Chapter 32 - and therefore the actuator could easily slip through the wide opening - see also Chapter 29 - S 4.

(5) The piston rod of the port actuator shows severe damage on the starboard side at an opening stage of about 400 mm which indicates that vessel and visor were heeled to starboard when the piston rod was extended by 400 mm.

(6) Similar damage cannot be traced at the piston rod of the starboard actuator.

(7) The foundation of the port actuator had been temporarily repaired in a poor and unprofessional way without informing, thus without approval, of the class. It was furthermore cut off B-deck at some time before the casualty and apparently refitted improperly to B-deck which explains its early failure.

(8) The foundation of the starboard actuator was apparently properly connected to B-deck and broke only after having been exposed to considerable additional forces. - See Chapter 32.



(click for full page images)

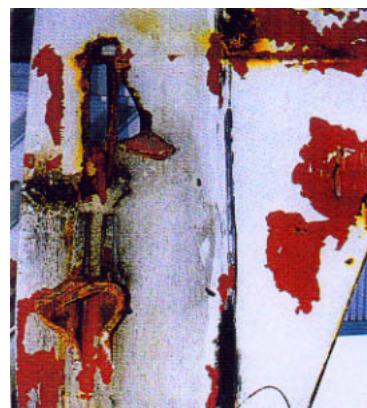
#### S 5 - Starboard Aft Bulkhead

The overview drawing shows the area of interest and arrows point to the items to be demonstrated by 7 photographs.

##### Pictures:

1 - shows the starboard aft bulkhead of the visor in total with the opening in the plating, to where the lug of the hydraulic side lock has been welded, further the bent hooks of the manual side lock. A further damage - see arrow and picture 1.3 - was probably caused by the foundation of the starboard actuator after having separated from B-deck.

2, 3 - show the area of the missing side lock lug and the considerably bent hooks of the manual side locks from the top and from the side. The side view shows that the area in way of the pushed out steel tongue - see arrow 1 - is bulged outwards indicating pressure from inside to outside, whereas the plating between the hole for the lug and the hooks shows smoke marks, which are explained in Chapter 32. Around the opening for the lug burning/welding marks from the cutting off and the subsequent rewelding of the lug are visible. The following picture has been taken from the JAIC Report and clearly confirms the above.

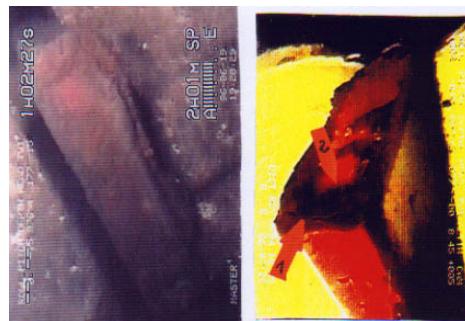


The picture below taken on 23.11.94 shows the lower part of the starboard aft visor bulkhead including the area under discussion looking downwards which is obviously very dark.



**Note:** According to the observations of previous passengers, for example truck driver Torbjörn Cederqvist - see [Enclosure 12.4.3.157](#) - Subchapter 12.4 - both lugs had frequently been burned off when the crew was unable to open the side locks hydraulically upon arrival in Tallinn. Obviously they were subsequently rewelded to the same location.

It is also obvious from the condition of the starboard lug as can be seen from the two video images of the corresponding lug still attached to the bolt on the wreck that the lugs had been repeatedly cut off and rewelded.



The very thick welding seam on the lower part - see arrow 1 - is actually a build-up of several welding seams, i.e. weld on top of the previous weld without grinding away of the remnants. It is obvious that the bulkhead part attached to the lug - see arrow 2 - had not been torn out of the bulkhead during the casualty scenario but much earlier because, due to the thickness of the accumulated welding seams, this original part of the visor bulkhead (Viking Line colour) could not come in contact with the adjacent visor plating. Consequently, it has to be assumed that each time the lug was cut off by burning it was just stuck into the respective hole in the bulkhead and welded from both sides, if at all - see also Chapter 29 - S 4.

The next pictures - also taken from the JAIC's Report - show the upper parts of the holes in the visor bulkheads where the lugs had been fitted.



The analysis and comparison of both pictures reveal the following:

(1) The plating around **the port** holes is unaffected. Some remains of welding seams are visible at the upper right corner and at the right (inside) there are indications that welding seams could have been there. At the outside (left side) there are no such indications which refers also to the upper hole. Only few spots of corrosion can be seen. In summary it has to be assumed that the lug had not or only to a very limited extent been welded from the outside.

(2) The plating around **the starboard** opening looks completely different because the plating is distorted, the stiffener at the inside is torn off the bulkhead, the plating had apparently been exposed to heat and subsequently became corroded. The steel part between the small hole and the bigger opening was pushed upwards, obviously by the lug then and still attached to the vessel, i.e. the visor made a downward movement in relation to the lug, i.e. the vessel. Thereby the lug was pressed into said steel part. The indication of the remnant of a welding seam is visible at the upper right corner of the big opening. Otherwise there are no indications of welding seams at all.

(3) The lugs of the visor's side locks were obviously not welded to the plating, but there were permanent holes in the plating of both sides through which the lugs were stuck and welded from the inside only. Thereby it was possible to adjust the part of the lugs extending the plating to the length required by the ever changing misalignment of the visor.

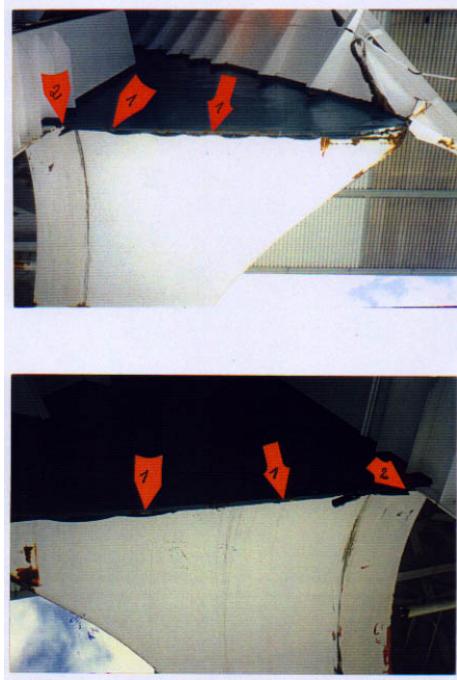
The discussion of the pictures on Sheet S 5 is continued:

#### Pictures:

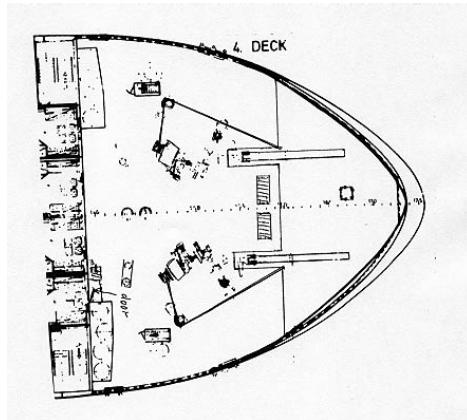
4 - shows the lower aft part of bulkhead/bottom in severely damaged condition which will be explained in Chapter 32 as the port is unaffected.

5, 6, 7 - show the upper part of the aft bulkhead with the forecastle deck and the recess - see arrows - apparently affected by the visor moving forward / aft after the visor hinges were broken and the vessel already had a starboard list.

In addition, attention has to be drawn to both aft parts of the visor deck shown on the two pictures overleaf. The corroded areas indicated by arrow 1 on both sides have been the spots where the visor had been welded to the vessel at the time when the bushings of the starboard visor hinges were renewed. This was the time when ESTONIA berthed in Tallinn stern first - see the statement of Torbjörn Cederqvist - Enclosure 12.4.3.157 and Subchapter 12.4.3 - the cars left the ferry via the stern ramps instead of the bow ramp as it is normally the case in Tallinn.

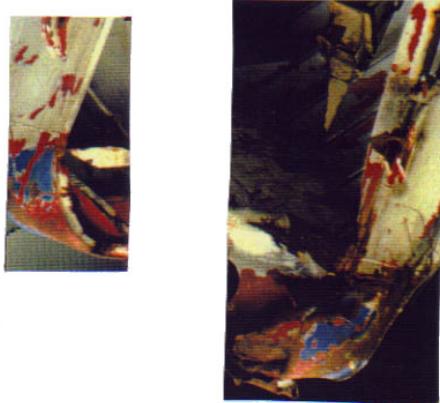


Arrows 2 on both sides indicate the corner between visor deck/aft bulkhead and visor arms along which the rope was running by which the bow ramp was kept close as tight as possible. The drawing below show the forecastle deck with the two winch drums by which the rope was heaved tight and the two fairleads around which the rope was running.



Consequently the following facts are considered to have been established:

- (1) The lug of the hydraulic side lock had been cut off and rewelded only from the inside several times without grinding off the remnants of the previous welding seams. This led to a build-up of thick welding seams, which reduced the load carrying capacity of this lock to a fraction of the original.
- (2) The plating around the pocket for the locating horn was unaffected.
- (3) The area around the lug of the side lock was pushed out, is distorted and was exposed to heat.
- (4) The area between the initial lug location and the bent hooks show intense smoke marks.
- (5) The lug separated from the visor bulkhead when the visor was in a forward/downward movement.
- (6) The hooks were crushed together in such a way which cannot be explained mechanically.
- (7) The bottom end of the aft bulkhead is partly crushed, partly torn and on the outside a deep fold in way of the contact area with the rubber packings of the corresponding front bulkhead of the vessel extends from the area of the lug down to the bottom area. - See the right picture on the next page. The corresponding area on the lower part of the port aft bulkhead of the visor, as can be seen on the left picture on the next page, is apparently undamaged.



(click for full page images)

#### P 5 - Port Aft Bulkhead

The overview drawing on sheet P 5 shows the area in question on which 8 arrows point to the areas of interest. 3 detail drawings demonstrate the as-built and as-found conditions of the flatbars with rubber packings underneath the attents of the visor deck which was overlapping the forepeak deck. The condition of the port aft bulkhead is explained by means of 8 pictures on the sheet and some additional photos incorporated into the text.

In detail:

#### Pictures:

3 - shows the port aft bulkhead as a whole with no damage except the punched-in plating below the pocket for the locating horn - see picture 4 from the outside and **picture 5** from the inside. The damage picture indicates several contacts between visor plating/locating horn which are only possible if either the hinges are already broken and the visor was raised by ca. 100-150 mm only, or if the visor was misaligned by this distance, which it was during the last month before the casualty - see the statement of Bo Pettersson, Enclosure 12.4.3.157.1, and Subchapter 12.4.3.

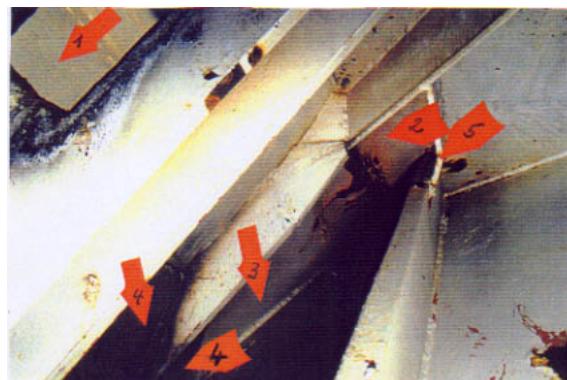
According to the observation of Bo Pettersson the port outer edge of the visor was extending the forecastle deck to such an extent that he could see the water through the gap. He estimated the difference between visor and forecastle deck to have been about 100 mm. Although crew members hammered with sledge hammers on the edge, the condition did not change and they gave up.

The image following shows the area in question. The arrow indicates where the crewman was hammering.

The consequences of such a vertical misalignment between port and starboard in combination with a forward/aft misalignment, as explained on the previous pages, are grave because nothing fits anymore as will be explained in the following:



(a) The locating horn does not reach its pocket anymore and caused damage to the plating below - see picture 4 - which was tried to be rectified by welding doubler plates - see picture 5 - below the holed plating and the picture below.



arrow 1 = opening cut around the holes where the lug had been located  
 arrow 2, 3, 4 = doublers fitted  
 arrow 5 = buckled bracket

The fitted doublers and the buckled bracket points to an area exposed to high stresses and apparently also to damage which has certainly to be seen in connection with the severe misalignment of the visor.

**Note:** When the visor was examined by members and consultants of this 'Group of Experts' the JAIC was asked for permission to remove the doublers to see what is below. Permission was, however, not granted.

(b) The visor deck plating (arrow 1) of the edge with the visor arm (arrow 2) is cracked - see picture 2 and comments on the previous pages.

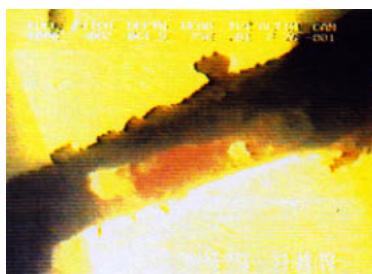
(c) The flatbars housing the rubber packings below the recess of the visor deck extending to the forecastle deck were hammered flat - see the drawing between pictures 1 and 2.

(d) The starboard locating horn and the pyramid on the forepeak deck do fit into their pockets only with difficulties (visor was opened/closed frequently - see Subchapter 12.4 - before the pyramid fitted into the pocket).

(e) In summary it must have been very difficult to close the visor and even more difficult to lock the locking devices and open them subsequently. It has been confirmed by many previous passengers that the crew was unable to open the locking devices, neither hydraulically nor by force - see Subchapter 12.4 - and then the next step was to take the burning gear and cut off the lug. Subsequently the lug was rewelded time and again and apparently only from the inside of the visor but always without grinding off the old remnants, in other words: totally unprofessional.

This confirms the observations of passengers on previous voyages - see Subchapter 12.4 - that the lugs of the side locks were frequently cut off by means of burning gear when the crew were unable to open them.

The following image shows the lug attached to the bolt inside the vessel before it was pulled out by the diver. Contrary to the starboard side this lug rested inside the bulkhead as visible, although it was on the high port side.



The next image shows the same lug after having been pulled out by the diver. Arrow 1 indicates the very thick accumulation of welding seams and arrow 2 indicates the bulkhead part torn or cut out at some time before the casualty.



The hooks for the manual side lock were just bent together, as can be seen on the picture on the next page. The area around the lug location shows burning marks obviously from cutting off the lug by flame cutting - see arrow - but no smoke marks as on the starboard side and the plating was not pushed out/distorted.



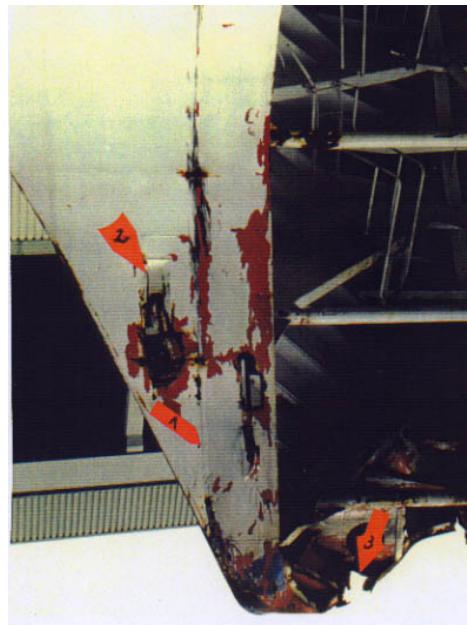
The commenting of the pictures on Sheet P 5 is continued:

#### Pictures:

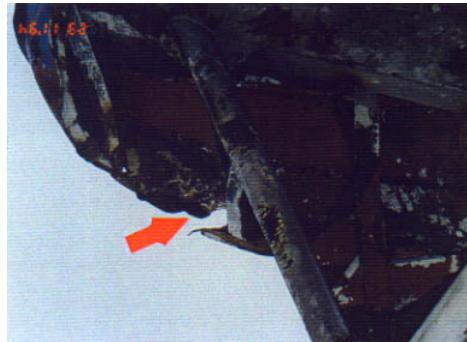
7 - shows the rubbing marks from the rubber packings at the vessel's front bulkhead which are straight in the upper part and slightly irregular in the lower part. The picture on the next page shows the lower port aft bulkhead. It becomes evident that the area below the pocket for the locating horn does not show any rubbing marks - contrary to the starboard side - which leads to the conclusion that the rubber packings at the front bulkhead of the vessel were missing also in this important location - see arrow 1.

The pressure mark of the locating horn inside the pocket - see arrow 2 - indicates pressure on the visor from port to starboard, which is a further indication for the severe misalignment of the visor.

Arrow 3 indicates a damage apparently caused when the visor fell off the bow ramp in the final stage when the heel of the vessel was already 120°/130° to starboard. This will be further explained in the following item 6 - The Visor Bottom.



8 - shows the lower aft bulkhead/visor bottom which is only moderately damaged compared to the starboard side - see also the picture below.



The arrow points to a damage to the port aft edge of the visor bottom which apparently occurred when the visor moved transversely from port to starboard. This will be explained in Chapter 31 - The Casualty Scenario. See also picture 5 on the following Sheet 6.

1 - shows the upper part of the aft bulkhead with the moderately affected recess which has already been discussed at the beginning of this item. The picture on the next page shows the recess as enlargement with damage at the edge of the shell plating - see arrow - which obviously occurred when the visor was moving in the transverse, i.e. athwartships, direction. - See also Chapter 31 - The Casualty Scenario.



2 - shows the corner between forecastle deck and visor arm - see the arrow 1 on picture 1 and the arrows 1 and 2 on the close-up - picture 2 - which were discussed already at the beginning of Sheet P 5.  
Evidently something solid had been underneath this corner when the visor was closed which caused the deck edge to crack and to be bent upwards.

The following facts are considered to be established:

- (1) Due to the vertical misalignment of the visor the port side of the visor was raised by 100 or more mm which made it impossible for the locating horn fitted at the port front bulkhead of the vessel to enter the mating pocket of the visor. Instead contact occurred in the area below the pocket - as the visor was raised - and the plating became damaged.
- (2) The crew fitted several doublers and support brackets in way to compensate for the stress created by the misalignment.
- (3) The lug of the hydraulic side lock including the plating part to which it was welded had apparently been cut off and rewelded several times without grinding off the remnants of the previous welding seams. This led to the very thick welds with substantially reduced load carrying capacity of the side locking device of the visor.
- (4) The rubber packings in way of the area below the pockets for the locating horn were either missing at the front bulkhead of the vessel or had not been in contact with the corresponding parts of the visor bulkhead due to misalignment.
- (5) The area around the location of the lug of the hydraulic side lock is not pushed out, nor do smoke marks exist.
- (6) The hooks of the manual side lock are just slightly bent together.
- (7) The recess at the upper part of the port aft bulkhead of the visor was damaged when the visor was moving transversely respectively athwartships.
- (8) The lower part of the aft bulkhead is not affected.
- (9) The plating between forecastle deck and visor arm is cracked and the steel pads protecting the rubber packings were hammered flat by crew members attempting to lower down the port side of the visor which was extending the forecastle deck of the vessel by 100 mm or more.



(click for full page images)

#### 6 - Visor Bottom

The overview drawing indicates the area in question in yellow and 6 arrows point to the area to be explained, viz.

- 1 - The general condition of the bottom
- 2 - The stempost area
- 3 - The pocket for the locating horn
- 4 - The contact area of resting pads (from the forepeak deck)
- 5 - The lug of the Atlantic lock
- 6 - The outer port edge

Detail drawing D1 explains the misalignment of the visor in forward/aft direction, D2 the indented visor bottom and D3 explains the way the visor lug of the Atlantic lock was bent. 3 pictures demonstrate the condition of this lug, 3 others the condition of the visor bottom and 2 further pictures show the inside of the pocket in the visor bottom to take-up the pyramid on the forepeak deck when the visor was closed.

**Note:** This pocket was the mating part of the locating horn - the pyramid - on the forepeak deck. The pyramid guided the visor in transverse direction which became increasingly difficult during the last month before the casualty.

In detail:

#### Pictures:

6 - shows the pressed in visor bottom with the pocket for the locating horn (pyramid) - see arrow 1 - the gap in the stempost area - arrow 2 - the visor lug - arrow 3 - and the damage caused by the pyramid after the visor had moved to starboard - arrow 4.

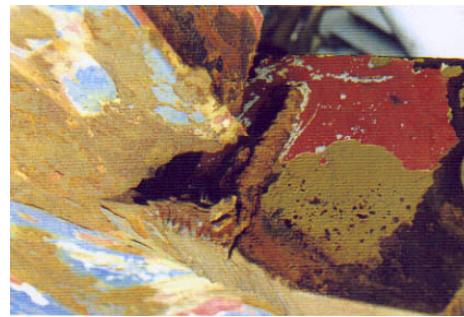
In the opinion of this 'Group of Experts' the bottom had been held back by the Atlantic lock until it finally also broke when the visor fell to starboard until it rested on the bow ramp. - See Chapter 31. - It is also obvious that the visor had overlapped the forepeak deck considerably to the effect that the forepeak deck had penetrated the inside of the visor bottom up to ca. 0.5 m. This must have given the visor the main support against falling off to starboard, because the bow ramp alone could not have carried the entire weight of the visor after the Atlantic lock had failed. - See Subchapter 34.5. - The damage picture of the strong ice strengthened hull plates on both sides of the collapsed stempost do confirm the above. See arrow 2 and also Chapter 31 - The Casualty Scenario.

7/8 - show the inside of the pocket for the locating horn on the forepeak deck - the pyramid - with contact marks of different depth at port and starboard side - see arrows 5/6. The scoring marks enlarged on picture 8 indicate visor movements from starboard forward to port aft whereby the pyramid only came in contact with the aft half of the pocket due to the extensive misalignment of the visor as demonstrated by the detail drawing D1 - on Sheet 6.

4 - shows the deeply pressed in visor bottom as indicated on detail drawing D2 on the Sheet 6 with the stempost folded backwards - see arrow - and the respective gap in the shell plating created by contact with the ice knife on top of the bulbous bow.

5 - shows a very sharp damage to the port aft edge of the visor bottom which probably occurred due to contact with the bow ramp when the visor moved transversely, i.e. athwartships in the final stage of gliding off the bow ramp and forepeak deck. - See also Sheet P 5 and Chapter 31.

1 - shows the visor lug being part of the Atlantic lock. Arrow 1 points to the previously burnt off part of the lug with cracks propagating from burning marks (arrow 2). The lug apparently became twisted to starboard when the visor moved abruptly to starboard until its port inner bulkhead rested on the port side of the bow ramp. The deep crack in the bottom of the visor to port of the lug confirms this. It further indicates that the visor lug was about to crack off the visor bottom when the lugs on the forepeak deck failed first. This is underlined by the impressive picture below indicating an upwards and to starboard movement of the visor when this big crack propagated and came to a stop when the lugs on the forepeak deck failed.



2 - demonstrates the elongation of the lug which is partly due to wear over 141/2 years and partly due to manipulation by Christer Koivisto already in 1982 - see Chapter 12.4.

3 - shows the yellow basic primer - see arrow - used in the whole foreship area by the Yard during newbuilding.

**Note:** The basic primer of the starboard lug of the Atlantic lock was analysed on behalf of the JAIC and found to be grey.

The following facts are considered to be established:

- (1) The visor bottom had overlapped the forepeak deck which penetrated deeply into the bottom structure of the visor which supported the visor during the increasing heel of the vessel.
- (2) The gap in way of the collapsed stempost of the visor was caused when this part fell on top of the ice knife on top of the bulbous bow. The very strong ice plates consequently bent up to both sides of the collapsed stempost provided further support to the visor and also prevented its falling off to starboard.
- (3) The scoring/scraping marks inside the pocket for the pyramid do confirm the vertical and forward/aft misalignment of the visor.
- (4) The very sharp damage at the port aft edge of the visor bottom was caused when the visor moved athwartships in the final stage of gliding off the bow ramp, the forepeak deck and finally the bulbous bow to the bottom of the sea.
- (5) The visor lug of the Atlantic lock almost cracked off at the bottom when the visor moved forwards and to starboard, however, then the lugs of the forepeak deck broke first and the crack propagation stopped.
- (6) The visor lug was considerably elongated due to wear in 141/2 years of exposure to changing loads and the manipulations by Christer Koivisto.
- (7) The basic primer of the visor lug is yellow which is an indication that it is still the original lug as the initial primer at newbuilding was of such colour. See also Subchapter 2.4.6. The basic primer of the starboard lug of the Atlantic lock was found to be grey by the JAIC which is a further confirmation that this as well as the other two lugs were not the original ones anymore.
- (8) The stempost was cracked 4 times well before the casualty and the crack had penetrated the stempost up to 50% of its thickness at the time of the casualty.



(click for full page images)

#### P 7 + S 7 - Port and Starboard Inner Longitudinal Bulkhead

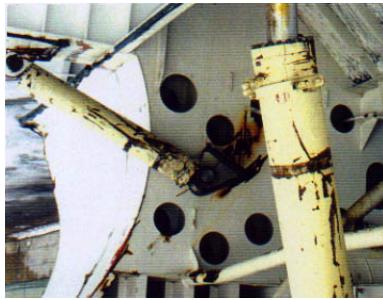
The so much different condition of both bulkheads is demonstrated by 2 photographs each which are explained as follows:

##### Pictures:

1 / 2 - show the port inner longitudinal bulkhead with scraping/scoring marks at the lower aft part - see arrow 1 - and very deep indentations with the steel plating partly torn - see arrow 2 - and enlargement picture 1.1. The picture below shows that the plating was actually pressed into the bulkhead up to 120 mm.



It is quite obvious that these deep indentations cannot have been caused when the port actuator was swinging inside the longitudinal inner bulkhead (due to the existing starboard list of visor and vessel) and got jammed there, as evident from the picture below.



After the actuator had been dismounted by MacGregor, Turku in February 1995 the area looked as it is shown by the following picture. Arrow 1 indicates the area at the edge of aft and inner bulkheads where the aft bulkhead is slightly extending the inner bulkhead and where metal parts were torn off when the actuator moved into its jammed positions. A detailed evaluation of this and other pictures did reveal that neither the actuator nor its foundation had come in contact with the bulkhead which is due to the angle between the fastening point at the lugs below the visor arm and the bulkhead edge. The actuator was able to swing into this position because of its spherical bearings which allow deviation of up to 15° to each side.



It is thus proven with sufficient certainty that the severe damage as well as the scraping and scoring marks were only caused by the bow ramp then lying inside the visor on the beam structure and the visor resting on the bow ramp in way of the damage area under discussion. This shall be explained in more detail in Chapter 31 - The Casualty Scenario.

The picture below shows the port inner side of the visor with the slightly damaged frames at the port aft part of the ramp house. The upper part of the longitudinal bulkhead is completely unaffected. The scorings and the deep indentations and deformation (arrow 2) are restricted to the middle part, and, in the foreground, the vertical beam which had been in contact with the upper part of the ramp with the folded flap in between is visible (arrow 1).



1 / 2 - show the completely intact and untouched starboard inner longitudinal bulkhead which - due to the starboard heel - remained obviously unaffected even during final separation of visor and bow ramp which will be explained in Chapter 31 - The Casualty Scenario.

Consequently the following facts are considered to be established:

- (1) The upper and the lower parts of the port inner bulkhead of the visor are completely unaffected, the middle part however is very severely scraped, indented and cracked which was caused by the bow ramp when the visor was resting on it.
- (2) The above-mentioned damage was exclusively caused by the bow ramp, the port actuator has not been in contact with the bulkhead plating.
- (3) The opposite starboard inner longitudinal bulkhead is completely unaffected, thus there has been no contact with the bow ramp.
- (4) The above explained severe damage at the port inner longitudinal bulkhead in connection with corresponding damage at the port bow ramp - see Subchapter 29.2 - The Bow Area - and witness evidence - see Enclosures 29.6.414 / 29.6.415 - confirms that the visor had been resting on the bow ramp which caused the damage to the port inner bulkhead.
- (5) Due to the absence of damage/scorings forward and aft of the existing damage approximately in the middle of the port inner bulkhead it has to be assumed that the visor fell off the bow ramp / forepeak deck towards the starboard side by force of gravity once the heel was sufficient, i.e. 130°/140°.



#### 8 - Internal Structure

The overview drawing indicates the area of interest, i.e. the 3 transverse - and the 2 vertical beams called pipe girders on the overview drawing. 5 arrows point to the areas to be explained. The explanations are assisted by 2 detail drawings - Nos. 3 and 8 - and 7 photographs.

In detail  
Pictures:

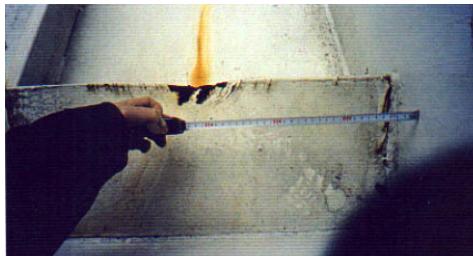
1 - shows the view into the visor inside with the 1st stringer above and the 2nd stringer below, the port and starboard longitudinal bulkheads in their respective conditions and the vertical beam as well as the cross-beams. Arrow 2 indicates the area on the vertical beam which took the main weight of the ramp. Arrows 1 and 3 indicate the damage respectively scoring marks on the cross-beam which cannot have been caused by the bow ramp at the early stage, because there is no corresponding damage at the ramp and, also, the lower parts, being almost at the underside of the beam, are unreachable for the bow ramp under any condition.

The explanation for these marks respectively damage on the cross-beam on both sides can be seen on the drawing 3., i.e. contact with the bell cranks on both sides at the top of the ramp already before the casualty when the visor opened/closed due to the slightly open and misaligned ramp (could no more be properly closed) and the misaligned visor. In particular the port bell crank is damaged very severely which was, of course, mainly caused by the contact with the port inner bulkhead of the visor. On the other hand, it has to be assumed that this already existing damage was exaggerated when the ramp was inside the visor and the visor hanging on the ramp.

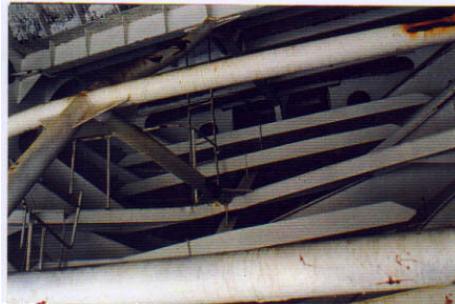
2 - shows the lower inside of the visor with the lower transverse beam in way of the 3rd stringer. This beam was found to be very severely scored and scraped, which was most probably caused during the lifting operation. The picture also demonstrates the very severely set up visor bottom which is underlined by the close-up No. 10 and explained by detail drawing No. 8. There are two further contact marks in way of the deck beam at the lower forward part of the ramp house, viz. in the most port and most starboard frame spaces, which were evidently also caused by the bell cranks of the ramp when the visor moved further forward and downwards and the vessel was already severely heeled to starboard already. See also sheet 2 - The Ramp House. The picture below indicates the short distance to the port bulkhead because of the starboard heel.



The picture below shows the starboard side with the longer distance to the starboard bulkhead also due to the starboard heel of visor and vessel.



The two pictures below show the damage to the top and port side of the vertical beam.



Consequently the following facts are considered to be established:

- (1) The upper cross-beam shows damage at two locations on the port side which cannot have been caused by the bow ramp, because there was no corresponding damage at the ramp.
- (2) The damage on the port side of the upper cross-beam and the scraping marks on the starboard side were caused during opening/closing of the visor by the bell cranks fitted on both sides at the top of the bow ramp.
- (3) The damage to the vertical beam was caused when the ramp was resting inside the visor on this beam with a flap in between. This flap in the centre line of the ramp is heavily damaged.
- (4) The vertical beam as well as parts of both sides of the 2nd stringer and the adjacent frames are thickly covered with hydraulic oil. It has not been possible so far to verify from where this oil originates and what caused this quite substantial spill.
- (5) There are two contact marks at the deck beam below the forward part of the ramp house, one at the starboard and one at port. The port one is closer to the adjacent bulkhead than the starboard one indicating that the contacts occurred when the visor was heeled to starboard and resting on the bow ramp. The contacts occurred with the bell cranks of the bow ramp when the bow ramp was pushed upwards.



(click for full page images)

9 - The 3rd Stringer The overview drawing shows the area in question which is explained by 1 detail drawing and 8 photographs.

In detail:

**Pictures:**

1 - shows a view into the port lower side of the visor with the 3rd stringer, the vertical and transverse beams and the set-up visor bottom. Arrows 1 are pointing to the different watermarks which indicate the heights of water inside the visor at different times and outside water level heights. Arrows 2 are pointing to the buckled frames which indicate that the whole stringer is set up. Investigations have revealed that this damage is of old origin. Arrows 3 indicate the oil on the stringer with the very clear footprints all over the stringer.

2, 3, 6, 7 - are detail photos from the above.

6 - shows that the fore part of the 3rd stringer is apparently severely oil stained and picture 5 shows the area at a later stage and better illuminated. Apparently the hydraulic oil floating on top of the water inside the visor and which settled down on the stringers and elsewhere when the water flowed out of the visor accumulated in the forward part of the 3rd stringer - see arrow 4, apparently because this part of the visor was deeper than the aft part which must have been the case for a longer time already because the brackets at both sides of this area (arrow 4), which are indicated by arrows 5, are white and not oil stained. - See also Subchapter 12.4.3.

4, 8 - show the visor bottom which has been commented already.

Consequently the following facts are considered to be established:

- (1) The visor's fore part had been lower than the aft part since some considerable time before the casualty which is another confirmation for the severe and increasing misalignment and deformation of the visor.
- (2) The port area of the 3rd stringer was severely set up with the frames buckled since some time before the casualty probably the ice winter 1994 when the vessel frequently forced ice. This damage extended up to the 2nd stringer and into the adjacent frames and brackets.
- (3) The visor had always been full of water to the outside level when the vessel was at sea. See the photo below.
- (4) The hydraulic cylinders/pipes were leaking which caused hydraulic oil to swim on the water surface inside the visor which settled down once the water left the visor.
- (5) People had been very active inside the visor, in particular on the 3rd stringer. The majority of the footprints are fresh and not covered by oil, thus originate from the time before arrival and after departure Tallinn on September 27, 1994.



## CHAPTER 31

### THE CASUALTY SCENARIO

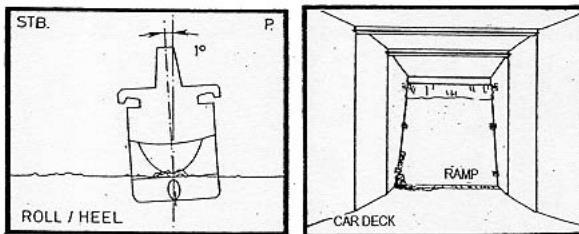
It is nearly impossible to reconstruct the exact casualty scenario, in particular because the key witnesses from the crew did not yet tell the truth. In order to get as close as possible to reality a sequence-of-events has been developed which is based on

- (a) the observations and the noise scenario according to the survivors' statements as explained in Chapters 20/21 and
- (b) the damage to wreck and visor as outlined in Chapters 29/30.

Also the condition of the ESTONIA upon departure from Tallinn - see Chapter 19 - and the apparent fact that the ferry was still in normal condition when she was observed by the Polish Ro-Ro vessel AMBER at about 23.30 hours were taken into consideration as were the positions and conditions of wreck and visor.

This sequence-of-events has been reconstructed by means of a model of the damaged foreship including the bow ramp and the damaged visor. Photos made of the decisive stages are incorporated into the casualty scenario on the following pages, which has been amended by drawings whenever considered necessary.

The scenario starts with the condition of the ferry upon departure from Tallinn at about 19.30 hours on the 27th September 1994. The departure condition is demonstrated by drawings and text below.



**Visor Locking Devices:** Atlantic Lock / hydraulic side locks engaged, manual side locks - not engaged

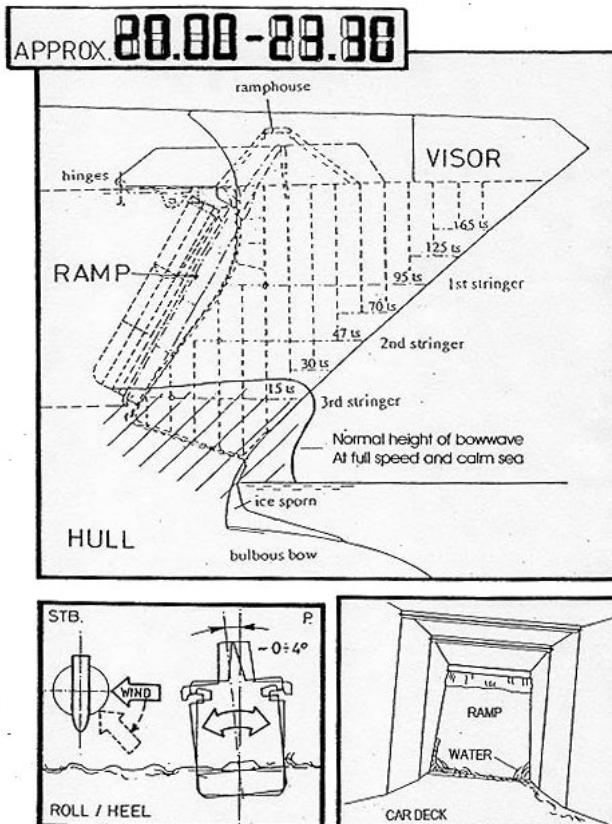
**Ramp locking devices:** Starboard ramp hook and securing bolts not engaged, Port ramp hook and securing bolts not engaged

Gaps between ramp/car deck seals by mattresses, blanjets, rags.

After the bow ramp had been closed as tight as possible by means of a tarpaulin at the top and a mooring rope in the winch drums - see Chapters 16/19 - and further, after the bolt of the Atlantic lock had been hammered by crewmembers through the 3 bent and misaligned lugs on the forepeak deck - see the footprints in the visor on Sheet 9 - Chapter 30 - the ferry quickly picked up speed when she followed the westbound lane in the TSS between the island Nayssar and the mainland. Due to the missing and/or defect rubber packings on the forepeak deck - see Sheet 7 in Chapter 29.2 - the inside of the visor quickly filled with water to the outer level.

The water level inside the visor was raising the deeper the bow was pitching into the waves coming in from port forward. Simultaneously water penetrated to the car deck at the port lower side of the bow ramp in spite of the "sealing material" stuffed into the big gap by the crew. - See drawings on the following page 1051.

At the end of the TSS off Suurupi Lighthouse the course was changed to 262° and the ferry proceeded with all 4 main engines on full output along the Estonian North coast. Due to the increasing south-westerly gale the ferry heeled 2-4° to starboard and was pitching harder and harder. - See Chapter 30. Passengers started to feel unwell and several became seasick.



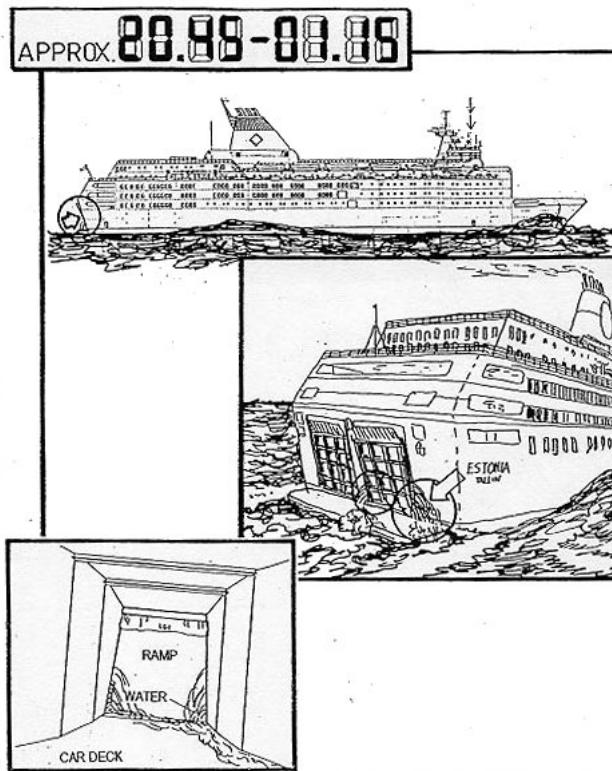
Even with calm sea the water level inside the visor was rising above the 3rd stringer when the vessel was at full speed. The lower side of the bow ramp was below 3rd stringer level, thus even in calm sea the water from the visor was penetrating the gap in the bow ramp and was flooding onto the car deck.

In the course of the following 1 - 1.5 hours the bow was diving increasingly deeper into the wave troughs and finally the foreship was shipping green water onto the forecastle deck. Therefore, it has to be assumed that the visor had been filled up with water up to the 1st stringer level or even higher. This means that the weight of the visor increased from 55 ts to approximately 200 ts which had, among other things, the effect that the 0.5 m stern trim might have been reduced.

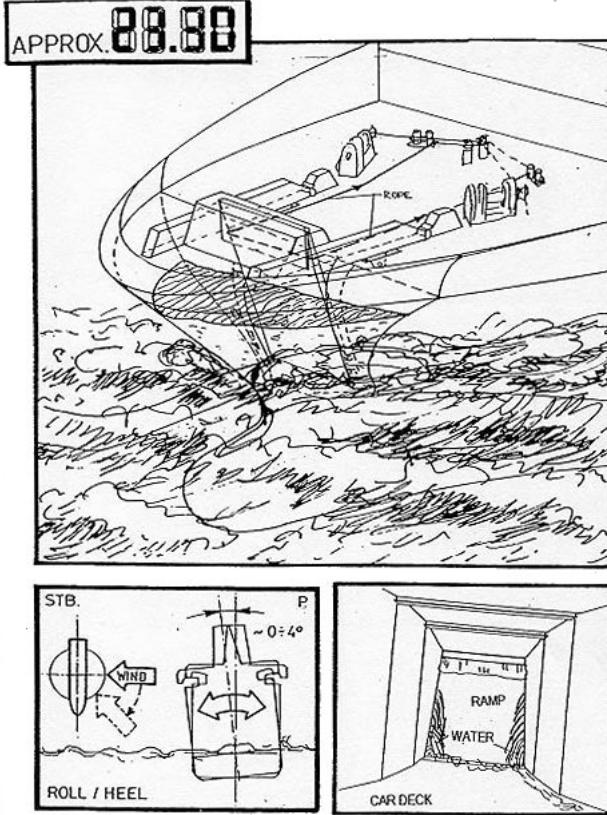
Due to the high water column inside the visor and the respective pressure on the unsecured ramp the port lower corner of which being plugged with "sealing material" the water quantities penetrating the gaps and streaming onto the car deck were increasing and accumulating at starboard to which side the vessel was continuously heeling since departure the scuppers at the starboard side being most likely unable to swallow all the water streaming into the car deck. To avoid the worst the crew seems to have opened the starboard stern ramp slightly and have kept it in such condition by means of the ice braking cylinders against which the ramp was pressed by the actuators to maintain the gap through which water was flowing from the car deck. The resulting high pitch hydraulic noise created by the aft hydraulic pumps disturbed the conference held on the 4th deck above to such an effect that it had to be closed down at about 20.45 hours. -See the statement of Rolf Sörman - Enclosure 21.3.3.335.1.

The approximate condition - existing onboard since about 20.45 hours - is demonstrated by the drawings on page 1054 ff.

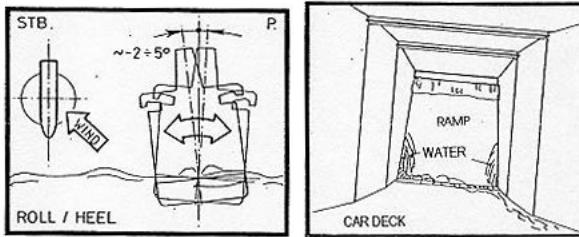
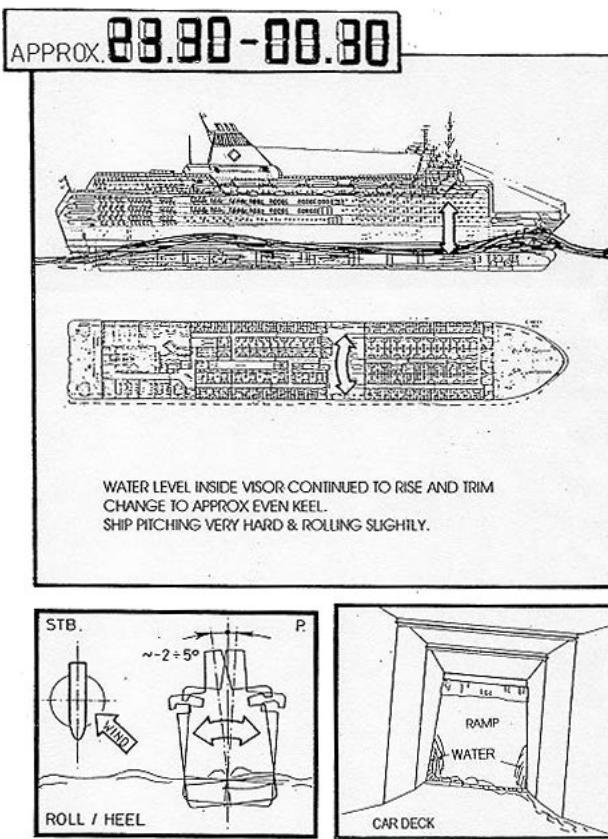
Since some time already low metallic banging noises had been noted by several passengers throughout the ship but, in particular, by those in the foreship area and in the sauna located on the O-deck. See the statements of Mikael Öun - Enclosures 17.2.224 / 17.2.225. At 23.30 hours ESTONIA passed the AMBER with very high speed, pitching severely in high seas from forward directions and taking green water onto the forecastle deck and spray all over the vessel. See the statement of the AMBER watch officer - Enclosure 20.237.



1. At ca. 20.45hrs. the aft hydraulic pumps were started on the STB. stern ramp opened slightly.
2. Due to the stern trim and the STB. heel of the ferry the water penetrating through the improperly closed bow ramp streamed off the car deck through the slightly open STB. stern ramp.
3. The high and very disturbing hydraulic noise was heard throughout the evening.
4. The vessel was pitching very hard in rough head seas.



1. Due to increasing wave height and deep pitching of the ferry the water level inside the visor rose higher and the pressure on the "sealing" material
2. Water entered the car deck in increasing quantities.
3. The ferry made very hard pitch movements.
4. The bow ramp was kept more or less closed by the rope and the water pressure from the visor side, however water penetrated at both sides of the ramp
5. This was the condition on board the ESTONIA when she met "AMBER".



Many passengers heard low metallic banging caused by visor moving within play of locking devices due to misaligned visor, damaged stempost and missing rubber packings.

The watch officer of the AMBER saw ESTONIA the last time at about 23.30 hours in the radar and apparently did not see anything abnormal as he would otherwise remember it.

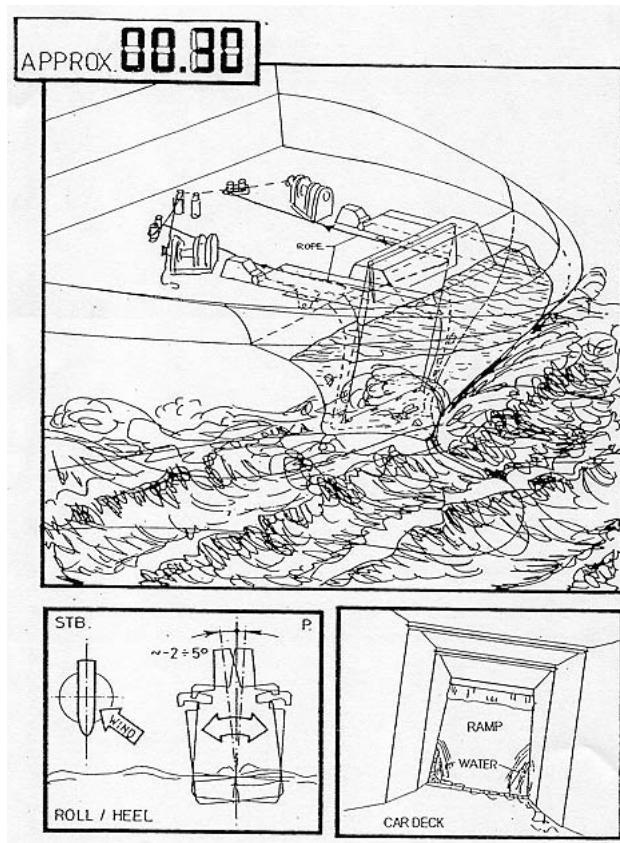
The track of the ESTONIA during the last hour before reaching the waypoint is unknown although big deviations were not possible due to the distance to be covered in the short time available.

At about 00.30 hours on 28 September 1994 the waypoint was reached and the course was changed 25° to starboard to 287°. The vessel began to roll in addition to heavy and hard pitching, because wind and sea came now about 4 points from the port side. The approximate condition of the ferry is demonstrated by the drawings following.

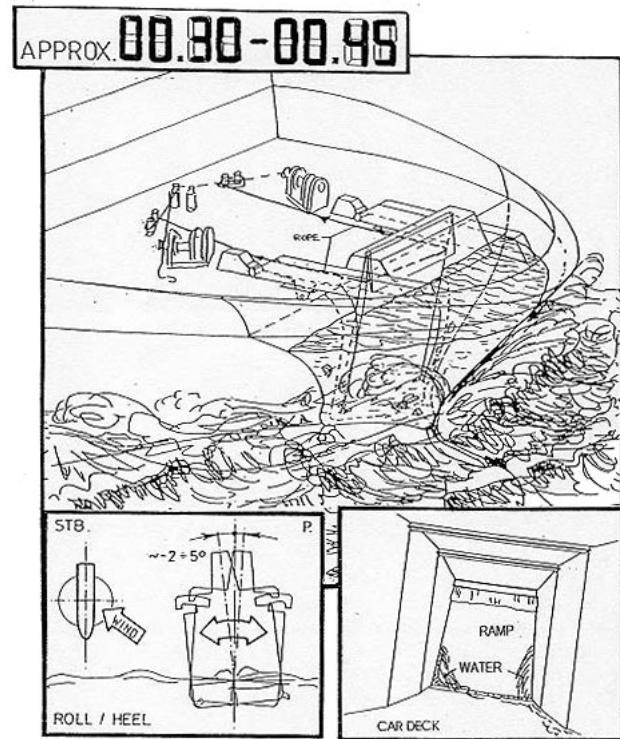
A little later the stabilisers were activated from the bridge, but it appeared that the starboard one did not move out of its pocket which was located about midships on 0-deck level. Sometime later the crew seems to have started to work on that stabiliser and have tried to hammer it out by means of sledge hammers. See the statement of Carl Övberg - [Enclosure 12.4.2.151](#).

At about 00.40/45 hours 1-2 heavy bangs, crashed were felt when the watchman A. B. Silver Linde came again to the car deck and must have seen big quantities of water moving between the cars and trucks, with personal cars already floating around in the forepart of the deck. Due to the heavily and hard labouring vessel there must have been heavy movement of the water.

Silver Linde alarmed the bridge at once by walkie-talkie shouting that there was much more water on the car deck and they had to leave the vessel. This was overheard by safety officer Ervin Roden, who had his walkie-talkie switched on when he was in his cabin - see statement of Paula Liikamaa [Enclosure 21.3.4.352](#). The watch officer certainly informed the master who most likely told him to send the boatswain with some deckhands down to try to rectify the situation. Most likely the chief mate and the chief engineer were also called to the bridge and the 2nd mate Peeter Kannuusaar sent down to the car deck as well, which would be the normal procedure.



1. Stabilisers activated and possibly problems with starboard fin.
2. Vessel took green water on forecastle deck due to very heavy pitching movements.
3. Water level inside visor was rising to about 1st stringer level.
4. Water ingress onto car deck had been increasing for some time but, the accumulation of big water quantities on starboard side was avoided by the slightly open starboard stern ramp.



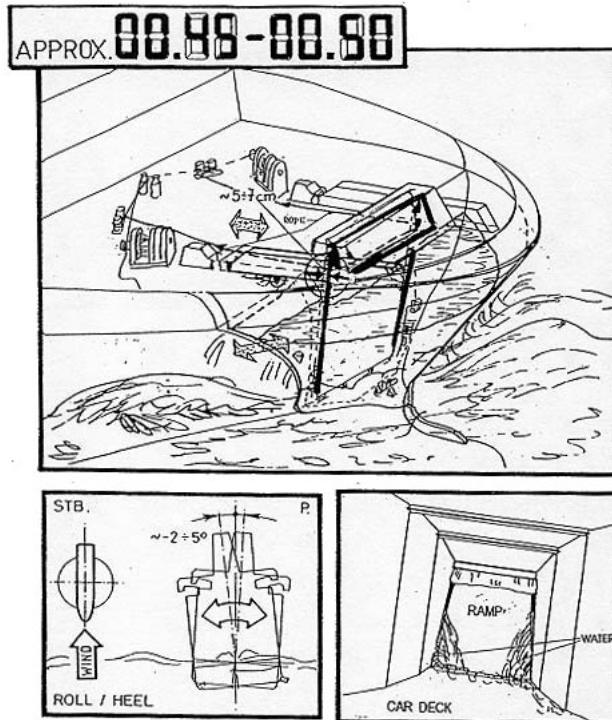
1. Low banging noises continued
2. Port stabiliser fin activated, crew started to work on the starboard fin.
3. The watch A.B. noted a lot of water on the car deck, alarmed the bridge and crew was activated
4. The course was changed to starboard and the ferry began to roll heavily, whereafter the vessel was turned back to port and started to pitch heavily. The speed was reduced.
5. The crew was working on the car deck to control the water ingress which turned out to be impossible.
6. The vessel made deep, slow pitch movements and was slightly rolling, more to starboard, less to port.

As the very weak condition of visor and bow ramp were with certainty known to the vessel's command, the speed was reduced and the bow slowly turned to starboard in an attempt to reduce the load on the visor and to avoid green water on to the forecastle deck, because crew members had to work also there and had to enter the port side house

from there as it was certainly not possible to reach the control panel from the centre casing. It was necessary for crew members to get to the forward port side of the car deck to the control panel to activate the hydraulic pumps in order to close the bow ramp best terms possible and probably also to hold the visor down hydraulically.

The vessel made slower but deeper pitch movements due to the speed reduction, but the rolling increased dangerously when the vessel got into or almost into beam seas. To reduce the rolling the ferry was turned back to port. The vessel was again in head seas, the heavy rolling stopped, but the deep pitch movements increased again and green water was taken on the forecastle, whereafter the crew had to abandon their attempts to close the bow ramp by heaving the mooring line. The bow ramp was then held by the actuators which, however, could only close the ramp to a final opening of about 5 cm. Thus water continued to stream onto the car deck and there was nothing the crew could do about it. It has to be assumed that the nautical advisor, Captain Juri Aavik, was also on the car deck/on the forecastle deck doing his utmost to get the situation under control, however in vain. It has further to be assumed that the 2nd mate and/or the boatswain informed the bridge continuously about the situation on the car deck.

Simultaneously the engine crew was working on the starboard stabiliser fin and sledge hammer noises were heard all the time. A further consequence of the vessel pitching against high seas from forward was the load increase on the visor attachments which had already been increased by about 150 ts of water moving forward/aft and side to side inside the visor. This caused the failure of the starboard visor hinge followed by the failure of the starboard side lock of the visor. - See the drawings on page 1062. Both components were considerably pre-damaged - see Subchapters 12.4.3/12.5 and Chapters 29/30 - and the load carrying capacity was substantially reduced. See also Subchapter 34.4. The Atlantic lock remained intact for the time being.



1. The crew members went on the forecastle deck through the door on deck 5 and tried to heave the rope holding the bow ramp which failed probably due to the green water taken on the forecastle deck.

2. The bow was held by the actuators and lowered down inside the visor.

3. The crew somehow managed to start the hydraulic pumps under extremely difficult conditions due to the water on the deck and the moving cars.

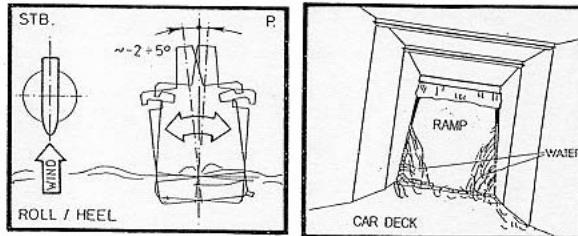
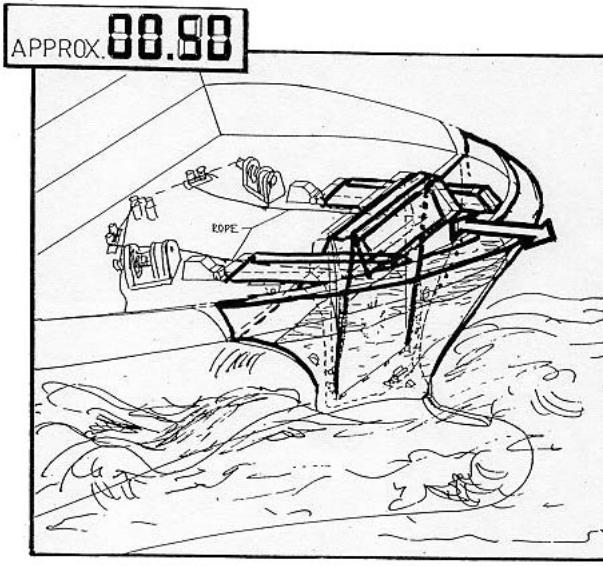
4. The substantially pre-damaged STB. Visor hinges failed followed by the equally pre-damaged STB side lock.5. The starboard side of the visor moved forward, the lugs cut through the deck plating and struck against the deck beam aft frame 159, the visor was pushed back when the vessel was diving into the next wave trough causing the broken visor hinge parts to smash against the hinge parts on the forecastle deck.

The starboard side of the visor was 5-7 cm moving forward/aft between the deck beam at frame 159 and the hinge parts on forecastle deck which created the heavy metallic banging noises scaring many passengers. The lug plates underneath the starboard visor arm came in contact with the adjacent plating and sustained scoring marks on the inside and on the outside because the vessel was only slightly heeled to starboard, still pitching in head seas and only slightly rolling. The port visor hinges remained intact for the time being.

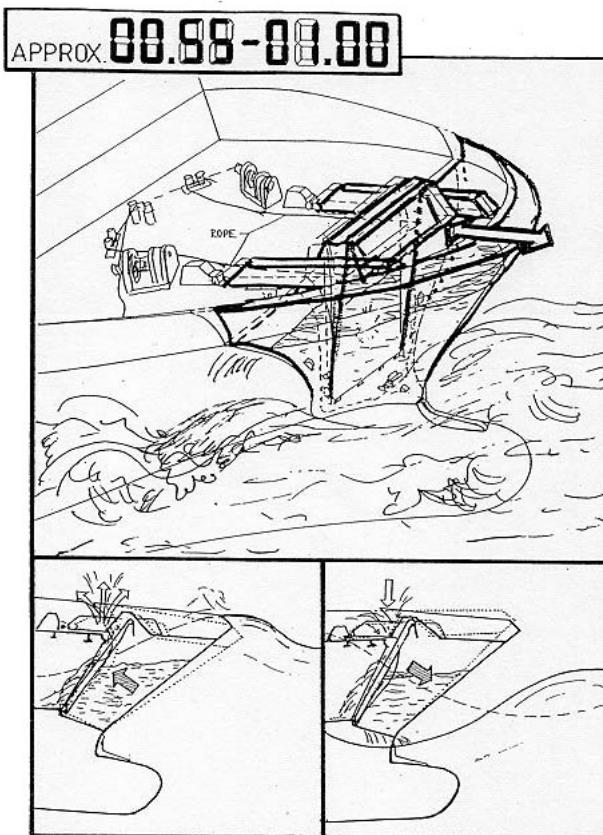
Due to the disappearing hydraulic pressure the bow ramp was lowering down into the visor and was resting on the vertical beam of the inner visor structure with the centre flap in between.

After some minutes apparently also the port hinges failed and the whole visor was now moving forward/aft between the deck beam at frame 159 and the hinge parts on the forecastle deck.

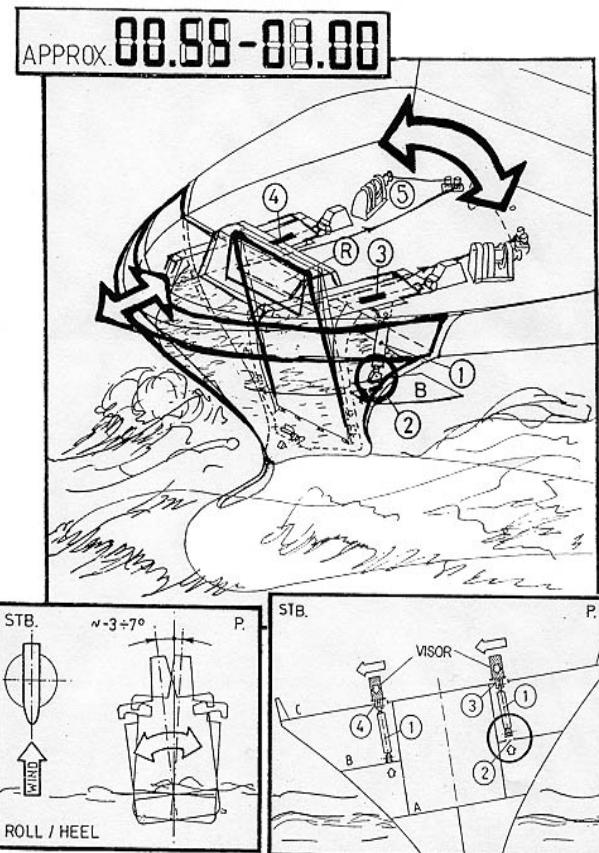
The now prevailing situation is illustrated by the drawings on the following pages. The dynamic forces created by the deep pitch movements of the vessel in combination with the movement of the big water quantity inside the visor and the weight of the visor finally resulted in the lug plates underneath the visor arm to cut through the deck beam at frame 159.



1. Also the port hinges and the port side lock failed and the visor moved forward/aft between the deck beam at frame 159 and the hinge parts on
2. Simultaneously hard scraping noises were caused by the upper flaps of the ramp scraping along the vertical beam inside the visor due to the movements in the sea



1. Hard metallic banging/knocking and scraping noises.
2. Visor moving forward /aft between the deck beam at the frame 159 and the forecastle deck parts of the hinges, the lugs underneath the visor arms were cutting through the deck beam.
3. The bow was deeply diving into wave troughs and the stern rising high up while the whole vessel was shivering.
4. The crew still working on the car deck.

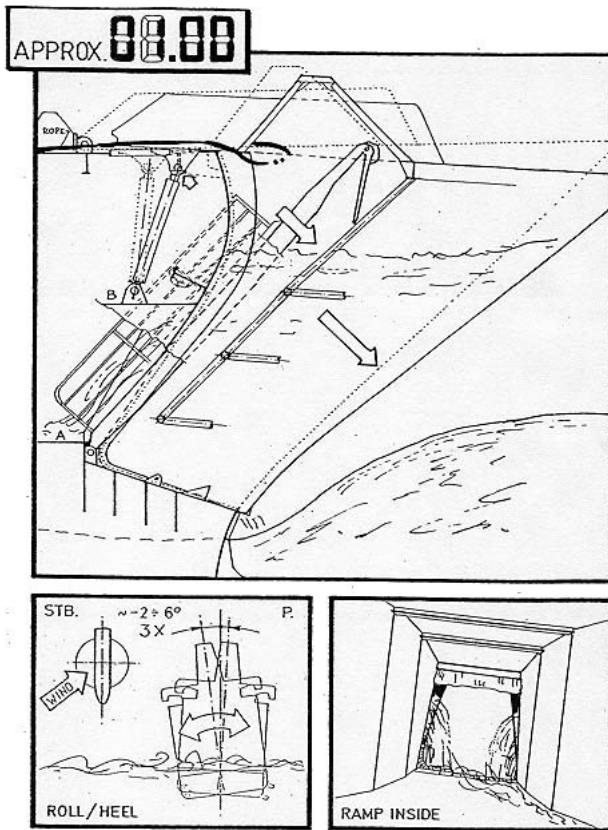


1. Hard metallic banging/knocking and scraping noises.
2. Crew tried to hold the visor by means of the hydraulic actuators (1) and the bow ramp by ropes (5)
3. The port actuator was torn off its foundation on B-deck.(2)
4. Deep contact marks occurred on the visor lug plates port inside/ starboard inside and outside. (3+4)
5. The vessel was slowly turned further to port and started to pitch and to roll.
6. The crew abandoned the attempts to hold the visor close to the bow ramp and rushed up to deck. 7. The ropes remained around the bow ramp and on the winch drums on the forecastle deck.

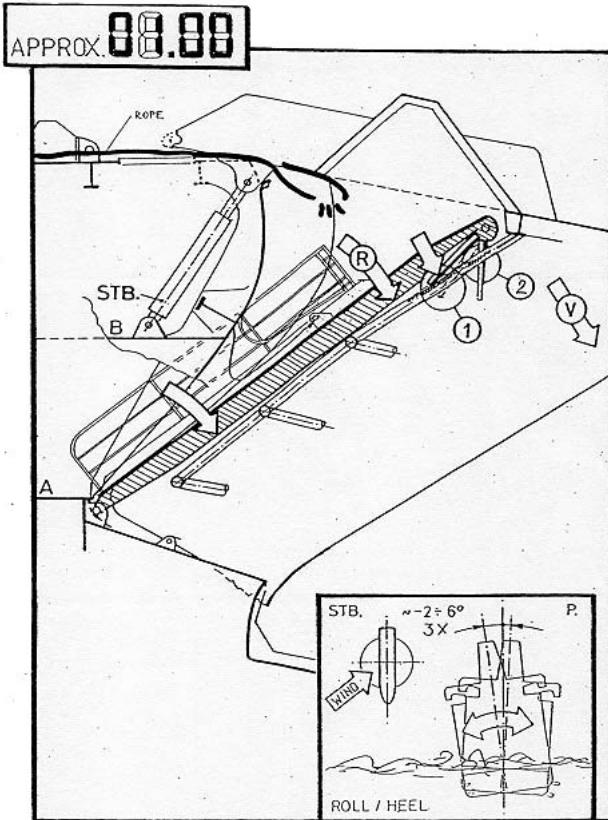
The lugs quickly cut through the deck plating still giving the visor support against the increasing heel to starboard which had caused the centre of gravity of the visor to shift from ahead to starboard. The subsequently developing situation which finally led to the sinking of the ESTONIA stern first and completely upside down is demonstrated by the following drawings with explanatory comments.

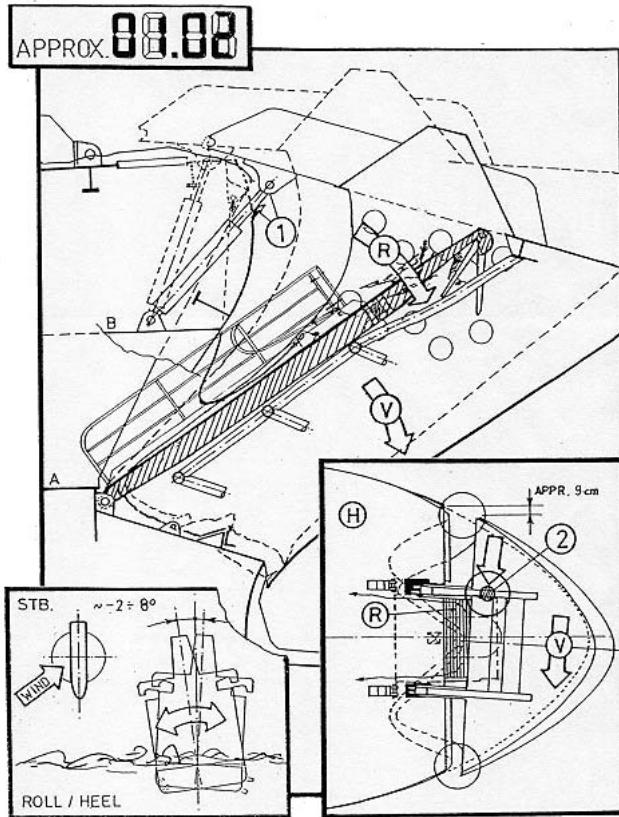
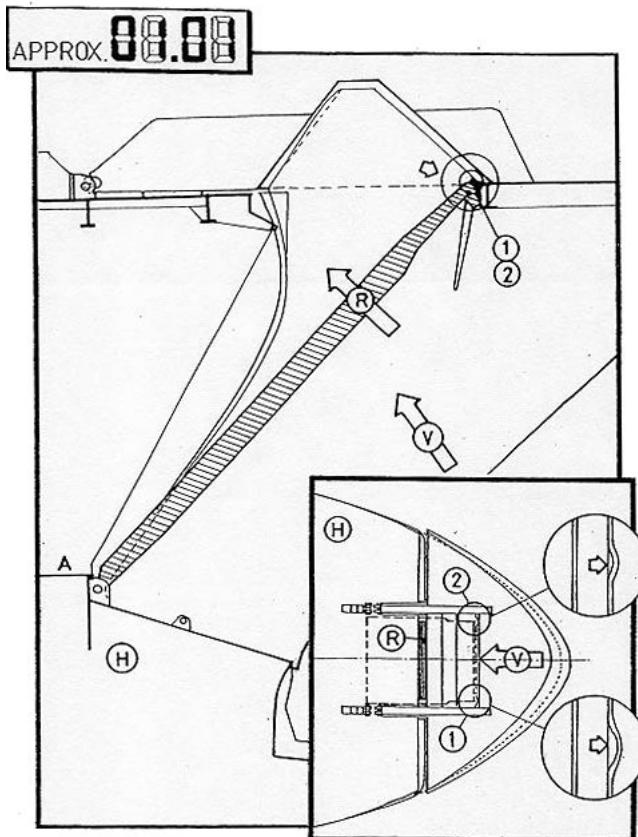
At 01.53 hours the radar echo of the ESTONIA disappeared from the radar screen of the nearest ferry MARIELLA. The biggest shipping catastrophe in Northern Europe after the World War II was a fact.

**Note:** Behind the drawings the sequence-of-events according to the summary of the witnesses' statements and the evaluation of the damages to the wreck and visor is shown on 20 pictures taken of a damage model.

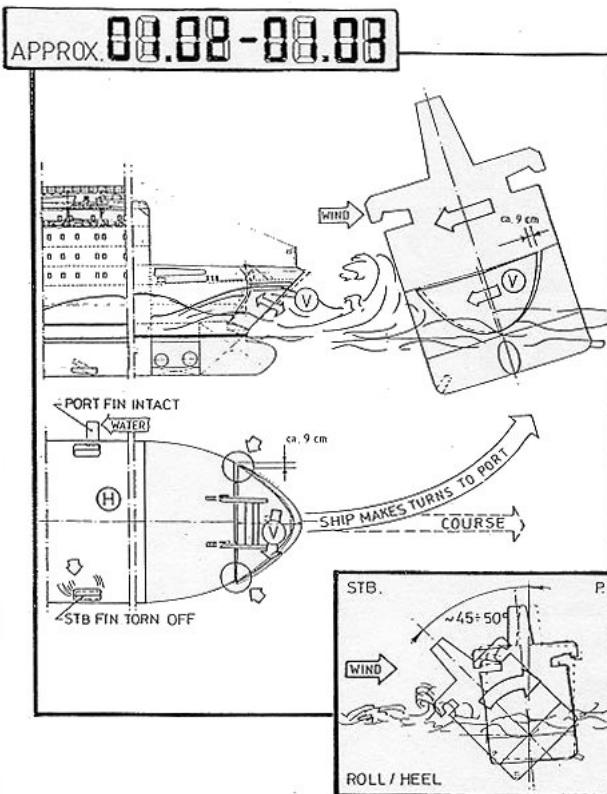


1. The visor lugs finally cut through the deck beam and the visor moved forward, the forepeak deck penetrated the visor bottom.
2. The vessel was now more rolling than pitching.
3. The ramp was inside the visor while the visor moved forward.

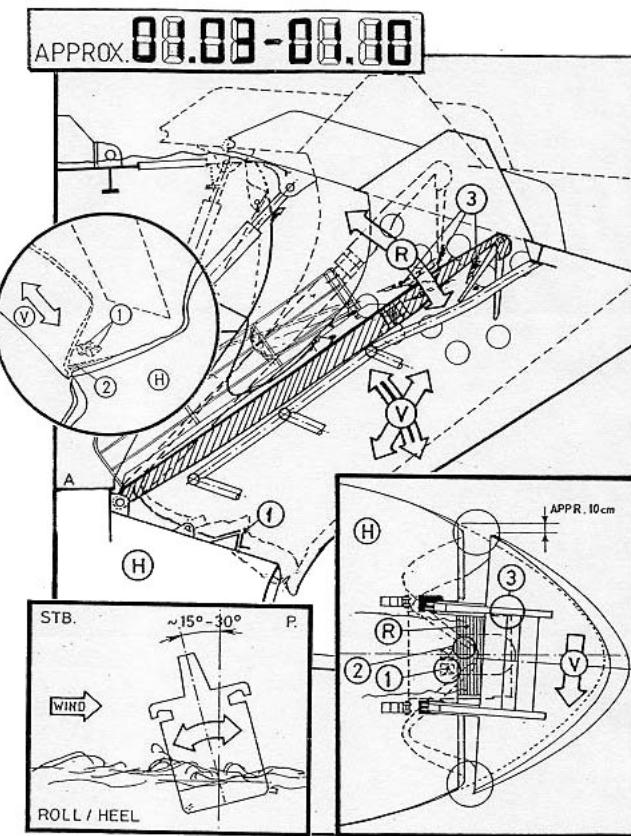




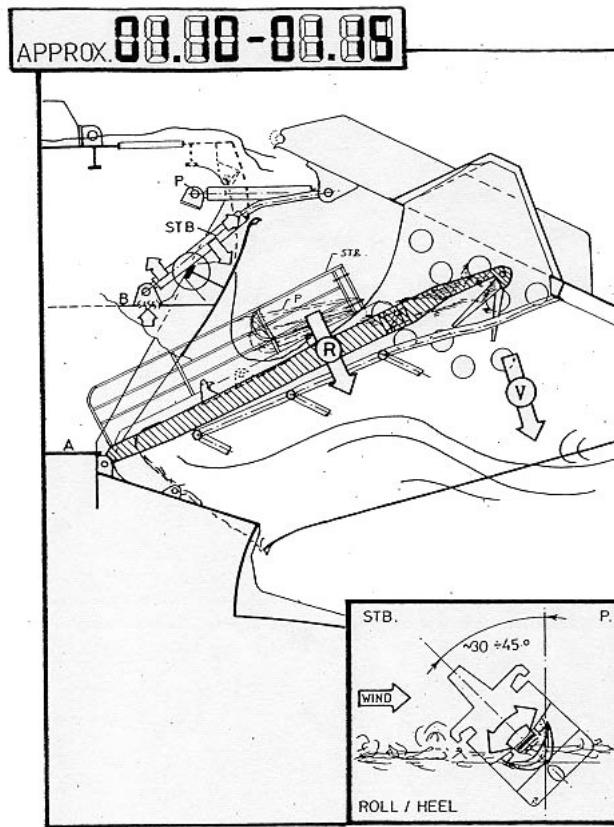
1. Vessel rolling more to starboard/less to port .
2. Visor lugs broke through the front bulkheads and did not support the visor anymore against moving towards the deeper starboard side (1)
3. With a big crash the visor fell abruptly about 10 cm to starboard until the inner port bulkhead was resting on the upper part of the bow ramp (2).
4. The visor was now extending the starboard front bulkhead of the vessel and the port front bulkhead was extending the visor.
5. The atlantic lock failed.



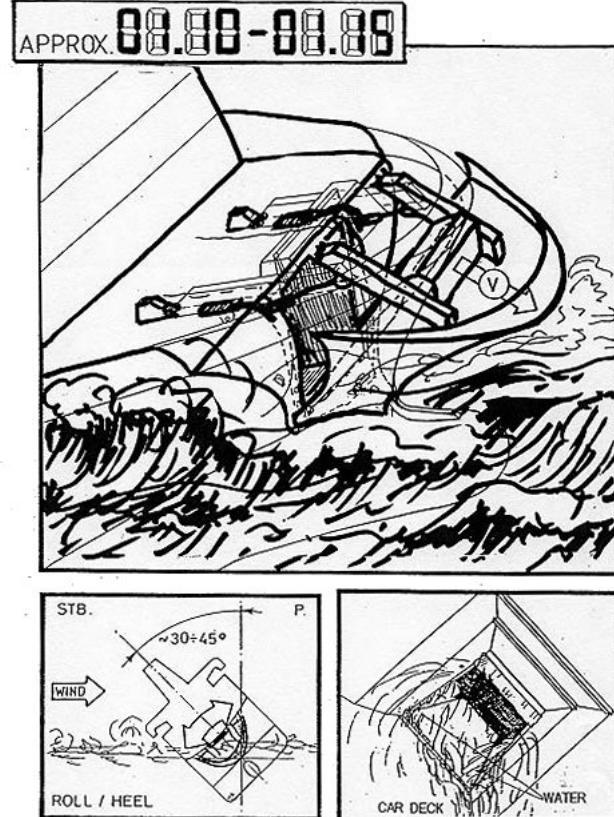
1. The vessel stopped abruptly. Water penetrated from O-deck under pressure.
2. The slow port turning increased rapidly while the vessel heeled wide over to starboard -ca. 450-500°, and came back to ca. 10° STB heel after the turning had stopped. The wind and waves now came from starboard abeam.
3. The heeling to STB increased stepwise with roll movements.

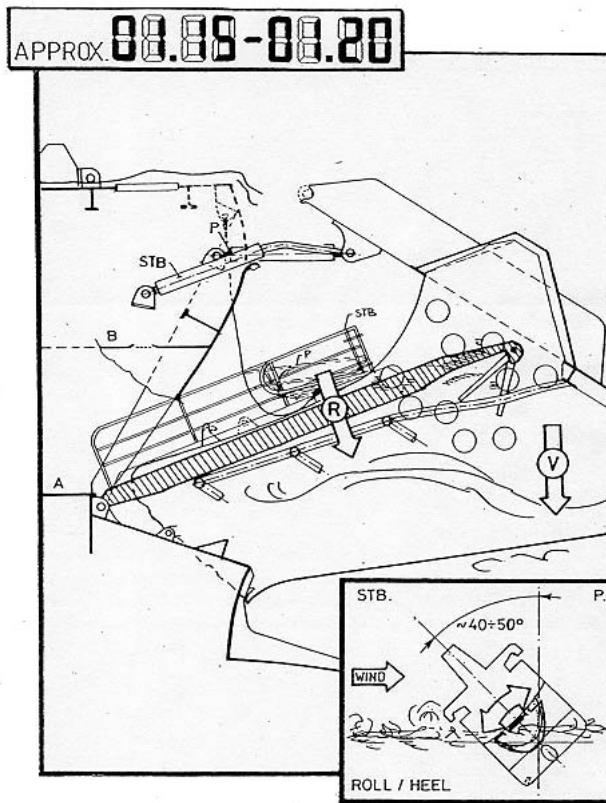


1. Approx 01.08-01.10 hrs the main engine shut-down automatically at a stoboard heel of ca 30°.
2. The visor was held by the bow (3) ramp and by the forepeak deck increasingly penetrating the visor bottom (1)(2).
3. The intact starboard actuator was resisting the forward movement of the visor.

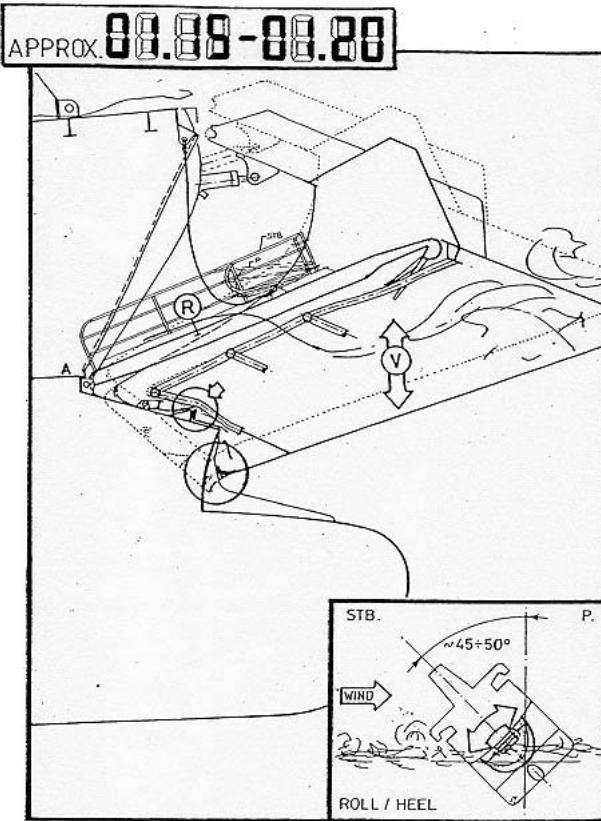


The visor moved further forward with the starboard actuator extending and the forepeak deck pressing into the visor bottom.  
The strong ice plates supported the visor further from falling off to the starboard and the further the visor moved forward the deeper the forepeak deck pressed into the visor bottom .

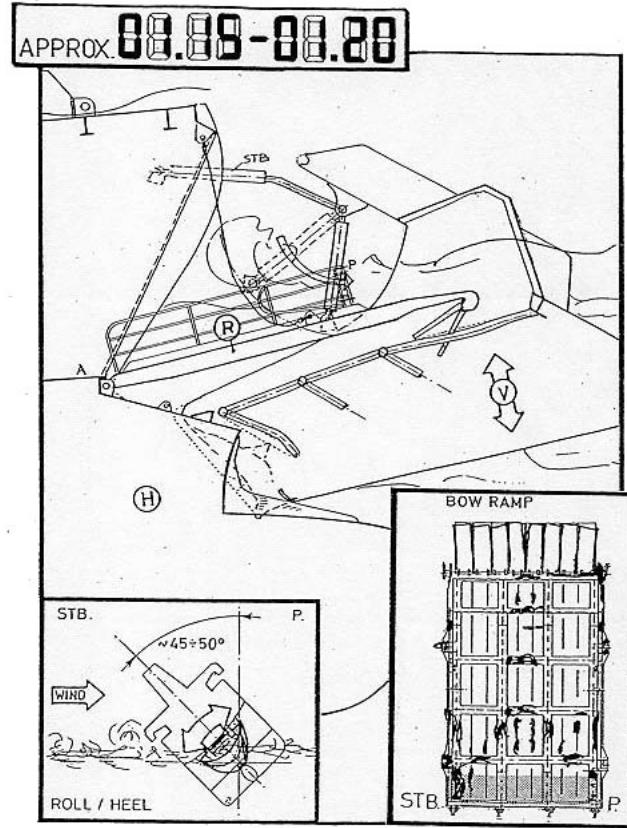
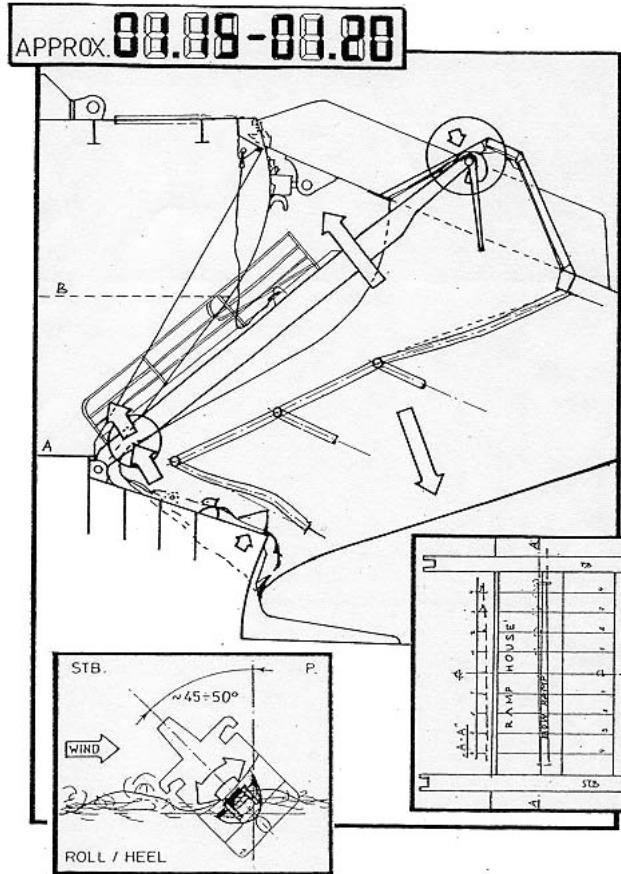




1. After the vessel had stabilised for some time at a heel of about 40o-50o the heeling increased again.
2. The visor moved further forward and downwards and also the starboard actuator was torn off its foundation and broke through the front bulkhead as did the port one.
3. The port actuator was completely retracted while the starboard actuator was fully extended with the piston rod bent.
4. The visor was still hanging on the ramp and was still supported against falling off to starboard by the forepeak deck being pressed into the visor bottom.

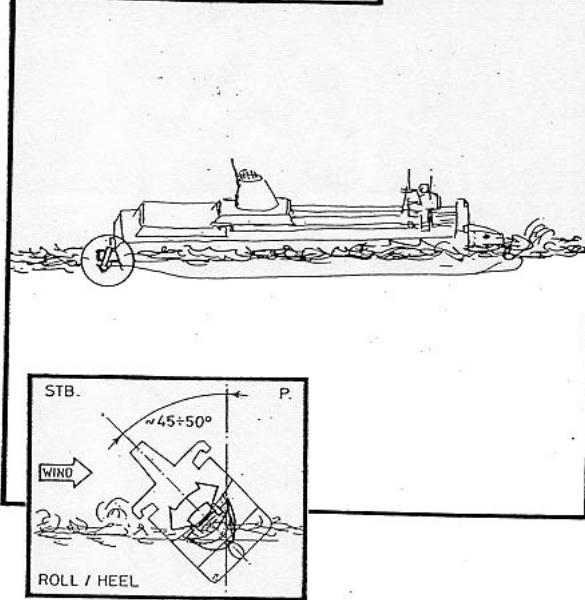


The vessel was still rolling stepwise and the visor with the bow ramp inside was labouring up and down and from port to starboard in the seaway.

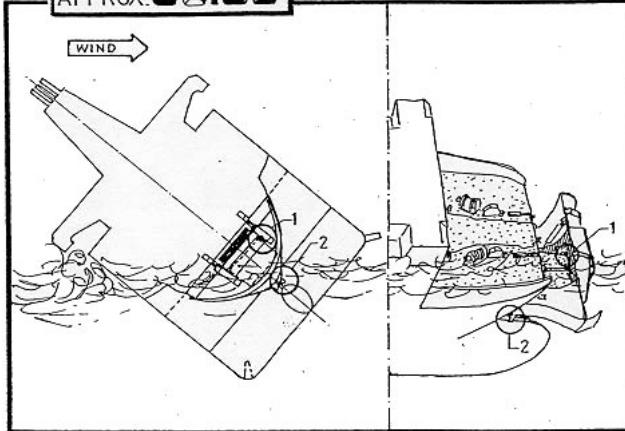


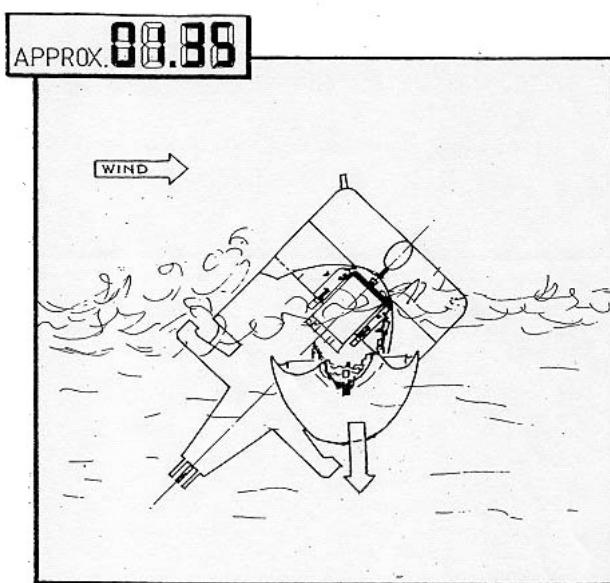
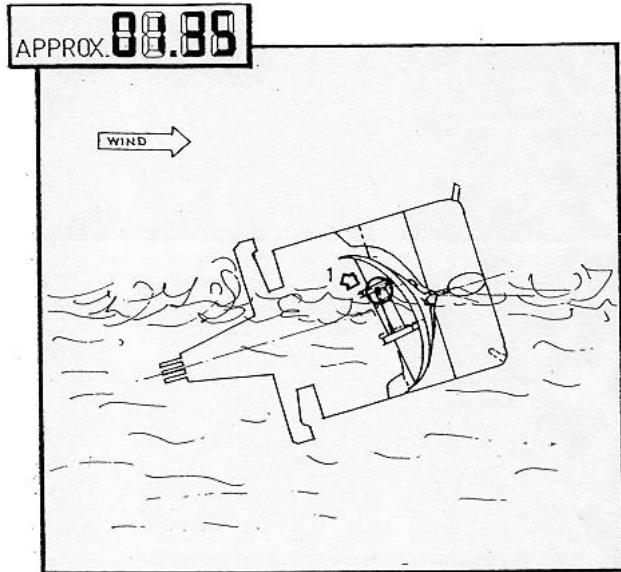
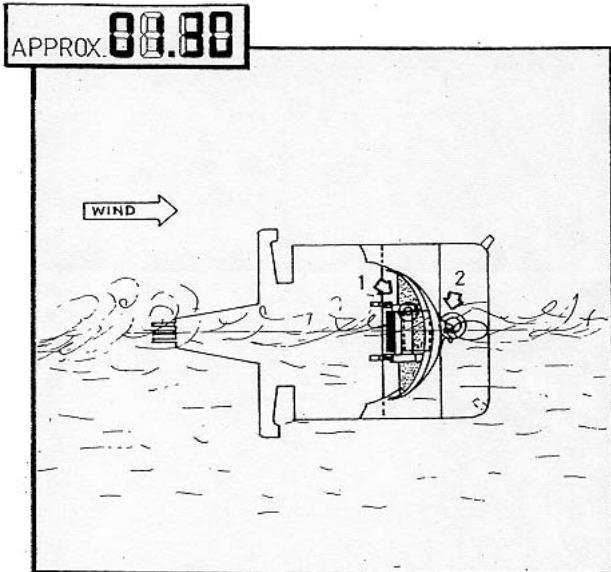
1. The port actuator broke through the front bulkhead, swung forward and got and crashed against the bow ramp.
2. The structure of the ramp was continuously and very severely deformed by the heavy and changing weight of the visor.

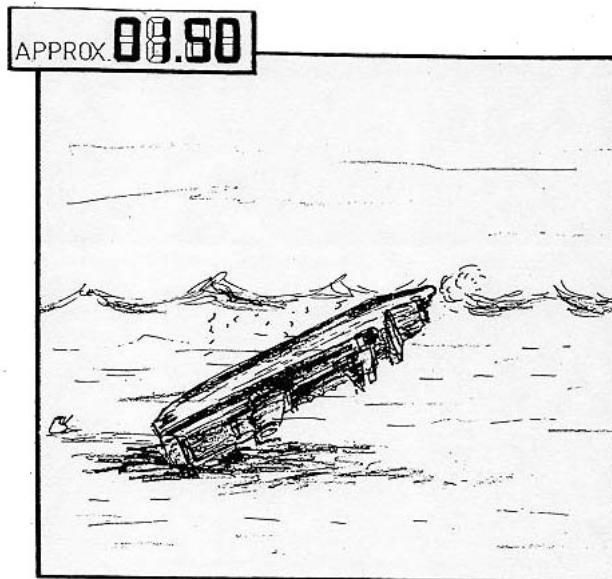
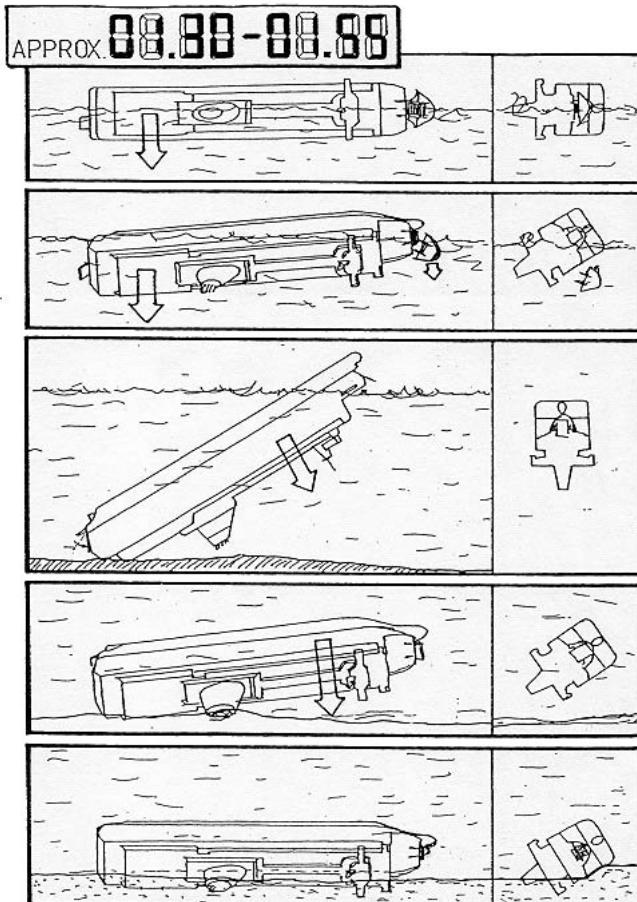
APPROX. 88.88 - 88.88



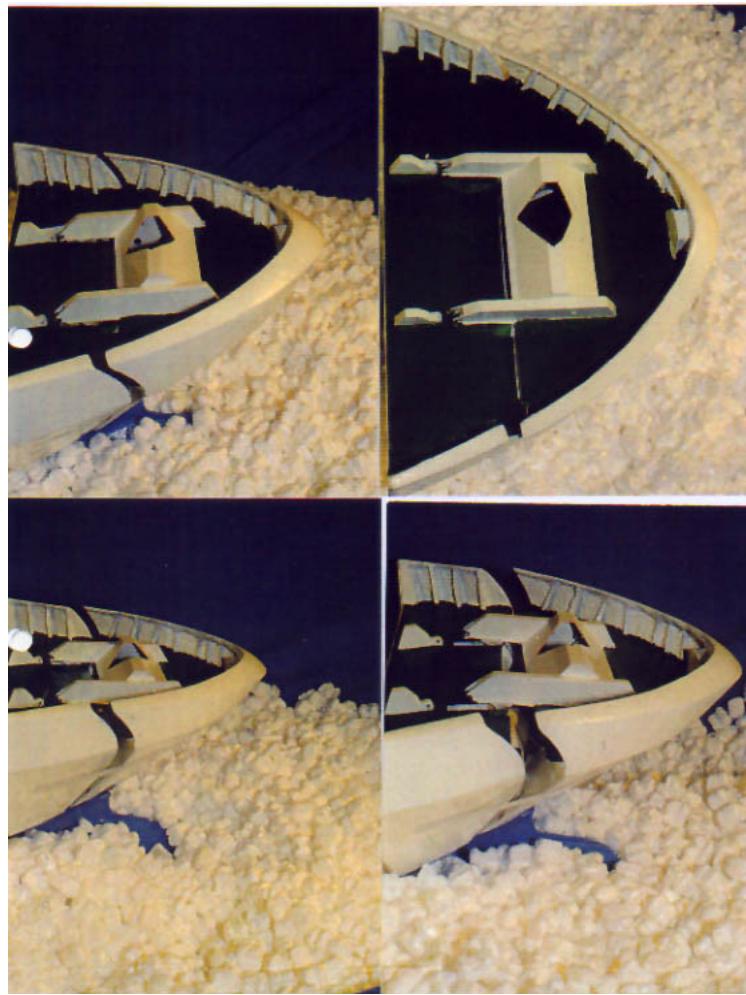
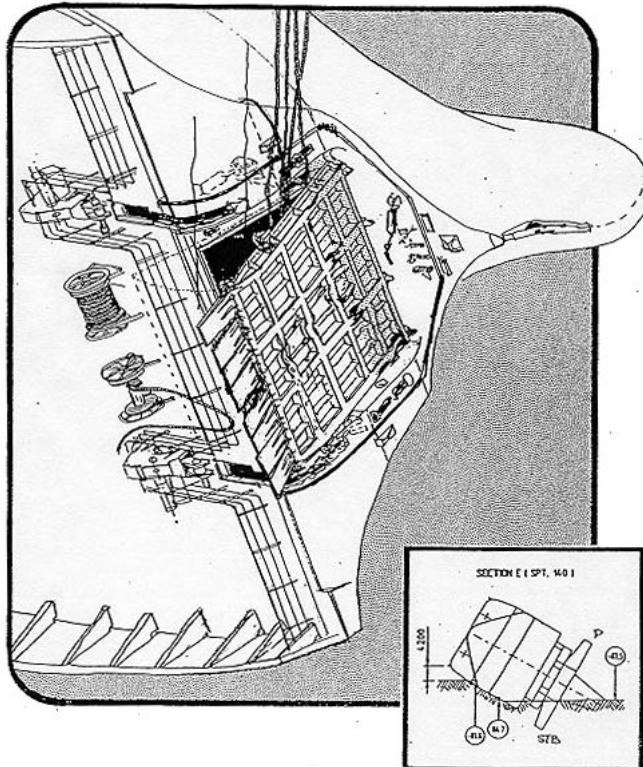
APPROX. 88.88

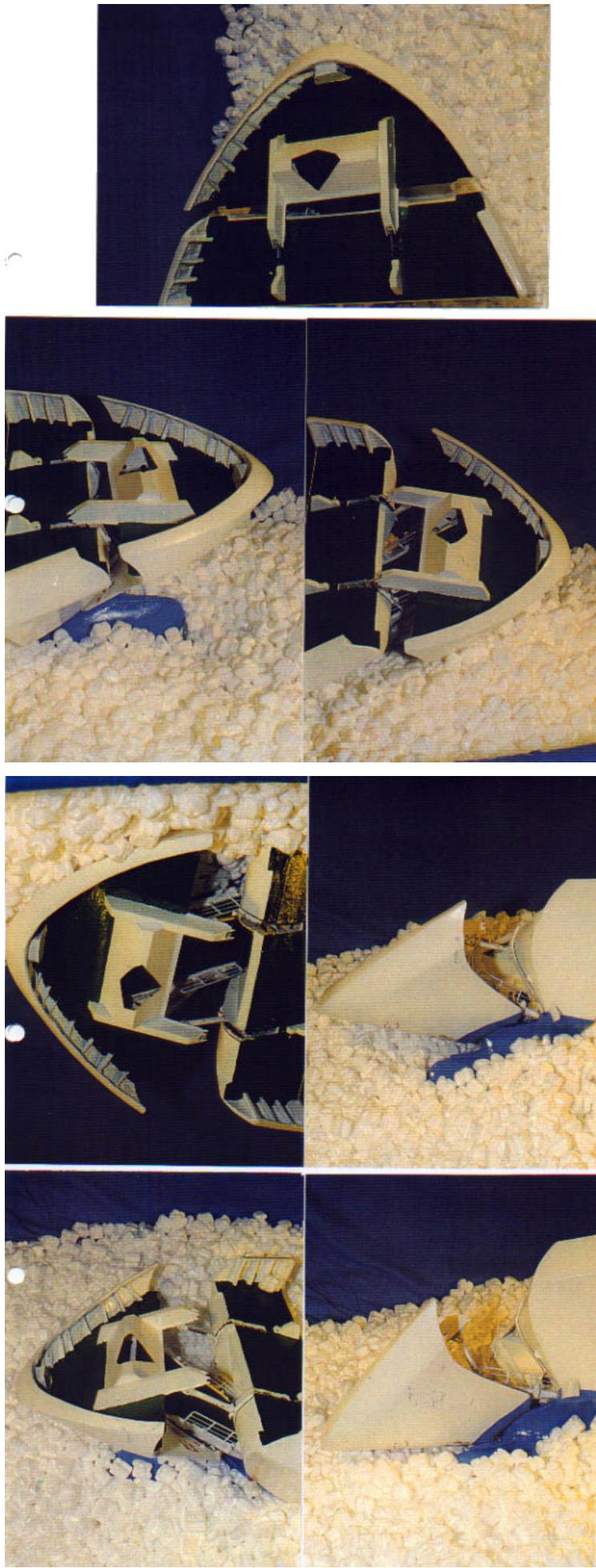


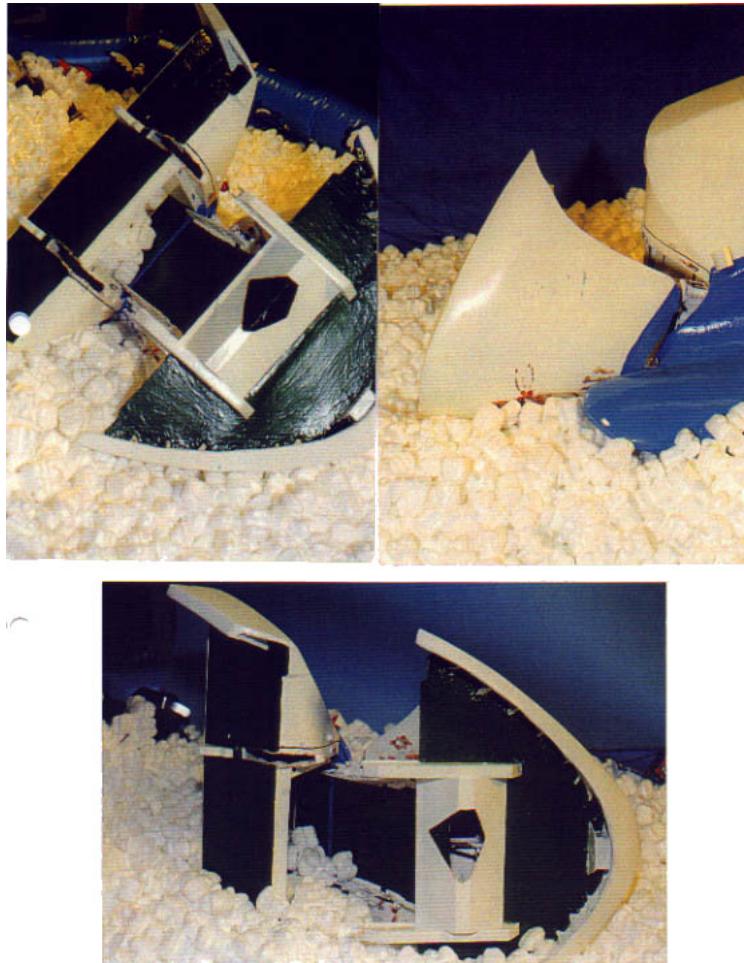




1. The Vessel sank stern first.
2. The bow was still above water when the stern was already on the sea bottom.
3. The visor sank about 1nm west of the wreck upside down.











## CHAPTER 32

### UNEXPLAINED DAMAGE / UNEXPLAINED EVIDENCE

#### 32.1 INTRODUCTION

In April 1995 the JAIC published the "PART-Report covering technical issues on the capsizing on 28 September 1994 in the Baltic Sea of the ro-ro passenger vessel MV Estonia" which included also certain picture material, among others the picture below showing the aft part of the visor bottom with the visor lug being part of the Atlantic lock.



The blue coloured part of the lug - see arrow - looked as if having been exposed to heat which was unusual since this part had been below water. The JAIC was contacted and it turned out that samples had been taken already on 25 November 1994 and had been examined upon request of the Central Criminal Police in Finland and Kari Lethola as chairman of the Finnish part of the JAIC on 30.03.95. The tests were carried out on 30.05.95 by the Criminal Laboratory Technical Division, Helsinki. The "available" documentation was received - already translated into English - from Kari Lethola.

These were:

- (1) A request for testing of 4 samples taken on 25.11.94 to find out whether there were traces of explosives in the samples. The request was made in Swedish language on a printed Swedish form by Kari Lethola. The document with translation is attached as Enclosure 31.392.
- (2) The results of the requested tests translated from Finnish to Swedish to English which is attached as Enclosure 31.393.
- (3) The request for and the results of testing samples 5.-9. translated from Finnish to Swedish to English which is attached as Enclosure 31.394.

as to (1): The request was:

**»To be investigated:**

1. port side lower attachment for sidelocks
2. plate between port side lower attachment and attachment or hole for the steering horn
3. starboard lower attachment for the sidelocks
4. plate next to starboard lower attachment

**What they are supposed to find out:**

*Is there rest of explosive materials, substances in the samples 1-4?*

*Samples were taken on 25 Nov 1994.*

*signed 30.03.1995*

*Senior Criminal Constable Jan Storing asking for this.«*

**Note:** It is unclear what exactly should be tested. Presumably these were the parts that were cut off from the visor around the openings where the lugs of the hydraulic sidelocks had been since these are apparently the only parts cut off soon after the recovery of the visor.

as to (2):

**»Result of investigations**

*Show remains of explosives aimed for civilian use with blasting works or of the most normal military explosives have not been found in the samples 1-4. They have not either found anything that indicates anything of self-made explosives in the tests.*

**Methods of investigation**

*Thin layer chromatography*

*Liquid chromatography*

*Indications reactions*

*signed Criminal Chemist Raija Turunen*

*Marja-Leena Eskelinen Criminal Chemist«*

**Note:** It is obvious that such a surface test would result in nothing because the samples had been under water for almost 7 weeks. Since the investigation of the TWA 800 crash it is public knowledge that explosives cannot be traced by means of the methods applied by the laboratory when the objects have been under water for more than one week. It would, even today and in 20 years time, be possible to prove explosion damage by scientific methods by means of which the destroyed molecular structure is examined. This, however, was not done according to the available documents.

as to (3):

**»List of samples**

*which came on the 30.03.1995*

5. paint samples taken next to the port side hinges
6. paint samples taken next to the starboard hinges
7. paint samples taken from the dent in the bow
8. which is a component mixture from the paint Inerta 160
9. which is a hardening mixture for Inerta 160 which is picked up from the Teknos Factory. (Note: The manufacturers of Inerta ice paint.)

**The requested investigations**

*Is there any strange paint in the samples 5. to 7.?*

**Result of the investigations**

*In the samples 5. and 6. there were paint splinters consisting of between 10 and 20 layers of colour. The white layer of paint that constituted the top layer on both the paint samples seems to be intact and some rubbings of strange paint could not be observed.*

*In sample No. 7 were paint splinters with paint layer structure that was different from the bow mentioned because lots of grey and blue epox paint had been rubbed on the top white paint layer. This epox paint was when it comes to the pigment and the component type to its chemical structure of the same type as the Inerta 160 epox colour, that had been manufactured in the laboratory from the samples 8. and 9..*

The results are self-explanatory and need no further comment.

These are the only known activities in connection with explosives which were incurred by the Authorities involved in the casualty investigation.

No further information relating to explosives having possibly been on board the ESTONIA on her last voyage were received until approximately mid 1996 when rumours were circulating that there was a big hole in the starboard side of the hull in way of sauna and swimming pool compartments on 0-deck. The information came at first from some source in the upper middle management of Sjöfartsverket. A check of the available video material - see Chapters 25-28 - revealed that the respective parts on all video tapes had been cut out - see Subchapter 34.6 - Disengage Report. A review of the statements of the survivors from the 1st deck having been rather close to the area in question did not allow definite conclusions until it was possible to talk to one of them personally. This was Carl Övberg - see Enclosure 12.4.2.151 and Subchapter 12.4.2 - who explained among other things that he saw water escaping under high pressure from the goose-necks fitted to two ventilation pipes coming up from 0-deck. He made this observation about 1 minute after the 3rd and most most heavy shock, vibration of the vessel but about 30 seconds before the big heel to starboard. This allows the conclusion that at least the 0-deck compartment directly below Carl Övberg must have been flooded and under pressure. This indicated a connection to the outside, i.e. a hole in the hull, in way of 0-deck as otherwise the compartment could not have been under pressure.

This scenario was among other things also presented at the first and second exhibition organised by this 'Group of Experts' in Stockholm in June and December 1997 when the complete investigation results were presented to the national and international public and media. Among the many pieces of information received during these exhibitions there were also explanations regarding possible explosions on board.

After a relatively silent 1998 when most of the interested people were analysing and subsequently criticising the report of the JAIC a new person appeared in Sweden apparently with sufficient time, and an undisturbed mind, to analyse again all the publicly available video footage and documentation on this subject collected by the JAIC. He found among other things on the video B40b, made by the SPRINT ROV on 03.12.94, a package on the port superstructure in way of the 5th deck which appeared suspicious to him. Video images were made and shown among others also to experts in explosives in Sweden and Germany. See the following image.



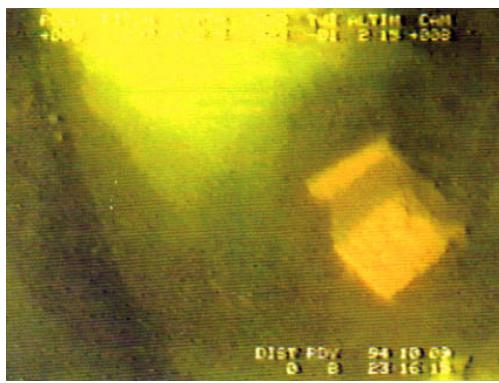
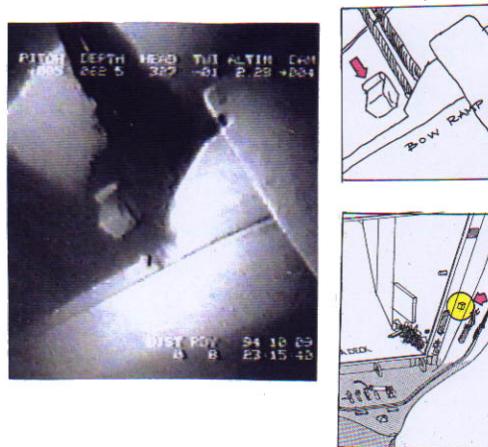
Both identified the package with about 90% certainty to be an explosive charge used underwater.

Evaluation of the footage made by ROV on 02. and 09.10.94 revealed, however, that the package had not been at the identified location on the 5th deck on these dates, thus must have been placed there between the 09.10. and 03.12.94 and therefore could not be casualty related.

In any event, the term "explosives", which had always been in the background during the preceding years of the investigation, was suddenly brought back to the attention of the investigators and the video footage available in Hamburg, all obtained from the JAIC, was analysed again also in an attempt to find possible explanations for numerous so far unexplained damage areas. It revealed among other things that an orange coloured cube had been attached to the recess of the port front bulkhead of the wreck in way of the hydraulic and manual side locks and the fastening of the bow ramp actuator.

The cube was clearly visible and had been closely looked at by the ROV during the inspection on 09.10.94, it could not, however, be found on the 02.10.94 videos which was possibly due to restricted visibility and was definitely not in this location on the SPRINT ROV made on 03.12.94 respectively on the diver video of the same date.

Images were made from the orange coloured cube and identified by all three experts from Sweden, England and Germany with a high degree of probability as an **"explosive charge"**. See the following two images.



As this charge attached in way of a very sensitive area - the port side locking devices of the visor and the fastening of the port bow ramp actuator - obviously did not explode, the corresponding area of the starboard side was analysed for possible explosion damage which was positively identified by the underwater explosive expert Brian Braidwood. This resulted in a further analysis of the available video footage all received from the JAIC. The results are outlined in the following subchapters.

## 32.2

### Findings

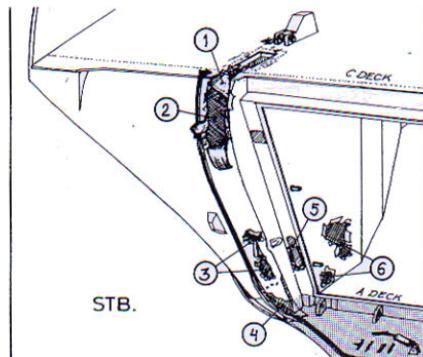
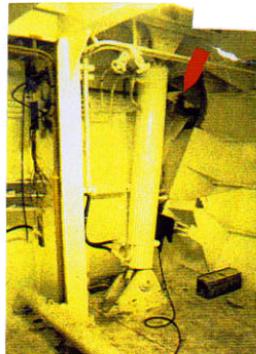
In total four suspect areas possibly damaged by explosions were identified, viz.:

- (1) the upper void space behind the starboard front bulkhead
- (2) the lower void space behind the starboard front bulkhead
- (3) the lower void space behind the port front bulkhead
- (4) the bow ramp.

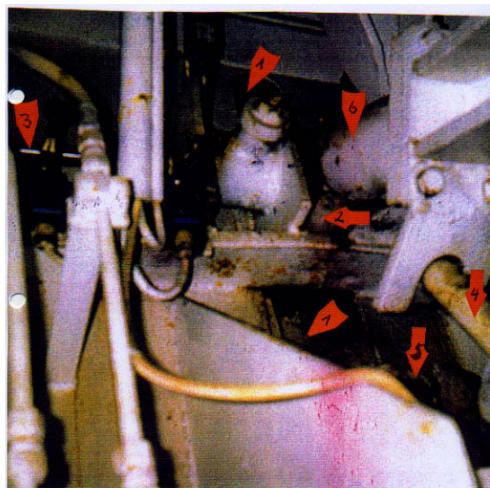
**The Starboard Front Bulkhead** - See also Subchapter 29.2 - where most of the possible explosion damage was identified, is explained by the drawing following.

- Arrow 1 points to a big steel piece sticking in the deck opening.  
 Arrow 2 points to the torn open part of the upper bulkhead.  
 Arrow 3 points to a hole above the lug of the side lock and to the enlarged opening for the manual side lock.  
 Arrow 4 points to the cracked off/distorted lower part of the bulkhead.  
 Arrow 5 points to the enlarged/cracked opening for the starboard ramp actuator.  
 Arrow 6 points to holes in the starboard longitudinal bulkhead inside the car deck.

Behind the front bulkhead there is an upper and a lower void space located. In the upper one - actually the B-deck - the visor actuator and the ramp hook arrangement was fitted. The part of the bow ramp with the mating lug for the ramp hook was extending into the void space as can be seen on the picture below. The arrow points to the ramp hook.



The lower void space - on A-deck - car deck level - was located directly below the upper one - on B-deck - and contained the hydraulic and manual side lock arrangements as can be seen on the picture below which is explained by 6 arrows. The visor is closed.



**arrow 1** = opening in front bulkhead with visor plating behind through which the lug of the hydraulic side lock was extending  
**arrow 2** = lug of hydraulic side lock

**arrow3** = cylinder and piston rod of hydraulic side lock

**arrow 4** = hinged eyebolt with nut of manual side lock

**arrow 5** = 2 hooks of manual side lock

**arrow 6** = ice cylinder

**arrow 7** = opening for hooks of the manual side lock with visor plating behind.

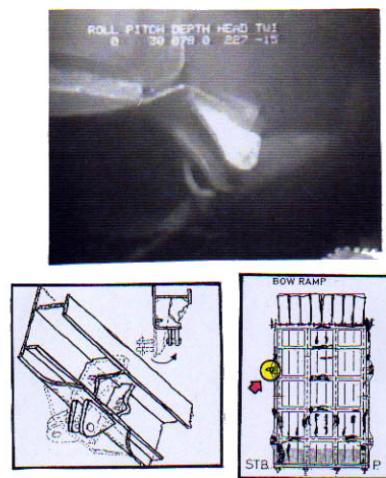
#### as to (1):

The upper void space behind the starboard front bulkhead shows considerable damage to the bulkhead plating with the plating bent from inside to outside and frequently cracked. This had obviously been possible because the upper part of the visor moved forward after the starboard hinges and side lock had failed and never contacted the front bulkhead again, because at the lower end of the blown open plating a big steel part is extending almost horizontally which otherwise would have been pressed back. The same refers to the steel tongue extending from the visor plating in way which was also not pressed against the bulkhead.

The image below on the left shows the lower part of the damaged upper front bulkhead looking from bottom to top. The image on the right shows the damage further up.



The following image shows the upper part of the same damage with the severely distorted and upwards bent mating lug for the starboard ramp hook.



#### as to (2):

The lower void space behind the starboard front bulkhead shows very considerable damage in way of the openings for the lug and hooks of the hydraulic and manual side locks but, in particular, further down the bulkhead was apparently completely cracked off the forepeak deck and pushed upwards.

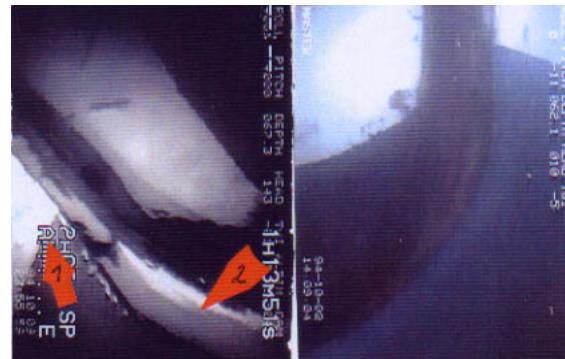
- The front bulkhead plating below the area of the hydraulic side lock was pushed outwards with exception of the rubber packing - see image below. It is clearly visible that the rubber packings, normally extending beyond the bulkhead, are in some sort of fold indicating that the surrounding plating was deformed towards the outside.



- The next image shows the area further down the bulkhead. Arrow 1 points to the lower edge of the opening for the hook, arrow 2 to the rubber packing and arrow 3 to the deep, sharp fold to starboard of the rubber packing, which extends from forepeak deck level up to the side becoming narrower the further up it runs. It is obvious that the surrounding bulkhead plating was deformed towards the outside of both sides of this fold and also between the rubber packing and the inner bulkhead edge.



- Further down the front bulkhead in the so-called "corner of the mouth", the area to the outside of the rubber packing is cracked open over some 300 mm - see left image below. The bottom part of the front bulkhead is severely deformed and apparently cracked off the forepeak deck as well as cracked off the inner bulkhead plating and probably also off the outer shell plating as can be seen from the left image below.

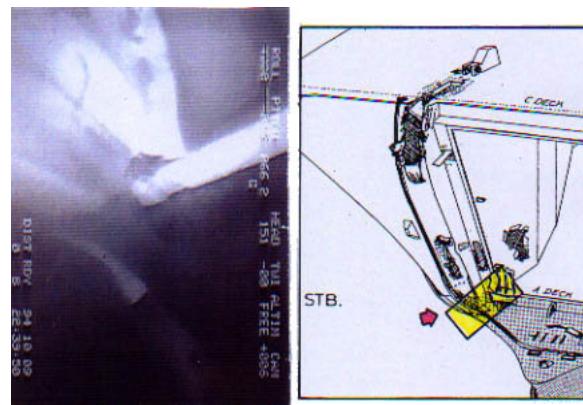


In explanation of the left image the following has to be noted:

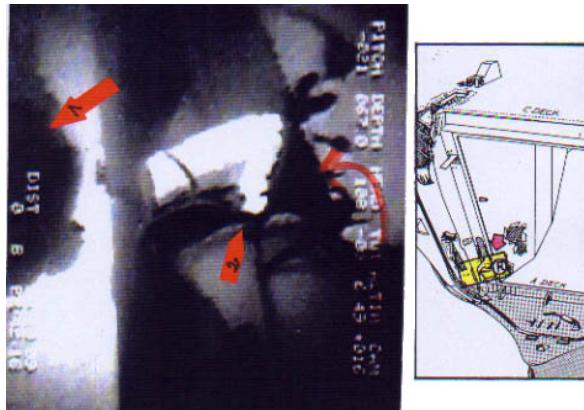
- arrow 1** = change over from blue to white paint. On the image below the arrow points to the respective area on the opposite port side.
- arrow 2** = points to the torn off and dislocated lower parts of the front bulkhead. The right image shows the corresponding intact port side.

**Note:** As the visor was resting against this area when a possible explosion occurred, the bulkhead could not burst open to forward and the pressure obviously escaped downwards and to the sides. Thereby the complete lower part of the front bulkhead was torn off the recess on the inside, off the shell plating on the outside and off the fore-peak deck on the lower side. Actually the area indicated by arrow 2 should be blue as can be seen from the image beside it showing the respective port side.

- Next to the cracked open inner bulkhead plating, the lower section of the starboard outer vertical girder of the bow ramp - being immediately next to the cracked plating when the ramp is closed. It is noted to be cracked off both from the upper and the lower transverse girder as well as from the bow ramp plating and extremely deformed and pushed to port. - See the image below with the explanatory drawing and also the extensive photo documentation in Subchapter 29.2.

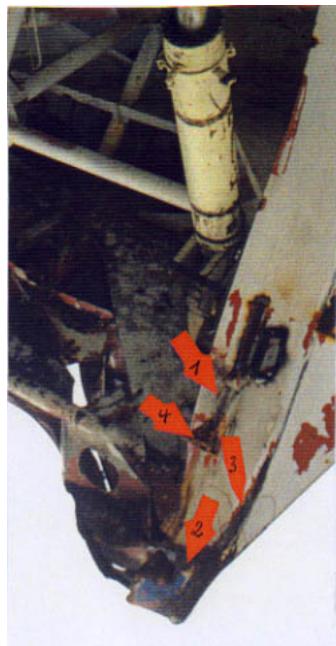


- Slightly further up, the landing of the fastening of the starboard bow ramp actuator was noted to have been cracked open, severely deformed, with the fastenings of the actuator missing and the actuator broken twice. See the following image.



Arrow 1 points to the enlarged opening in the front bulkhead for the manual hook and arrow 2 points to the burst open landing to which the starboard bow ramp actuator had been attached.

Due to the extent of this damage it has to be assumed that additional areas were affected, e.g. the bottom part of this and the adjacent void spaces, and the bulkhead towards the car deck. The appearance of the corresponding parts of the starboard lower aft bulkhead of the visor do confirm that the damage existing in way of the lower starboard front bulkhead of the vessel and the adjacent area was most probably caused by the same occurrence, viz.:



- the area between the lug and the hook shows intense smoke marks and had obviously been exposed to heat (arrow 1).
- the bulkhead plating at the change-over from white to blue and deeper is cracked at least twice with the plating severely distorted and plating parts torn out (which excludes pounding) - (arrow 2).
- a deep fold in way of the contact area with the flatbars housing the rubber packing of the vessel runs up the aft bulkhead from visor bottom to the hooks (arrow 3).
- the way the two hooks were crushed together (arrow 4).

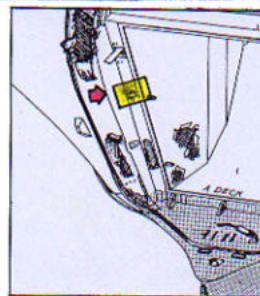
The two pictures below were taken from page 168 of the JAIC Report. The left picture shows the port aft bulkhead of the visor and the right one the starboard one, both in way of the initial location of the lugs for the hydraulic side locks. See also Chapter 30.



It is most likely that the starboard side had been exposed to considerable heat which is indicated by the corroded surface as a result of the changed metal structure. It is also most likely that the starboard side had been exposed to pressure from inside to outside which is indicated by the distortions and the cracked off stiffener, indicating a possible explosion in way. - See also Subchapter 37.7.

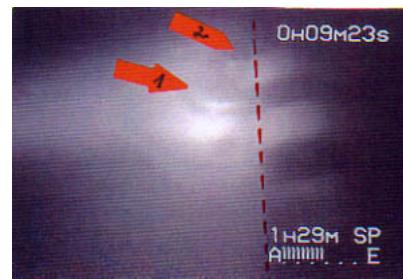
As more damage had to be expected to the bulkheads surrounding the forward void space on starboard side between A-deck (car deck) and B-deck, the available video footage was again analysed and the following was found: While the diver walked up (down) the starboard inside of the bow ramp and adjacent bulkhead plating from the opening at forecastle deck level to the hinges respectively lower flaps of the bow ramp, then along the flaps to the port side and up the port side of the ramp to the port opening, he was instructed only to look for the securing bolts and mating boxes of the bow ramp and that was exactly what he did, thereby ignoring completely most relevant damage areas. Unfortunately the quality of the footage is very poor and thus the images are rather foggy. Nevertheless the important findings should be understandable to the reader the following explanations:

The image on below shows the area of the recess bulkhead between the lug for the preventer wire and the upper mating box. Arrow 1 points to the rubber packing of the bow ramp and arrow 2 points to the edge of the bow ramp. Between the arrows a metal flap is visible which is apparently part of the recess. Transferred to the front bulkhead around the corner this is the area of the big damage above the lug of the hydraulic lock. See also the above drawing.

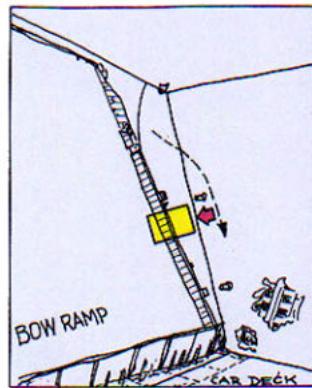


The next image shows the black/yellow painted tire-protection bar edge of the bow ramp to the right with the remains, i.e. the inner part of the fastening, for the starboard ramp actuator - see arrow 1.

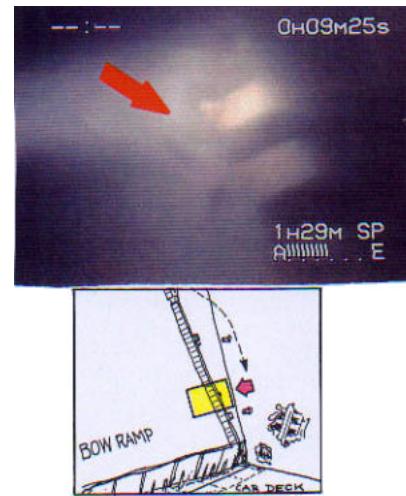
It is further visible that the edge of the ramp is bent up - arrow 2 - above the line of the recess bulkhead - see red dotted line.



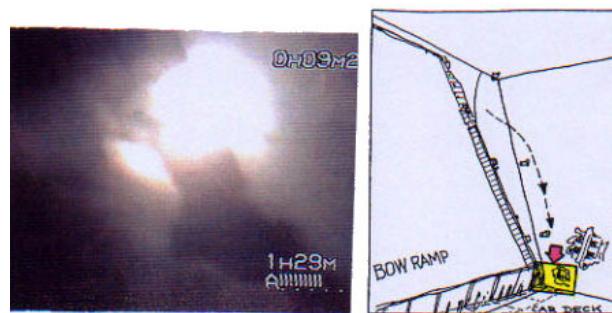
This is the area where the broken piston rod of the actuator was seen from the outside to be jammed in between the ramp and the recess.



The next image shows the crushed lower mating box which was ignored by the diver. See arrow. This is most probably old damage, see Subchapter 29.2.



From about this position the diver looks to his left to the bulkhead of the void space with cracked open plating and pallets/other debris dropping out of the opening.



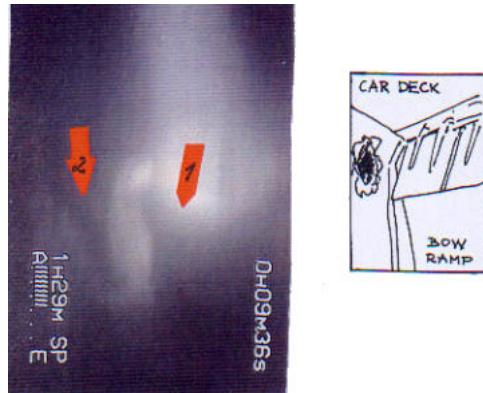
The diver looks directly into the big hole in the bulkhead and more debris becomes visible - see image below.



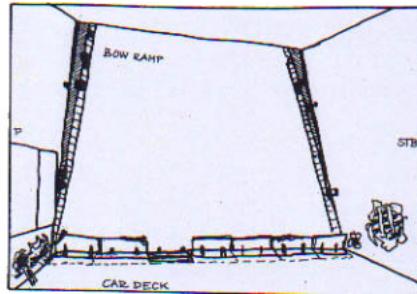
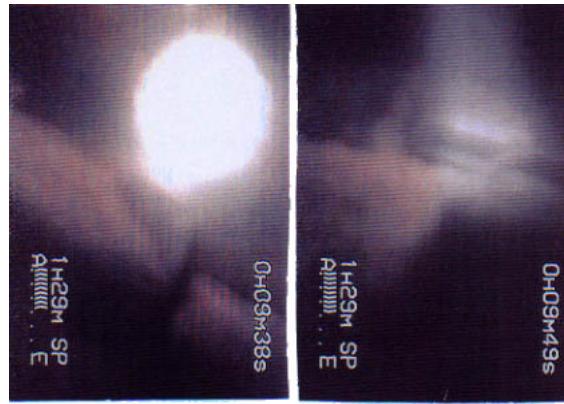
4/8/2021

## contents

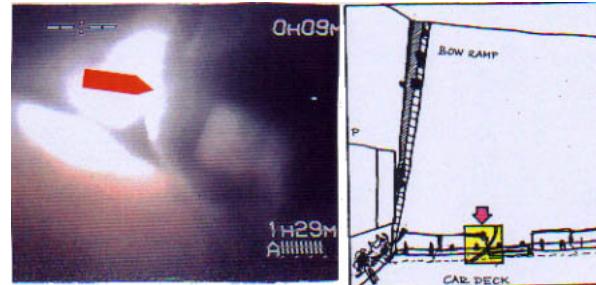
The diver looks down towards the lower flaps of the bow ramp and sees the first one on starboard side in raised condition - arrow 1 - and next to the flap he sees another hole in the bulkhead - see arrow 2.



The eight flaps of the bow ramp covering the gap between the car deck and the open ramp were found to be in different condition: some were well painted, green and intact, while others - in the middle - were brownish/red and partly damaged. See the two images below.



The next image shows the second flap from port upright and the third one from port down and in between some rope or wire - see arrow.



The next image shows the first flap on the port side of the ramp - arrow 1, the lowest point of the raised black/yellow ramp edge - arrow 2, the vertical bulkhead into which the control panel was installed - arrow 3, and the damage area commencing in way of the car deck plating - arrow 4 - and extending into the vertical bulkhead below the control panel. This will be explained in the following item (3) - The Void Space Behind the Port Front Bulkhead.

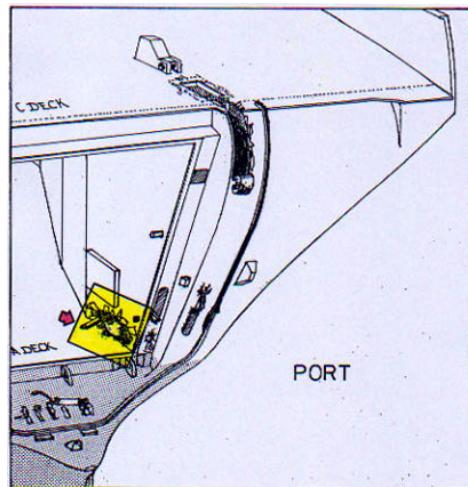


image as to (3): **The Void Space Behind the Port Front Bulkhead.**

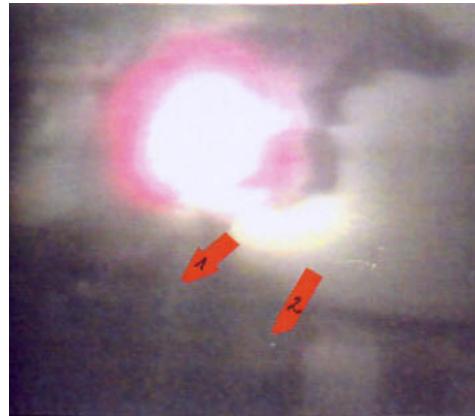
When the diver pulled himself up along the flaps on the car deck side of the ramp, he looked very briefly into the gap between the upright first flap from port - arrow 1 - and the car deck - arrow 2 - and the result was the image below which shows distorted car deck plating - arrow 3 - and something red in the background. Arrow 4 points to the bottom end of the port raised ramp behind of which the white vertical car deck bulkhead is visible.



Reference is also made to the drawing following this page showing the port side of the car deck opening without bow ramp.



The diver looked further up - it becomes obvious that the damage from the car deck extends into a large hole in the vertical bulkhead as can be seen from the image below.



Arrow 1 points again to the first flap from port, arrow 2 shows the bottom end of the raised port ramp edge, behind which the white vertical car deck bulkhead is visible, out of which the metal is bent from inside to outside, i.e. from the void space into the car deck.

A close-up of the upper right side shows a bent and twisted beam sticking out of the hole. See the image below.



The diver looked to the left and the image below was made.

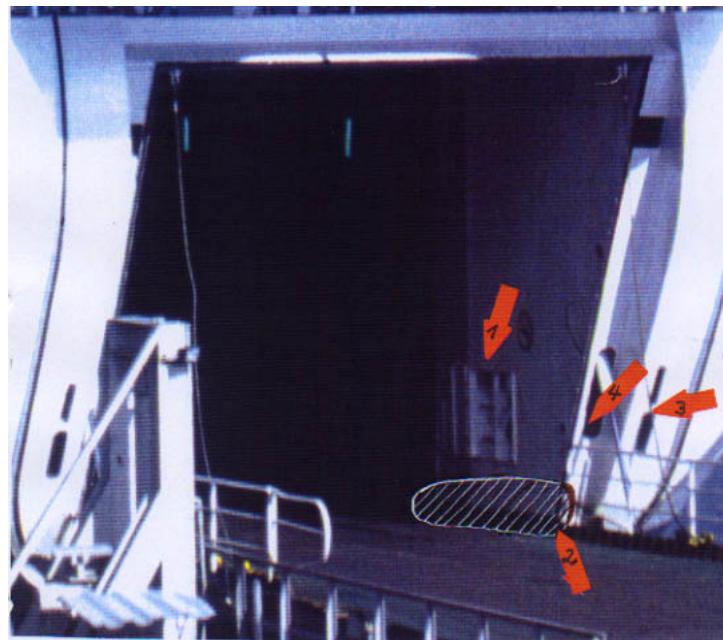


Apparently something red which could be bedding or mattress is sticking in the hole (behind this bulkhead was one of the two spaces where the boatswain stored second-hand mattresses, bedding and blankets as sealing material for the gap in the bow ramp).

The diver looked further to the left along the car deck bulkhead and more distortions became visible.



The diver continued to look further along the apparently torn open bulkhead with all sorts of things sticking out of it - see the image below apparently showing some rubber tire (used as fenders on the ferry) - arrow - together with other debris. This should be the area below the control panel as can be seen from the following image showing the entrance to the car deck with the open bow ramp.



**arrow 1** = control panel

**arrow 2** = bottom end of raised black/yellow ramp edge and first flap from port side

**arrow 3** = openings for hydraulic and manual side locks

**arrow 4** = opening for ramp actuator - the arrow points to the position of the actual fastening when the ramp was in closed condition.

The red hatched area indicates the damage, whereby the extent into the car deck is unknown because the diver looked only slightly further to the left as can be seen from the following image, which shows even more distortion with two apparently wooden planks sticking out of the torn up bulkhead edge - arrow 1 - and something like a stanchion with two guides or lugs at the top below the plank - see arrow 2.

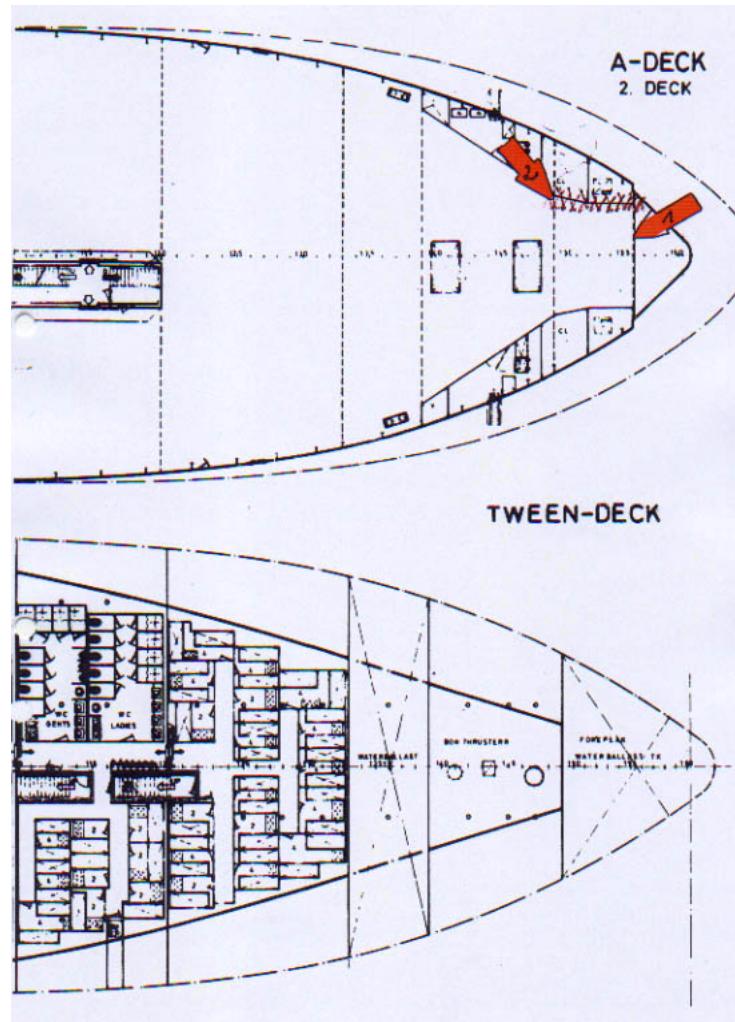


The close-up below shows the situation somewhat clearer.



The diver suddenly turned his head abruptly to the right and headed for the port lower mating box and the securing bolt where he spent some 10-15 minutes. **The large and spectacular damage explained above of an area which could not have been damaged in the course of the "heavy weather casualty scenario" was not examined by the divers, at least not on the publicly available video footage.**

The drawing below is a part of the general arrangement plan of the vessel which shows the forward part of A-deck = car deck and the area directly below on tween deck = 1st deck. The red hatched area shows the damage area which can be seen on the images explained on the previous pages. The distance from the bow ramp - arrow 1 - to the corner of the bulkhead - arrow 2 - is about 4 m. Below the dotted line the bow thruster space begins, before that space the full forepeak was located.



Although it has to be assumed that also the fastening of the port ramp actuator was blown off when the ramp was in slightly open or closed condition, this cannot be documented by video images because this area was ignored by the diver.

#### as to (4): The Bow Ramp.

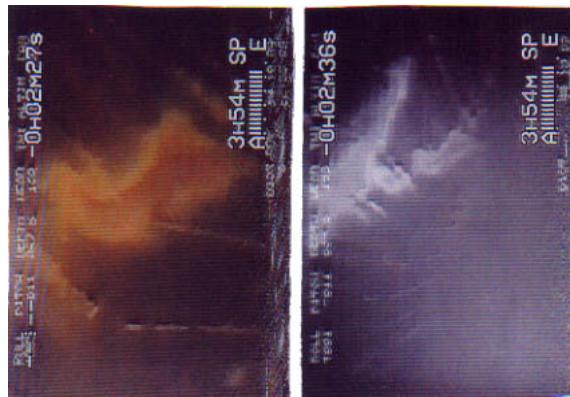
The bow ramp - see also Subchapter 29.2 - is damaged in various places to such an extent that it cannot easily be explained, for example:

- The area in way of the 2nd transverse girder from the top (2nd girder below the upper flaps), which is crushed together over about 70% of the depth of the web with the dimensions 150 x 12 mm. See the images below.

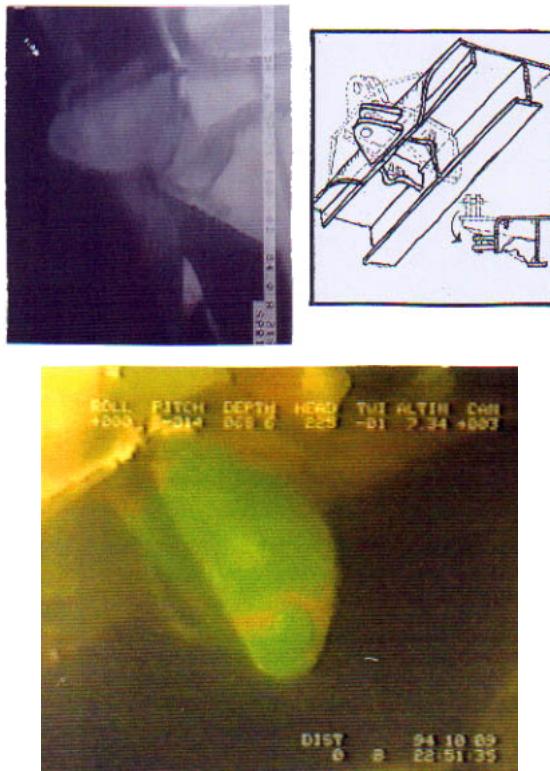


This very severe damage cannot have been caused by contact with any part of the vessel as long as the hinges were intact (at time of the diving survey the starboard outer and inner bow ramp hinges were still intact).

The respective inside of the bow ramp shows severe deformation and a burnt area in way. See the images below.



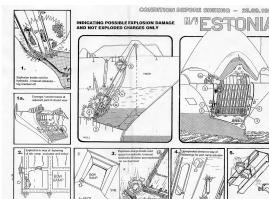
- The pushed up landing of the mating lug for the starboard ramp hook. See images below and on page 1106.



The landing with the apparently unaffected lug was pushed to starboard and upwards which has now also been verified by the expert Brian Braidwood and the results are confirmed in his "Supplementary Report" - see Subchapter 34.7.1. - [Enclosure 34.7.1.435.1](#). In summary of the before explained items (1) to (4) it has to be assumed that the damages shown on the drawing behind the next page had been caused by explosion.

#### Final Comment

This 'Group of Experts' emphasizes that the video images and the other evidence discussed in the foregoing are evidently based on the material in the possession of the JAIC. However, the JAIC has nowhere in its report in any way commented on this most disturbing evidence, including the presence of severe structural damages to the hull.



#### 32.3 Further Evidence

There was no further evidence available at the time of closing this Report.

## PART B

### ASSOCIATED FACTS AND SEPARATE INVESTIGATIONS

#### CHAPTER 33

##### BOW DOOR FAILURES AND OTHER INCIDENTS OF RO-RO VESSELS

Following the ESTONIA catastrophe the governments of the countries involved - Estonia, Finland and Sweden - initiated a number of investigations concerning

- (1) the national organisations with responsibilities for own vessels according to national law and international conventions;
- (2) the national organisations with responsibilities for foreign vessels under the Port-State-Control (PSC) regime;
- (3) the activities of the international Classification Societies.

First of all, however, all car/passenger ferries with bow doors were closely inspected as soon as possible whenever they arrived in a Swedish or Finnish ports. It is unknown whether this procedure was also carried out in the Estonian ports. From Sweden it is only known that reportedly 28 vessels were found to have serious defects to their bow-door arrangements.

From Finland the following report was received:

*»The bow and stern doors of all the Finnish passenger/Ro-Ro cargo/ferries have been inspected by the maritime inspectors of the Finnish Board of Navigation (F.B.N.). Two vessels were stopped for repairs. The locking arrangements have been welded into closed position on board the ferries which run between Helsinki-Stockholm, Helsinki-Travemünde and Vaasa-Sundsvall, and also on board the ferries which are cruising in the Northern Baltic. A special Port State Control Survey has been carried out on board all the passenger ships which are regularly trading to the Finnish ports. Captain Veikki Inkinen, Chief Maritime Inspector of the Gulf of Finland Maritime District, informed that two main categories of damage to the locking devices were found:*

1. Fatigue fractures.
2. Wear and tear.

*Cracks and fatigue fractures in the lugs of the locking devices and wear and tear failures in the bolts. Some of the bolts were 78 mm undersize (max. acceptable 3 mm) due to extensive wear. Also corrosion damages were found.*

*The inspectors found damage to almost every ship's bow visor's locking devices.*

*Maritime Inspector Tom Sommerdal surveyed about 10 vessels in Helsinki. Also he found wear and tear damages in the lugs and bolts of the locking devices of the bow visors. Also leakages in the hydraulic systems were noted.*

*The vessels under Estonian flag were in worse condition than those under Finnish flag.«*

In addition, the Swedish government instructed already on the **03.10.94** the previous Supreme Court Judge **Magnus Sjöberg** to carry out an internal investigation of the National Maritime Administration for Shipping and Navigation - Sjöfartsverket - and, in particular, its Sjöfartsinspektionen - The Shipping Inspection (Shipinspec). This investigation covered among other things the subjects 1) to 3) stated on the previous page and was performed on basis of a Government decision defined as follows:

*»On 28 September 1994, the passenger ferry Estonia foundered south-west of Utö in Finland en route from Tallinn to Stockholm. The vessel was flying the Estonian flag. On 29 September 1994, the Government commissioned the Board of Accident Investigation to assist in the accident inquiry. A joint accident board was then formed, with representatives from the Estonian, Finnish and Swedish authorities. One of the main functions of this board is to establish the reason for the accident. Survivors of this maritime disaster have stated that the vessel's bow "visor" was torn away, which is supposed to have been an important cause of the sinking. Information has since emerged to the effect that incidents and problems with bow doors have occurred previously with ferries of the same type as the Estonia. A high standard of safety at sea demands that the necessary conclusions are regularly drawn from incidents and accidents that occur. In addition to the investigation now being carried out by the joint accident board (JAIC), other matters should be dealt with including the reporting routines within the Shipinspec.*

*The Government commissions former Judge of the Supreme Court Magnus Sjöberg to carry out such a survey. As part of this, the investigator is to examine how information relevant to maritime safety is analysed and promulgated within the department, and where necessary put forward proposals for improvements. The investigator is also to look at the options for and the frequency of exchange of relevant maritime safety information between maritime safety authorities and other bodies that have important functions in the field of maritime safety, such as classification societies, insurers and shipowners' associations. Finally, the investigator should examine how such information exchange takes place between Shipinspec or corresponding bodies within our local region, and where necessary put forward proposals as to how this might be improved.*

*The investigator shall carry out his work in contact with the JAIC and in co-operation with the special committee on increased maritime safety for ferry services that the Government will be setting up.*

*The Government authorises the Minister of Communications to appoint a secretary or other assistant to the investigator.*

*The work of the investigation shall be completed with the utmost dispatch.«*

The complete "Report on Maritime Safety Work by The Shipping Inspection" by Magnus Sjöberg is attached in the Swedish Original and in English translation as Enclosures 6.3.116 and 6.3.116.1. It comprises 58 pages and deals exclusively with the conditions existing before and at the time of the ESTONIA accident and among other things the investigator has closely looked into the history of bow door failures and associated incidents as they were reflected in the various files of the different Sjöfartsinspektionen offices - not at a central register - of which some shall be explained below:

#### (a) The car/passenger ferry "VISBY"

The car/passenger ferry VISBY was built in 1972 and had a gross tonnage of 6665 registered tons. On 12 November 1973 on its ordinary run between Nynäshamn and Visby, the forebody of the ship was struck by heavy seas. The result was that the bow door opened and water was shipped on the car deck. The master therefore decided to turn the vessel back to Nynäshamn. This event took place after the vessel had come out into the open sea. There was a high wind and heavy sea at the time. On survey of the damage it was found that both of the locking hooks of the bow door had been broken off and indentations were left on the door. As a temporary measure the bow door and cargo ramp were welded to the hull. After the repair had been water-tested and surveyed by the relevant Classification Society, Lloyds Register of Shipping, the vessel received temporary permission to continue trading until the next yard inspection. In February 1974 permanent repairs were carried out, in which the bow door received new locking hooks of heavier dimensions than previously, and the locking device was further reinforced by shroud screws with lashing attachments.

The Shipinspec's conclusion about the cause of the accident, as stated in the investigation report dated 1 November 1974, was that the bow door locking devices were of too weak construction.

#### (b) "STENA SAILER"

The Ro-Ro cargo ship STENA SAILER was built in 1973 and had a gross registered tonnage of 2872. On a voyage between Zeebrugge and Dover on 16 January 1974 with a cargo of trailers and transport lorries, the vessel encountered heavy weather with increasing opposing seas. The vessel reduced its speed, but the strong sea broke apart the locking devices of the forward bow door, and lifted it out of closed position. The space between the bow door and the bow ramp was filled with water. The ramp was therefore secured using six chains. In order to avoid additional damage, the vessel was hove to and subsequently Rotterdam was called on as port of refuge where a temporary repairs were carried out. The locking mechanism and hoisting arms of the bow door had been damaged, and the port side ramp hydraulic actuators had become unusable after the failure

of the operating rod attachment. The investigation report of Shipinspec dated 12 December 1974 found that the cause of the accident was the took weak constructions of the locking devices of ramp and bow door.

**(c) "SVEA STAR"**

SVEA STAR, a car/passenger ferry built in 1968 with a gross registered tonnage of 9963, was registered with Lloyd's Register of Shipping. Between Travemünde and Helsingborg on 5 May 1974, the vessel encountered heavy weather and rising seas. A particularly heavy sea struck the vessel, breaking the forward locking devices and extra securities and lifting up the bow door. Water collected between the forward door and the ramp. The vessel returned to Travemünde for damage inspection. Upon survey it was found that all three hydraulic locking devices were completely damaged, and even the extra securing with two 2-inch turnbuckles had been torn apart. No damage was evident to the actual door or ramp. The locking devices were temporarily repaired and surveyed two days later in Helsingborg by both the Classification Society and the Department.

The Shipinspec investigation report dated 12 December 1974 states that in the opinion of the master, of the Classification Society and of the Department the accident was due to the too weak construction of the locking devices of the bow door.

**(d) "SAGA STAR"**

The car/passenger ferry SAGA STAR, with a gross registered tonnage of 8226, was built in 1981. On 6 May 1982 the vessel was about to sail from Travemünde to Helsingborg. The weather was calm. When the bow visor was closed the port hinge failed which caused the port side of the visor to fall down four meters. The hydraulic hinges broke and oil leaked out. Immediately afterwards the starboard hinge failed too and the entire visor fell down. After having been surveyed by Lloyd's Register of Shipping, the vessel was given a permit to proceed to Helsingborg - via Malmö - without its bow visor. Upon survey damage to the visor and its attachments to the hull, and hull damage between ramp and visor was ascertained. It was stated in the Shipinspec investigation report that the accident was probably due to the visor hinges having been of insufficient dimensions.

**(e) "STENA JUTLANDICA"**

The car/passenger ferry STENA JUTLANDICA was built in 1983, with a gross registered tonnage of 15 811. On 12 October 1984, STENA JUTLANDICA was berthed at Fredrikshamn. When the bow door was opened, the port hinge of the bow door failed and the bow door fell down about 2 metres. After having been lifted back into position, the door was welded in place. A permanent repair was carried out on a later occasion. When the bow door was inspected, cracks were found in the hinge attachment welds. The attachment plate was also partly cracked. According to the Shipinspec investigation report the cause for the hinge failure was the under-dimensioned welding seams of the hinge attachments which led to crack propagation.

**(f) Certain other accidents to ro-ro vessels**

The accident on 16 March 1987 involving the HARALD OF FREE ENTERPRISE led the Shipinspec immediately to carry out a review of all Swedish flag ferries from the stability point of view. Letters were also written to the owners with questions about such matters as their routines for operation and checking of bow and stern doors. During this investigation details were also obtained of previous bow door damage to Finnish car/passenger ferries. For example, it was stated that the Finnish vessel FINLANDIA sustained damage to her bow door in 1981 which also led to a modification of her sister ship SILVIA REGINA, later STENA SAGA. It was also revealed that the Finnish car-passenger ferry MARIELLA suffered very severe visor damage in 1986 - see also further in this chapter - which led to structural changes of her and the visor of her sister ship OLYMPIA, then still under construction. During the investigation of the above events it turned out that the bows were designed with too much flare, which had resulted in extreme bow stresses.

As a result of the disaster involving the ESTONIA, one of the actions taken in autumn 1994 was a specific inspection of passenger ferry bow visors by the Gothenburg Shipinspec office. Of the twelve ships examined within the Gothenburg area, eleven showed deficiencies. These ranged from the formation of cracks in the locking devices to operating system deficiencies. One vessel, the LION PRINCE, was not permitted to sail, while heavy weather restrictions were imposed on certain other vessels.

Finally, the following should be noted in this context. The mass media reported that the ESTONIA's sister ship, DIANA II, nearly lost her bow visor between Trelleborg and Rostock on the same stormy night in January 1993 when the Polish ferry JAN HEWELIUSZ sank. However, no so-called Section 70 report was submitted to the Department's Investigation Section as required by the existing regulations. Nor was this event, as far as it is known, brought to the attention of the central authority in any other way until after the loss of the ESTONIA. The Department subsequently submitted the question of the master's conduct for possible prosecution, but the prosecutor decided not to bring an action.

The DIANA II as well as the also above-mentioned MARIELLA incident shall be explained in more detail later on in this chapter. Before, however, the reaction of the administration on the SAGA STAR accident shall be outlined as follows:

After survey the chief inspector of the Malmö Shipinspec office, Åke Sjöblom, decided on 17 May 1982 that SAGA STAR could sail without the bow visor until the end of May, provided that the weather was good, that the voyages were undertaken at reduced speed, that due attention was paid to the other factors which might affect the seaworthiness of the vessel and that the log extracts were submitted to the Shipinspec after each voyage.

It was further decided that complete drawings, together with calculation material for "bow door", hinges and hydraulic arrangements should immediately be submitted to the Shipinspec. Following a survey on 17 May 1982 Lloyd's Register of Shipping awarded an Interim Classification Certificate in accordance with the Shipinspec's decision.

The new bow visor was surveyed and approved on 14 June 1982.

The Classification Society submitted the requested calculation material, and the then Safety Section of Sjöfartsverket drew up its own highly comprehensive memorandum with computation sheets. This memorandum is dated 14 July 1982 and was intended to form the basis of discussions at a safety meeting. The memorandum proposed that the Administration should determine how various forces are to be calculated. There are also references to the accidents referred to above, and the fact that these led to changes in the rules of the Classification Societies. It was alleged also that the calculations submitted by the Societies indicated inadequate engineering input on the calculation and design side, and it was alleged that the Classification Societies did not monitor this aspect sufficiently. It was mentioned for example that the bow doors of the VISBY and a vessel named WASA STAR subsequently had to be strengthened. The author of the memorandum expressed a desire for further Classification Society and yard calculation material, and proposed that the Administration should take measures to prevent further accidents of the kind in question.

According to the file the matter was finalised by the then acting Sea Safety Direction of Sjöfartsverket who wrote to Lloyd's Register of Shipping on 21 September 1982, criticising the Society's calculations and superintendence. The letter concludes as follows: "The Administration requests that you test the suggestions made regarding the present version and indicate the reinforcements that you consider necessary. In view of the fact that the locking devices of bow visors broke open in bad weather on a number of vessels, the Administration further requests you to account for the dimensioning of the locking devices of this vessel."

Apparently the SAGA STAR accident had triggered off even more activities within the Administration as reflected in the letter that the then Safety Director, Per Eriksson, wrote on 15.03.84 to Lorenzo Spinelli of the Italian Classification Society RINA - see Enclosure 33.419. It reveals that the strength expert, Gunnar Hjertstedt, of the National Maritime Administration (Sjöfartsverket) had written a memo after the cause investigation following the SAGA STAR accident and after the subsequent discussions with Lloyd's Register, of which page 1 is available and where among other things it is stated:

*»The correspondence and discussions with the classification society involved in this problem have shown that they consider the opening and closing arrangement of doors as lifting appliances exempted from their surveys, except on special request of the owner, while the other scantlings of the door and the locking arrangement are subject to their control.*

*To this procedure the Swedish Administration of Shipping and Navigation (Note: Sjöfartsverket) has the following objection. Details involved in the opening and closing of bows are integrated parts of the doors, which we find difficult to separate from the regulations concerning securing and the problem to calculate and establish the scantlings of other details of the door. If the control in this case is separated to different authorities the hazard of missing important control objects is great, which has been demonstrated in this case. The Administration of Shipping and Navigation would suggest that this problem is discussed within IACS.«*

The memo had apparently been written sometime in 1982, but in March 1984 the responsible safety director was obviously not even certain whether he had passed it on to "dear Lorenzo" when being reminded by his strength expert before his retirement, which is another demonstration of the attitude of the responsible authorities in those years. The only page available of this memo is attached together with another page from another letter or memo signed by Gunnar Hjertstedt but without date referring to the "closing and securing of doors" as Enclosure 33.420.

After each of the above-mentioned accidents exclusively concerning bow doors of car/passenger ferries or Ro-Ro cargo vessels which were only 1 year or less old - with the exception of the SVEA STAR having been 8 years old - Shipinspec and/or Sjöfartsverket only investigated against the Classification Societies, mainly Lloyd's Register but also Bureau Veritas and Norske Veritas. The Building Yards are not even mentioned and the Classification Societies were blamed for took weak construction and/or under-dimensioned locking devices and hinges.

This is, of course, remarkable to note bearing in mind that the head of the Investigation Section of the National Maritime Administration (Sjöfartsverket) attended all the meetings of the JAIC investigating the ESTONIA casualty, be it the official full Commission meetings or the internal meetings of the Swedish part of the JAIC where it had obviously been decided already shortly after the catastrophe to put most of the blame on the Building Yard.

Finally the report of the Gothenburg office of the Shipinspec concerning the STENA SAILER accident shall be quoted as follows:

*»On 2 May 1974, a report was received from the Gothenburg Shipinspec office of a meeting dealing with examination of bow door locking devices. From this report it emerged that STENA SAILER's bow door had come open during a previous voyage. It also appeared that the bow door of STENA SAILER's sister ship, the*

*UNION WELLINGTON under the New Zealand flag, despite having been reinforced, had been opened during heavy weather. Another sister ship, the SEA TRADER, had crossed the Atlantic in bad weather, but on this vessel the bow door had been welded closed. The following may also be found in the report. "During the meeting, it emerged that very little is known about the forces that affect the bow door. However, through the trials conducted by G.L. (Note: by Germanischer Lloyd), some slight understanding of this has been gained. It appeared that more or less all the locking devices on existing vessels with bow doors are of too weak construction. That matters have gone as well as they have so far is due to the fact that vessels with bow doors are mostly used in restricted trades where they do not normally meet such heavy weather. I propose that the Administration investigates how locking devices on bow doors ought to be placed, designed and constructed, and that there should then be a check on the locking devices of existing vessels. This presumably will not be done by the Classification Societies, since after all these have already approved the existing locking devices."*

**Note:** Special attention has to be drawn to the obvious fact that this proposal was made already in May 1974 by the chief inspector of the Gothenburg office to the National Maritime Administration - Sjöfartsverket.

The report of Magnus Sjöberg on the STENA SAILER continues:

*»On 8 May 1974, the Department wrote to Bureau Veritas, with which STENA SAILER was classified, and sent the society the same memorandum and questions as had formerly been submitted to Lloyd's Register of Shipping in connection with VISBY and SVEA STAR. Bureau Veritas was given the chance to respond to the questions in the memorandum and to give its views on the accident in question. It was then asked what maritime safety measures Bureau Veritas intended to undertake in connection with the bow door accidents that had happened. Bureau Veritas replied at the end of July 1974, and this response indicated inter alia that the society intended to make its requirements for bow door locking devices stricter.«*

**Note:** When DIANA II and VIKING SALLY (ESTONIA) were designed and built in 1978-1980 there were no requirements at all in the Bureau Veritas Rules then in force (1977 Rules). This reveals from a letter that the BV head office wrote to the JAIC on 10.01.95 where it is stated among other things: »The bow door drawings of the MV ESTONIA were reviewed by the Hamburg local office of Bureau Veritas which was in charge of the review. List of reviewed drawings is given as Annex 4. « »The drawings were checked against the Bureau Veritas 1977 rules which did not contain formula for the rule strength of securing devices of shell doors opening outwards.«

The complete letter is attached as Enclosure 2.4.3.37. See also comments in Subchapter 2.4.3.

So much for the Swedish investigations publicly known. The results were certainly one of the reasons why Safety Director Bengt-Erik Stenmark had to resign from his position and was replaced by Johan Fransson.

It is unknown whether a similar investigation was carried out in Finland with the Finnish Board of Navigation - then Sjöfartsstyrelsen and now renamed Sjöfartsverket. Certainly on first view the Finns would even have had more reasons to look into the performance of this organisation which, after all, had issued wrong "Passenger Ship Safety Certificates" for VIKING SALLY, SILJA STAR, WASA KING - the three previous names of the ESTONIA while trading under the Finnish flag. It is also unknown whether a similar investigation was carried out in Estonia.

In any event, in the course of the investigation by this 'Group of Experts' some further bow door incidents concerning car/passenger ferries in the Baltic have come to light which are worth being explained, viz.

#### **VIKING SAGA** now REGINA BALICA

Built for AB Sally - simultaneously with VIKING SALLY - at the Turku Shipyard in 1980. On 20.10.84 the vessel was on her scheduled voyage from Helsinki to Stockholm and encountered a south-westerly wind of 14 m/s, i.e. Bft. 6-7, when at around 23.00 hours she was shaken hard by the sea, coming from ca. 3 point on port side. The alarm of the locking device system was not activated. In Stockholm, however, heavy structural damages in way of the port visor side were found and temporary repairs were carried out. During the permanent repairs, performed later, it was recommended to reinforce the visor. For particulars see the survey reports attached in original and in office translation as Enclosure 33.421. Classification Society: Det norske Veritas (DnV).

#### **MARIELLA**

Built for Rederi AB Slite at Turku Shipyard and delivered in March 1985. On 07.11.85 the ferry was on her scheduled voyage from Helsinki to Stockholm, when at around 23.00 hours she was hit in the front by an uncommonly high sea from port which shook the vessel hard. Locking devices and hinges of the visor broke, the visor was lifted up and remained connected to the ship only by the visor actuators. Due to the enormous pressure, exerted on the pistons during thrusting up the visor, the pistons were widened and the pressure lessened. As a result thereof the visor came down again and the ingress of a large quantity of water onto the car deck was only prevented by the immediately initiated full-aft stern manoeuvre. The ship continued to Stockholm on very slow speed. The Classification Society of MARIELLA was and is Det norske Veritas. At the time of this incident the vessel was still under guarantee. It was considered to exchange the heavily damaged visor with the identical visor of her sister ship OLYMPIA which was still under construction at the Turku Shipyard, but it was subsequently decided to repair and convert the visor on site while the ferry kept trading and during which time the loading/discharging operations were carried out exclusively via the stern ramps. The repairs, which also included the locking devices being considerably reinforced, required about 5 months.

This incident, which was probably the most serious visor damage of a car/passenger ferry in the Baltic area before the ESTONIA catastrophe, led to considerable discussions in the shipping industry. The fact that DnV participated in the inspections/meetings with three Finnish representatives and one Swedish representative underlines that the problems were realized and that it was clearly considered to be a Class matter, the F.B.N. was not involved. After analysing the events it was agreed that the immediate reduction of the speed and the turning of the stern into the sea had finally prevented the loss of the visor and the subsequent probably unavoidable catastrophe. - See the Inspection Report Enclosure 33.422.

The MARIELLA - same as the ESTONIA - is equipped with a visor/bow ramp combination, i.e. the upper part of the ramp extends into a deck house which is part of the visor. In addition to this the vessel is equipped with a 2.50 m high and moveable collision bulkhead on the car deck.

As a consequence of the MARIELLA accident the locking devices for the bow visor of her sister ship OLYMPIA, delivered in April 1986, were totally changed upon the instructions of the Swedish Sjöfartsverket - inspector Lennart Ahlberg. The owner, Gustav Myrsten, was reportedly personally handling the changes and reinforcements of the locking devices. Subsequently the OLYMPIA was chartered by P&O and used in liner service between Southampton and Bilbao. At the same time the Classification Society was changed from DnV to Bureau Veritas (B.V.) and P&O ordered the installation of eight additional locking devices in view of the regular crossing of the Bay of Biscay.

#### **SAINT PATRICK II**

Built for SF-Line, the third Viking Line partner, in 1973 as TURELLA by Sietas Werft, Hamburg. She is a passenger/Ro-Ro cargo/ferry of 7984 gross tons and 1325 dwt, built to Lloyd's Register Class Rules and supervision and is classed + 100 A1, Ice Class I, Ice Class IA, which corresponds to Finnish/Swedish Ice Class Rules 1971. The vessel is fitted with a bow visor and ramp for vehicle access at the forward end. At the aft end there is a stern door/ramp. The mean draught is 5.35 m, while ESTONIA's draught was about 5.5 m. Information was received from Helsinki about damage to the visor of this ferry having been in bare-boat charter for Tallink (ESCO) from September 1993 to May 1994 between Helsinki and Tallinn. During this time the ferry experienced the following:

**- on 11 January 1994** - The bow visor was frozen in position above and below the Atlantic lock, which was the modification fitted in 1982 consisting of a hydraulic locking arrangement between the forepeak tank top below the bow ramp position and the bottom of the visor. The visor could not be opened in Tallinn and the vessel was discharged by the stern. The visor's lower area was heated with steam hoses to clear the ice and then released.

**- on 18 February 1994** - The starboard side bow plating, below the visor and in way of the Atlantic lock space, was found to be heavily set in and the visor could not be opened. After discharge of vehicles, on the early morning, the vessel went to the Baltic Shipyard, where repairs were effected to the starboard bow. See the attached photo documentation. After this incident on 18 February, extreme care was taken when navigating in ice conditions, with the vessel being trimmed by the stern to keep the visor higher above the waterline.

**- on 29 March 1994** - The bow visor was found to be jammed and upon examination it was noted that the port side bow shell plating, in way of the Atlantic lock position, had been heavily set in, similar in nature to the damage noted on the starboard side on 18 February 1994. Immediate temporary repairs were carried out to allow the vessel to continue her service. On 4 April 1994 it became necessary to carry out some additional welding to the temporary repair on the port side. Upon subsequent dry-docking it was found that extensive damage to the shell plating on both sides had been sustained whilst the bow visor was damaged as follows:

- Bow lower edge plating, port and starboard buckled and set in and visor void tank possibly breached.

- Visor locking arrangement open position, port side fractured and starboard side missing. Visor displaced slightly to port.

A photo documentation with explanation is attached as Enclosure 33.423.

The experience of the SAINT PATRICK II as explained above confirms the observations by passengers on board the ESTONIA during the ice winter 1994 and the respective damage to visor and locking devices found subsequently.

### 33.1 The "DIANA II" Incident in January 1993

As this relatively minor incident was made into a near catastrophe by the Nordic media with the visor allegedly almost lost, clarification was needed and thus the matter was also investigated by this 'Group of Experts' with the following result:

DIANA II was delivered by Meyer Werft in 1979 as forerunner and near-sister of the ESTONIA. The DIANA II as well as the VIKING SALLY (later ESTONIA) were trading in the Viking Line service between Stockholm-Mariehamn-Turku until 1990. From the chief mate Karl Ole Lindroos, who had practically been on board from the time of delivery until 1990, as well as from the mate and master Thorsten Söder, who served in this rank for many years, the following information has been received:

- It was well known to all navigators that the bow visor was the most sensitive part of the vessel and was endangered in head-on seas at too high speed.
- The visor was the responsibility of the chief mate who also opened and closed it.
- There were always problems at the time of opening and closing the bolt of the Atlantic lock, so that the bolt was finally thinned by 5 mm. After the visor had once been lowered with already closed bolt of the Atlantic lock, the bolt had to be renewed.
- Before it was possible to open the locking devices it was necessary to press the visor hydraulically down as otherwise the bolts could not have been opened respectively closed hydraulically against the pressure of the rubber packings.
- During the winter time there were always problems with the rubber packings being frozen to the visor bottom.
- It often occurred that the visor closed with a loud "bang" as the man at the operating panel could not see the respective position of the visor.
- About one year before changing from the Site Line to the Trelleborg-Rostock Line (TR Line) the pistons of the hydraulic cylinders were newly coated.
- After the bankruptcy of Site Line in 1992 DIANA II was taken over by TR Line on basis of a bareboat. At first the Site crew remained partly on board. Thorsten Söder and Lennart Elfors remained masters and Karl Ole Lindroos was one of the two chief mates for several months.
- The vessel was engaged in the Rostock-Trelleborg service and made three trips daily, two of which were carried out during the daylight at full speed and one during the night with the speed reduced to ca. 12 kn.
- On the morning of **16 January 1993** during the voyage from Rostock to Trelleborg - i.e. two days after the hurricane in which the JAN HEWELIUSZ sank - there was again a storm of Bft. 10 blowing. Captain Söder was already on board the DIANA II to take-over the command from Captain Elfors after arrival in Trelleborg. The vessel proceeded through the very rough sea at ca. 12 kn. The chief mates Lindroos and Hartwigsson were on their handing-over round just in the forward part of the car deck when they noticed water leaking through the bow ramp. After the vessel had reached the shelter of the shore, both mates entered the inside of the visor through the hatch on the forecastle deck and found considerable damage to the hydraulic side locks (the manual side locks were not engaged) as well as to the Atlantic lock. After arrival the Classification Society B.V., Sjöfartsverket as well as TR Line were immediately informed and the responsible TR inspector instructed the master to have the damage repaired prior to the next departure.
- The ship's command entered the following remarks into the logbook:

*"Upon arrival Trelleborg the following damage was found to the bow visor: Locking devices out of order, starboard side lost, port side bent, Atlantic lock ca. 2-3 cm cracked, cracks in starboard side web, cracks in the starboard hinge."*  
(Logbook page 6 - see [Enclosure 33.1.424](#))

An inspection was carried out by the B.V. surveyor Axel Gall after commencement of repairs on 16 January 1993 and after completion of same on 17 January 1993 - see the B.V. Survey Report [Enclosure 33.1.425](#).

Accordingly the following damage was found:

- The lug for starboard lock plunger was lost;
- the lug in centre line (the "Atlantic lock") was bent and the weld cracked;
- the lug for port side plunges was bent and the weld cracked;
- a minor crack at hinge on starboard side;
- the girder in centre line and two webs on starboard side cracked.

The following repairs were carried out by Trelleborg Industri- & Byggservice AB and their invoice with working sheets is attached as [Enclosure 33.1.426](#).

- The lug starboard side renewed with doubling plate on the back side;
- the lug in centre line fairied and re-welded; the stay above the lug renewed;
- the lug port side fairied and the crack chiselled and welded;
- the crack at starboard hinge chiselled and welded;
- the cracks at the girder and the webs chiselled and welded.

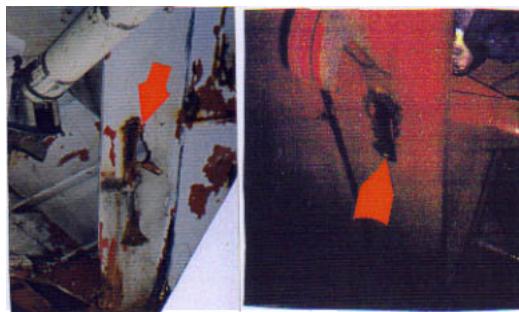
In the presence of the B.V. surveyor, Captain Söder informed Sjöfarts-inspektionen Malmö - Åke Sjöblom - and invited them for survey. However, due to lack of time this was allegedly not possible and Sjöblom confirmed that the survey carried out by B.V. was sufficient and the repairs would be inspected later. Actually this was performed ca. three months later by the Safety Inspector Nilsson, according to the logbook entry.

- The B.V. lawyer Johnsson from Stockholm wrote in a letter to Dr. Peter Holtappels on the incident as follows:

*»According to the Captain in command of the DIANA II two officers discovered the damages at sea. For some time it had been "wet" on the forward ramp and crew members at sea went down between the forward ramp and the visor to see if the packing was leaking significantly. When they went down, the damages to the visor were discovered. On arrival at Trelleborg on 16 January 1993, they had a close look while the visor was opened. Thereafter the repairs were ordered through TR-Line in Trelleborg. The captain said that the weather had been bad for a few days, 15-25 m/s high waves, and it was dark. Thus, the damages might have happened several days before the 16 January 1993. He does not know when or under what circumstances the damages were suffered. The captain advised the chief surveyor of Malmö Inspectorate about the damages on 16 January 1993 by telephone.«*

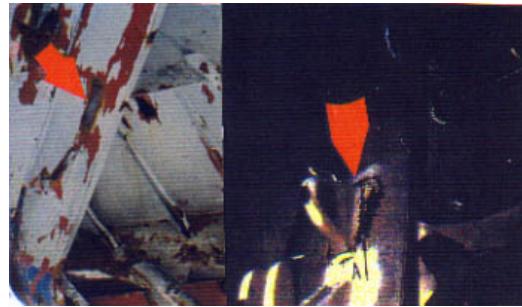
The complete letter is attached as enclosure 33.1.427.

- A comparison of the damage to the side lock lugs of DIANA II / ESTONIA is shown below.



ESTONIA

DIANA II



According to the ship's command the torn off starboard lug was lost. This is possible as first the lug hangs on the bolt of the hydraulic locking device and after opening the same it falls into the water. As noticed from the letter of the B.V. lawyer Johnsson, the repairs had already been commenced when the B.V. surveyor boarded the vessel. Thus practically neither the class nor the safety board ever saw the damage in its original condition.

The ship's command was unable to attribute the damage to a special occurrence, such as a hard blow of the sea. Therefore the TR Line inspector Griesmaier is of the opinion that the damage to the locking devices occurred over a longer period. This would be in conformity with among other things the statements of the chief mate Karl Ole Lindroos.

- DIANA II remained in charter with TR Line until the end of September 1994. Since June 1994 Nordström & Thulin had become interested in the ship, in order to take her into their Stockholm-Tallinn service in addition to the ESTONIA. First inspections were carried out which included checking of the B.V. survey reports on board, thus inspector Hobro saw the B.V. report concerning the broken/cracked locks of the visor.
- After the ESTONIA sank, the take-over was quickly performed. On 29 Sept-ember 1994 in the presence of the B.V. surveyor Kirchhoff and the N&T inspector Hobro, all locking devices were opened and closed with closed visor, the indicator lights were checked and all found to be in order. The vessel remained in Warnemünde until 4 or 5 October 1994. As a consequence of the ESTONIA accident the bow visor was welded closed, however, broke open again during her subsequent voyage to Turku.
- After the take-over, Nordström & Thulin instructed Messrs. Turbo Technik of Wilhelmshaven to inspect the bow visor and its locking devices and the following was ascertained:

- Inspection of the hinges by means of the "dye-check" method showed no cracks;
- the play between the bolt and the lugs of the Atlantic lock was measured to be 35 mm and was different from lug to lug - including bolt / visor lug;
- the prevailing pressure was to forward, thus the play was only aft;
- the lugs were oval as were the bushings;
- the bushing for the spring loaded securing bolt fitted to the bushing between the port and the centre lugs was present;
- the visor lug was oval and fixed to a bar, running diagonally upwards. This was not in conformity with the lug as per drawing No. 48611-373;
- at the centre and port lugs and possibly at the sensor plate there were two angle bars in athwartships direction, from where a pipe was leading to the cross beam of the 3rd stringer level of the visor;
- below this cross beam (round) a double T-beam was fitted, probably to give the visor more transverse strength in the bow wave area (ice);
- the sensors should have been fitted to the 2nd stringer level (mode of operation unclear at present);
- all three lugs of the Atlantic lock had been rewelded to the forepeak deck;
- the lug of the starboard side lock was not original.

In summary Turbo Technik concluded:

"On the whole we do not consider it safe to run the vessel under this condition."

The complete report of Turbo Technik is attached as [Enclosure 33.1.428](#).

### 33.2 The "HABIB" Visor Damage on 04.10.78

Finally attention shall be drawn to one visor damage which occurred outside the Baltic Sea area in the Western Mediterranean sea. It concerns the brand new car/passenger ferry HABIB also classed by B.V. and built for the Tunisian owners Cotunav, Tunis, for service between Tunis-Genua-Marseille by the Nobiskrug Shipyard/Rendsburg in 1978. The vessel has a length of 145.73 m, a breadth of 23.51 m and a draught of 6.16 m. The service speed is 23 kn. The bow ramp was regarded as upper extension of the collision bulkhead above the bulkhead deck and connected to the visor.

On 4 October 1978 the ferry was on voyage from Tunis to Marseille when at 01.10 hours the course was changed to the west and at 02.15 hours to 320° towards Marseille; wind: West Bft. 9-10, speed 15.8 kn. From 07.00 hours onwards they were sailing under the French coast. Around 11.00 hours it was noticed that the locking devices of the bow visor had broken and the visor was set to starboard.

The visor was lashed/secured, and the voyage was continued with reduced speed to Marseille. The visor was temporarily closed and repaired during the following yard period. The locking device system, built and installed by MacGregor, was reinforced after the occurrence.

## CHAPTER 34

### SEPARATE INVESTIGATIONS

In the course of the year 1995 and subsequently this 'Group of Experts' initiated a number of technical and scientific investigations to ascertain the load exposure of the visor and its locking devices, the actual strength of the Atlantic Lock and the condition of parts recovered from wreck and visor. Also the break load of the bow ramp hinges and the forces necessary for the visor lugs to cut through the deck beam at frame 159 were calculated. In addition the available video footage was evaluated and analysed and the videos still showing unexplainable damage to the wreck were examined by a diving and explosive expert. Furthermore the investigation results of "The Independent Fact Group", Stockholm, concerning the forgery of documents to hide the initial unseaworthy-ness of the ESTONIA have been taken up into this chapter with the permission of the authors. Finally, the results of an investigation by the Det Norske Veritas Classification A/S Håvik/Norway concerning the design load aspects for the bow area of Ro-Ro vessels under the heading "Bow Impact of Ro-Ro Vessels" have been made available and shall be considered in this chapter as well.

In detail:

**34.1**

**Forgery of Documents to hide the initial Unseaworthiness  
of the "Estonia" by The Independent Fact Group, Stockholm (IFG)**

This group consists of Björn Stenberg, Johan Ridderstolpe and a number of unknown members, preferring to stay in the background. It was founded in the beginning of 1999 to clarify, in a well structured and methodical way, the many open questions and speculations in connection with the ESTONIA catastrophe, the work of the JAIC and behaviour of the Government.

It is the purpose to enable the political decision makers on basis of facts to reconsider the matter and, finally, agree on a new investigation.

The first work of the IFG concerns the very carefully performed analyses of different documents found in the archives of the JAIC and Shipinspec in Stockholm. These documents relate to the inspection of the ESTONIA until about 2 hours before her last departure by The Swedish inspectors Åke Sjöblom and Gunnar Zahle from the Shipinspec Malmö office. The inspection was meant to be a Port State Control (PSC) to train 8 or 9 high ranking Estonian officials. - See Chapter 15. At the end the normal PSC form used by Shipinspec inspectors in Swedish ports was filled out and the "findings" entered. Both form and findings do exist in at least 4, probably 5, different versions, all of which are discussed and evaluated by the IFG, the apparent purpose being to hide in hindsight the initial unseaworthiness of the ESTONIA upon departure from Tallinn which would clearly have been established if the complete findings would have been entered into the form as required.

The complete IFG Report in the Swedish original and in German translation is attached as Enclosures 34.1.429 and 34.1.429.1.

**34.2**

**Structural Analysis of Bow Visor and Locking Devices  
by means of the Finite Element Analysis by the Technical University Hamburg-Harburg**

As part of the investigation in connection with the sinking of the ferry ESTONIA the structure of the visor has been calculated on the basis of the load requirements by the Classification Society Bureau Veritas (B.V.) by means of the Finite Element Method. Thereby the distribution of the reaction forces on the fixing points of the visor, and especially on the Atlantic lock, were of particular interest because of the allegations published by the JAIC that the casualty had been initiated by the failure of the locking devices of the visor. For this reason detailed calculations have been performed, including cases whereby only a limited attachment still existed after the hinges had failed.

At the time of the design and construction of the vessel in 1979/1980 such detailed calculations were neither required by the Classification Societies nor were they state-of-the-art. The selected load on the model is based on an analysis of B.V. whereby the load, acting normally on the shell plating of the visor was assumed to be the water pressure acting on the visor when the ferry was underway. The load acting on the lowest part of the visor was assumed to be 7 t/m<sup>2</sup> and decreasing continuously with increasing height. At no height level is the pressure less than 3.5 t/m<sup>2</sup>. The load includes the C-deck (forecastle deck).

The weight of the empty visor and the rubber packings on the forepeak deck have been taken into account in all calculations. Wave loads have been assumed to act only on the port side of the visor.

Before discussing the results, the symbols for the directions into which the forces were acting shall be explained:

- x = transverse ( athwartship)
- y = longitudinal ( forward aft)
- z = vertical

The calculations clearly reveal that as long as the hinges are intact the Atlantic lock takes only very little load. The force direction is opposite to the direction into which the vessel is proceeding, i.e. aft. The small load is to be attributed to the low stiffeners and the high deformation of the visor bottom. Even by using a more detailed net of finite elements no other tendencies became apparent respectively no other results were achieved.

In normal cases the highest loads appear in way of the side locks. The loads cause the aft bulkheads of the visor to be pressed against the front bulkheads of the vessel in the middle and upper areas.

In case also the rubber packing of the visor on the vessel's front bulkheads are taken into account the vertically acting loads are reduced.

If a load is acting on the visor only from one side the hinge on this side has to bear excessive load while the load on the other is less than normal, however, partly acting from different directions.

In case the visor is under constant pressure the loads on the hinges and side locks do increase while the load on the Atlantic lock is decreasing. In case one or both hinges fail all other fixing points have to bear substantially more load and the force direction on the Atlantic lock changes to the opposite direction, i.e. to forward.

In case one hinge fails the Atlantic lock has to bear 2.6 times of the normal load, if both hinges fail the Atlantic lock has to bear 15.8 times of the normal load.

The results of this structural analysis of the visor can be summarised as follows:

By means of several calculation models various load conditions have been simulated, for example the pressure load according to B.V., the load from the side and the load due to a permanent pressure load. In all cases the visor's own weight was taken into account.

The different fixing point conditions were simulated as follows:

- visor fixed to hinges and locking devices,
- additionally the rubber packings were considered,
- additionally considering the manual side locks,
- failure of one and both hinges. The analysis reveals that the Atlantic lock absorbs only a small force component as long as the hinges are intact. The force direction is aft.

The highest forces on the fixing points are effective when the load is acting simultaneously on both side locks. If the visor is exposed to a load only on one side, the load on the hinges on this side is the biggest.

In case that one or both hinges fail, the Atlantic lock becomes exposed to very heavy loads and the force direction changes by 180° to forward.

If both hinges fail the Atlantic lock has to take the heaviest load. The complete Report is attached as Enclosure 34.2.430.

**34.13 Comments on the JAIC Report  
by Prof. Dr.-Ing. H. Petershagen, Hamburg**

The JAIC Report has been analysed from the naval architects point of view and the resulting comments are completely incorporated into PART C. The conclusions of Professor Petershagen read as follows: "The sections of the final report of the Joint Accident Investigation Commission commented in this contribution are based on a number of individual investigations. Most of these are carried out according to the present state of knowledge and analysis methods. However, the results involve large uncertainties, especially with regard to the loads on the bow visor at the time of the accident. Moreover, the report contains misinterpretations and neglects possible influence factors on the visor failure such as maintenance conditions of the structures in question and pre-existing damage. Summarizing it has to be stated that the parts of the final report commented do not offer a reliable basis for a realistic assessment of the bow visor failure of MV "ESTONIA".

**34.3**

**Systematical Fracture Tests with Atlantic Lock Mock-ups of  
M.V. "Estonia" by the Institute for Naval Architecture of the University of Hamburg**

As it had been established by the before explained analysis of the visor structure that the Atlantic lock was exposed to less load than the side locks as long as the hinges were intact and that the force direction would be aft, it was suggested to the technical group of the JAIC - Börje Stenström - Tuomo Karppinen - Klaus Rahka - to have mock-ups built and tested to destruction by an institute of their choice, also by the Finnish VTT where both Karppinen and Rahka were employed. This was, however, not possible as this institute did not have sufficient pulling power, agreement was reached to have the break- tests carried out by the Institute of Naval Architecture (Institut für Schiffbau) in Hamburg and four

mock-ups were built according to the suggestions of Stenström/Rahka which were identical with exception of the welding seams between the bushing starboard lug and the housing/centre- and port-lugs.

These were:

- (1) welding seam thickness 3 mm (as found on the lug remains recovered from the wreck);
- (2) bushing and housing only spot-welded to the lugs;
- (3) no welding seams at all;
- (4) welding seams 3 mm but visor lug strengthened above dimensions according to drawings.

The tests were carried out in the presence of members of the technical group of the JAIC as well as B.V., the University of the Armed Forces, Hamburg and this 'Group of Experts'.

The lugs were made of normal steel and the bolt, bushing and housing of high tensile steel. The results were as follows:

**Test (1)** : The big visor lug broke at a load of 204.3 ts. The bolt was slightly deformed, the lugs and welding seams remained unaffected.

**Test (2)** : The starboard and centre lugs broke at a load of 142.5 ts., the port lug was deformed towards port but did not break the visor lug and the bolt remained unaffected.

**Test (3)** : The starboard and the centre lugs broke at a load of 99.2 ts., the port lug in its forward part was slightly deformed towards port but did not break, the visor lug and the bolt remained unaffected.

**Test (4)** : The starboard and the centre lugs broke at a load of 204 ts., the port lug did not break at the test because the pulling was discontinued after the breakage of the starboard and centre lugs; it has to be assumed, however, that it would have broken if the pulling had been continued as it had been in practice. The bolt was slightly deformed, the visor lug apparently remained unaffected.

The complete Report is attached as Enclosure 34.3.431.

#### 34.4

#### Determination of the Steel Quality of the Atlantic Lock Mock-ups by the Institute for Failure Analysis and Failure Prevention, Hamburg

The systematical fracture tests with Atlantic lock mock-ups by the Institut für Schiffbau, Hamburg have been discussed in Subchapter 34.3 and the respective report is attached as Enclosure 34.3.431. These tests were performed upon recommendation and in the presence of members of the JAIC and the resulting report - Enclosure 34.3.431 - was sent to them soon after the tests in 1996. Although the report clearly states that the lugs were made of **normal (mild) steel** and that the bottom lock assembly broke at **2.04 MN** load the JAIC has stated on page 189 of their Final Report among other things :

*»Two contributing lugs would then have given the complete bottom lock assembly a holding capacity of about 1.5 MN including a small contribution from the starboard bracket. The Commission considers this to be a realistic maximum value.*

*The Commission is aware of a series of tests carried out in 1996 at the Technical University of Hamburg on behalf of the yard with full scale mock-ups of the bottom lock assembly made of high-tensile strength steel. In these tests, characterised by different extent of welding between the attachment lugs and the locking bolt housing, failures occurred between 1.0 and 2.0 MN. A test that incorporated intermittent welds resulted in failure at 1.42 MN.«*

In order to prove that the lugs were not made of high tensile steel as stated by the JAIC the Institute for Failure Analysis and Failure Prevention, Hamburg carried out tensile tests of the mock-up remains and the result was: The lugs of the Atlantic lock mock-ups were made of

**normal shipbuilding steel, e.g. according to GL.**

The letter with test results and findings is attached as Enclosure 34.4.432.

#### 34.5

#### Bow Impact of Ro-Ro Vessels by Det Norske Veritas

This paper - given to the Society of Naval Architects of Japan by Det norske Veritas (DnV) - concentrates on design load aspects for the bow area and presents results of recent work carried out by DnV with the aim of evaluating the long term bow impact loads that a Ro-Ro vessel may be subjected to during its operational life. The reason why it has been incorporated into this report is the obvious fact that the results are partly absolutely contrary to the findings of the JAIC. The paper is attached as Enclosure 34.5.433 and the conclusions are as follows:

*»Bow impact of five different Ro-Ro vessels is studied numerically and empirically. Impact is considered both from an ultimate and a fatigue point of view. For the ultimate load case, the loads are found to be strongly a function of the wave height and the forward vessel speed. This illustrates the importance of speed reductions in rough seas. The study also shows that the highest waves do not necessarily induce the highest impact loads on the structure. The bow impact loads from the DnV Classification Rules are intended to cover all types of designs and design conditions.*

*A fatigue investigation of the bow door support system for one typical vessel has been carried out. A long term distribution of the bow forces has been established based upon a gradual speed reduction when wave height exceeds significant wave height = 5 meter. The results of the analysis show a fatigue life exceeding 66 years when using the North Atlantic wave climate as basis and constant operation in head seas. This corresponds to 400 years fatigue life for operation in all headings and on this basis it is concluded that fatigue does not represent a problem provided the vessel is operated with good seamanship. These conclusions are based upon the assumption that the bow doors are designed for ultimate loads according to the DnV 1994 Rules and that NV36 strength steel or lower is applied. The welded details are according to normal ship practice and with an intact corrosion protection.«*

#### 34.6

#### Investigation Report of Video Tapes Featuring the Car/Passenger Ferry "Estonia" by Disengage, Axminster/UK

All the video tapes available to this 'Group of Experts' showing the ESTONIA afloat and on the bottom of the sea were supplied to Disengage/UK specialised in the evaluation and interpretation of video tapes and the production of video images. The aim of the investigation conducted by Disengage at the beginning was to assist the explosive expert Mr. B. Braithwaite in identifying possible explosion damage to the vessel. This has been completed and now the aim has been to identify the technical nature of the videos, provide fully detailed listings of the content of the cassettes, provide still images of any items of possible interest to the overall investigation and identify any anomalies in the content of the cassettes including missing sections of tape and unidentified activity of wreck site.

Thirteen cassettes have been submitted to Disengage for analysis. Of these 13 cassettes 4 stem from diver activity and 9 were filmed by remote Operated Vehicles (ROVs). This includes 3 tapes that are duplicates.

There are two main differences between videos made by ROVs and videos made by divers.

- The ROV videos show data on screen during recording, including date, time, course, depth and camera pitch angle. The ROVs are also generally well lit due to them carrying more than one light to conduct filming.
- The diver videos carry no data on screen resulting in dates and times being estimated from brief official documentation and on screen encounters with ROVs from which information is available. The picture quality of the divers videos is also hampered because of the poor lighting used on the head mounted cameras. The single very bright light tends to bleach out the

images which effect has been worsened during the duplication process.

- The investigation into the cause for the excessive brightness and unclear, foggy pictures revealed that the contractor Rockwater made the original master recordings of the underwater survey on VHS cassettes in a PAL format, however, tests have shown that the copies supplied have been played back and duplicated on PAL/SECAM machines without the necessary converters in place. This has created the breakdown in colour definition, excessive brightness and tracking problems making accurate work with the video tapes very difficult and sometimes impossible. The contractor Rockwater was further requested to explain why so many, and partly long, video pauses had been made respectively long parts of the tapes were just flickering. Their reply was that it is normal practice for cameras to continue recording, for safety and continuity, throughout a survey whether it is conducted by ROVs or divers which is especially relevant when an ROV such as the Sprint unit is used, because it is only image platform with no other capacity than the collection of stills and video. As out of 13 cassettes reviewed only 4 have no cuts (because they were most probably made for demonstration purposes) it is quite obvious that these cuts do not fall into the responsibility of the contractor Rockwater, but were made elsewhere. It has also become apparent that the breaks basically occur in the same areas of the vessel, for example the starboard shell plating in way of the 0-deck below the bridge and funnel.
- Another concern regarding the cuts in the footage is the relationship between the on screen timing and the VHS time code. Most of the occasions when a tape cut takes place the elapsed time on the ROV 'on screen clock' is greater than that on the VHS cassettes when most of the cuts in the footage were made at the time of duplication and not when the survey was taking place.

In summary Disengage has made the following main findings:

- According to the cassettes from the 2/10/94, 9/10/94 and the 2-4/12/94 there is evidence that between these dates there has been movement of what would be expected to be stationary items such as ropes and debris. This is most clear on the hawsers to the port side of the bow ramp.
- According to the cassettes from the 2/10/94, 9/10/94 and the 2-4/12/94 there are occasions when other activity is taking place on the wreck, visible by other ROV and diver lights on footage. This activity is not covered in the available cassettes.
- There are areas on the vessel that have not been surveyed enough to be documented properly. These areas are either missing from the footage due to cuts in the footage or because of a lack of detailed investigation when the ROV or divers are in the area.
- This refers in particular to the starboard mudline, bow ramp hydraulic actuators and ramp locking hooks, seabed debris and the car deck in general. On the occasions when the ROV got to the starboard mudline the tape is cut between the funnel and bridge or until the ROV arrives at the starboard rudder or moves to another area on the hull away from the mudline.
- The bow ramp actuators have both been bent and damaged, however the diver does not attempt to conduct any kind of detailed investigation. Apart from a brief comment about the eye on the end of the starboard actuator on tape B40c/number 19 there is no other comment or video documentation of these important items.
- It is possible to access the car deck and on tape B40c/number 19 the diver enters it to inspect the ramp securing bolts and mating pockets. On the respective video there is remarkable damage briefly visible which is totally ignored by both the diver and his supervisor and all the many others in the control room on board of SEMI I who were watching what the diver was doing and frequently interfered with instructions.
- For example, the diver briefly looked onto a big damage to the port longitudinal car deck bulkhead when he was climbing up the bottom flaps of the bow ramp from starboard to port.
- On cassette B40b/number 20 the ROV attempts on several occasions to enter the car deck and fails. On several of these occasions the operator believes he has entered the car deck, but then discovers he's wrong and on the seabed. On the final occasion they are sure they have entered and this is very difficult to confirm due to several cuts in the tape, but on the later diver cassette B40e/number 10 from the same date and time the diver sees the ROV on the seabed at the same time as this footage. Due to the large number of cuts on this ROV tape B40b/number 20, including one cut of nearly one hour, no conclusions can be made. There is however some confusion in this ROVs activities as during the hour long cut in the ROVs footage the diver sees the ROV active and inside the bow ramp.
- From the limited footage available from the seabed near the starboard bow of the vessel at a depth of 91 m it is difficult to identify many of the pieces visible, however, some wooden pallets with cement bags on can be seen as well as other debris. This is made worse by the very regular cuts in the footage throughout the time the ROVs are viewing the seabed.
- On cassette B40a/number 6 dated 4/12/94 the opening dialogue on both the screen and audio commentary states that this is cassette two. Starting at 2 o'clock in the afternoon and featuring footage shot by the SPRINT ROV, no cassette has been received labelled as number one or any timed recording before this time on this date.
- There is a large amount of repeat coverage of certain areas of the vessel without any new information, procedure, agenda or evidence being discovered.
- On two of the cassettes that have been supplied, the official tape logs that have been supplied as documentation generated at the time of filming do not correspond with the content of the video cassette.
- It has been confirmed by the contractor used for the diver survey, Rockwater, that it is common practice for divers to be equipped with two different earpieces to allow both the dive supervisor and technical personnel to communicate with the diver. It is apparent on the diver video B40c/ number 19 that the diver is receiving instructions in another earpiece. It is unfortunate that these instructions have apparently resulted in the missing of potentially important areas of the vessel survey. There are no transcripts at all of any of these communications.
- There is evidence indicating that there has been movement of the bow ramp at some point before it came to rest in its current position. The evidence visible on the tapes is the two hawsers trapped inside the car deck on the port side near the manual side lock. The other evidence is on the starboard side where the visor actuator has caused considerable damage on the front bulkhead, there is a large flap of this metal caught between the ramp and the bulkhead and there is further evidence on the starboard bulkhead recess in way of the blown up fastening of the bow ramp actuator that the ramp had been opened/closed which it had already been resting on the starboard bulkhead.
- On tape B40c/number 19 the divers have cut some items from the bow and are taking them to the crane for lifting, one diver is at the upper port side of the ramp and the other is at the bottom starboard side of the ramp. The diver who is standing on the starboard side bottom of the bow ramp near the hinge turns his head twice towards the seabed. On both occasions another diver is visible on the starboard side of the ramp below him, this diver is wearing different equipment from the two divers already detailed and is not explained in any of the other footage.
- When the divers are in the area of the port bridge there is a large amount of damage on the under side of the port wing of the bridge which was - at least to some extent - already visible on the ROV video from 02.10.94 and the sheeting appears to be torn off the underside of the bridge wing with heavy scoring marks on the inner side of the vertical stanchion supporting the wing.
- The lower outer wire strengthened glass window of the backside of the port bridge wing was also found to be broken trapping what appears to be a victim in the strengthening wire still attached to the window. The diver first pulled the mesh wire away and then pulled the body out of the window and let it float away.
- On tape B40d/number 9 the diver says that he is going to the seabed, but there is no tape showing this part of the survey.
- In the time and date order of the cassettes, tape B40e/number 10 chronologically comes before tape B40d/number 9.
- On the ROV survey conducted in 1996/number 11 the tape is dated from the official source as 19/06/96 but it is cut so badly that it goes back in time by whole days to the 09/06/96, 26/04/96, 17/06/96, 11/06/96 and contains still images from a video pause during duplication.

Disengage reached the following conclusions:

- There is a disturbing lack of continuity in the cassettes due to the large number of tape cuts. These tape cuts appear to have been made at different times and with different levels of competence. The cuts vary between very clean, single frame cuts with no interference on screen, to long pieces of interference and on several occasions the contents not only change location but go back in time and date. The worst example of this type of cut occurs on the most recent cassette from 1996 that jumps back in time nearly two months. Very few of the tape cuts that have been documented in this report occur in locations where victims could be or are located and they are not due to technical issues, leaving no apparent reason for their existence.
- The fact that the tape cuts repeatedly occur in the same areas of the vessel on different cassettes from different times and dates does not allow us to generate full documentation of a very serious casualty. This is a particular concern as the areas that lack documentation are very important to the investigation and include the starboard mudline and car deck.
- There is wide range of diver and ROV activity on and around the wreck site that is not detailed in the available footage. The time comparisons detailed in this report illustrate that the activity of some of the ROVs and divers visible on the tapes is not documented in its own right due to lack of tapes or tape cuts. On several occasions this undocumented activity is in areas where there is a lack of overall documentation, including the car deck and bow ramp.
- Format problems resulting in poor duplication and footage quality hamper independent investigation of the official cassettes. The lack of format conversion during duplication has resulted in a large drop in quality, combined with the tape cuts it has meant that reaching conclusions from the tapes and still images has been far more difficult, sometimes impossible.

The complete report is attached as Enclosure 34.6.434.

#### 34.7

#### *Investigation Report on Possible Explosion Damage on the Ferry "Estonia"*

by Brian H.L. Braidwood, MBIM, MIExpE, Weymouth/UK

At the beginning of this subchapter the Estonian managing director of Estline, Johannes Juhanson, shall be quoted when he told the Estonian media on 29.09.94:

»"Estonia" was sunk by an abnormal factor, an explosion or an underwater collision.«

In February 1999 Brian Braidwood was requested by this 'Group of Experts' to look into certain aspects of the casualty in his capacity as diving and underwater explosives expert, in particular to investigate whether explosive devices were present on board the ESTONIA and had caused damage when they exploded before the sinking of the ferry. After a very careful investigation Brian Braidwood concentrated his attention on three aspects, viz.:

- a. The suspect package found during underwater surveys by the port side of the bow ramp.
- b. Damage near the visor starboard side locks.
- c. Damage on the car deck at the port side forward.

After dealing with each item in turn, he has drawn certain conclusions.  
These are:

#### a. The suspect package

It has been considered whether this suspect package could have been an explosive device even if the sides of the cube were no longer than 100 mm - the smallest estimate. A block of this size would indeed have enough space to hold all the essential components of a small explosive charge of one to two kilograms.

Finding such a device near the side locks suggests an attempt to damage the ship at a particularly vulnerable position. However, in later video surveys of the same area, the package has disappeared. When or how the device got there must remain a matter of conjecture. It can only be emphasised that the act of placing and arming such a charge takes only a few seconds as the firing time will have been set beforehand. A determined saboteur might well decide to increase his possibility of success by placing more charges, at similar vulnerable points elsewhere on the ship.

Brian Braidwood concludes that on a balance of probabilities the suspect package could have been an explosive device containing between one and three kilograms of plastic explosive.

#### b. Damage near the visor starboard side locks

Photos of the visor tank on land, show that on the starboard side, the two metal plates forming the hook for the manual side lock were severely distorted and folded onto an overlapping position. The lug for the hydraulic side lock has been ripped off the visor tearing away a flap of metal. The photos also show distinct darkening of the white paint surface above the badly distorted hook for the manual side lock. This marking looks like burn or scorch marks.

On the port side, however, the ends of the two metal plates forming the hook for the manual side lock had only been pressed together. Also, the lug of the hydraulic side lock had been ripped off where its welding has given way, but there was no sign of burn marks anywhere on the port side.

There are several black and white photos and one composite picture made up of overlapping video stills. This composite picture gives a dramatically clear impression of the damage to the ship's bulkhead in the area of the side locks. This view of the damaged area was taken from the forward side of the bulkhead looking aft. The bottom half of the picture shows the opening for the manual side-lock hooks. Above that is the hydraulic side-lock lug which was torn off the visor. Above that again is a fresh hole in the metal. Dealing with the details from the bottom, the picture shows that the extreme lower end of the manual side-lock opening is still in the shape of a smooth curve and so is undamaged. However, within a very short distance, the metal has been splayed out towards the camera. This is easier to see in the actual video.

At the top of the opening for the manual side lock, photos show damage to the bulkhead in the immediate vicinity of the visor damage just described. In a colour photo, the opening designed to receive the hook of the manual side lock, has been enlarged by damage at its upper end and some pieces of metal may have been completely displaced from the area. The manual side-lock securing mechanism can be seen still inside the hole as it was never secured for the final voyage.

The hydraulic side-lock lug, which was ripped away from the visor, was lodged in its recess on the starboard front bulkhead where it would normally be located when locked. At the edges of the hole the metal seems to have split in all directions away from the centre. This is all characteristic of the sea of an explosion.

Just above this area there is a fresh hole which is made by a flap having been pushed back in an S-shaped fold. It is a fairly round hole about 250 mm across. Some of the metal has been pushed in, (away from the camera position).

A comparison with the port side bulkhead showed no damage at all that might have been compatible with an explosion.

The circumstances surrounding a possible explosion can be explained as follows: By midnight, the weather had deteriorated and because of an ineffective seal the visor space was filling up with sea water. By 0045 the level would have been well above the hydraulic side locks. This water would have been pouring through the openings for the side locks to flood the compartments adjacent to the car deck. It would also have been coming directly into the car deck past the ineffective bow ramp seal. At about this time a major crash was heard from the forward part of the car deck. There was certainly a lot of noise by this time and this may have masked the sound of a small explosion.

The marking and damage suggests that if an explosive device was used it would have been placed on the after side of the bulkhead, just above the manual side-lock slot. This means that a device like the one described earlier would have remained in place despite water flowing through the slot just below it. When it exploded, it was probably completely surrounded by water, with the other side of the bulkhead also flooded. This would have resulted in a strong shock wave through the water reaching the nearby visor. However, the presence of water on both sides of the bulkhead would have reduced the area of damage. The chock might well have fractured the welds of the hydraulic side-lock lug, which was retained in the bulkhead by its pin. The welds apparently tore out the triangular strip of metal seen on the photo of the visor.

To sum it up, the following damage has been described and illustrated in the area of the starboard side lock:

- Split and torn metal damaged around the top part of the manual side-lock opening front bulkhead.
- All of this damaged metal has been pushed forward towards the visor.
- Darkening of the visor paintwork at exactly the same level as the damaged metal described.
- The hydraulic side-lock hooks just below the burn marks were pushed down and severely distorted in a manner unlikely to have resulted from any mechanical impact.

On a balance of probabilities Brian Braidwood has concluded that:

- The damage near the starboard visor side locks was caused by an explosion.
- The charge weight was between one and two kilograms of TNT equivalent.
- The explosive device was placed on the forward bulkhead, just above the manual side-lock recess.
- The device could easily have been placed by someone following the route taken by the crewman responsible for operating the manual side lock.

#### c. Damage to the car deck port side forward

Brian Braidwood investigates damage in the port forward corner of the car deck, to establish if it might have been caused by an explosion. The damage can be seen in a short part of Video B40c which was taken by a diver. From the video it seems that the diver may not even have been aware of this particular damage, or else was told to look away and concentrate on other areas. The damage is only visible when the camera and light, which the diver is wearing on his head, are turned briefly to one side. There is no reference to the hole by either the diver or his supervisor. Nevertheless, the relevant section of the video has been studied in great detail to establish the possible cause of damage. The image is seen most clearly when the video is played in very slow motion, or even frame by frame, using specialist viewing equipment.

The videos and still photos from around the port forward corner of the car deck show a widespread presence of some sort of red or pink material. Some of it is very shiny and reflects the diver's light. The material may be bedding. In an case it seems to have been used to reduce the flow of water from the flooded visor space past the edge of the raised bow ramp and into the car deck.

Based on estimates from studying the video and still photos, the lower edge of the damage is about 300 mm above the deck level and there is no apparent damage to the deck itself. This suggest that the device may have been lying on something, perhaps bedding, when it exploded. It could, therefore, have been placed in a higher position and become dislodged by some physical impact in the immediate vicinity. The forward edge of the damage is about 300 mm away from the forward edge of the bulkhead.

Inside and around the hole can be seen the red and pink colouring of the bedding. It looks as if some of it was inside the adjacent compartment and can be seen through the damage hole. The damage hole itself is fairly round and about 300 mm across.

The hole is bordered by petals of split metal which have split in all directions away from the centre of the hole. The photos are taken looking at the bulkhead from inside the car deck space and it can be seen how the petals cast strong shadows onto the bulkhead. This clearly shows that the metal has been pushed away from the bulkhead into the car deck space.

The circumstances surrounding a possible explosion can be explained as follows: By midnight, the weather had deteriorated and because of an ineffective seal the visor space was filling up with sea water. By 0045 the level would have been well above the hydraulic side locks. This water would have been pouring through the openings for the side locks to flood the compartments adjacent to the car deck. It would also have been coming directly into the car deck past the ineffective bow ramp seal. At about this time a major crash was heard from the forward part of the car deck. There was certainly a lot of noise by this time and this may have masked the sound of a small explosion.

When the device exploded in the manual side-lock access compartment the space would have been flooded. This means the device would have been surrounded by water with air on the car deck side of the damaged bulkhead. However, from the comparatively small extent of damage, it is unlikely that any device exploded in contact with the bulkhead, and there is no way of knowing how far from the bulkhead it might have been.

In summary the following circumstances were established:

- A fairly round damage hole in the port bulkhead of the car deck adjacent to the bow ramp.
- Split and torn metal petals around the edge of the hole.
- All of the damaged metal pushed away from the bulkhead into the car deck space.

- That any explosive device used could have been dislodged from a higher position and fallen on some bedding in the compartment next to the car deck.
- Any device used would have been surrounded by water when it exploded. These points, taken together, suggest that a small explosion occurred on the far side of the bulkhead with the seat of the explosion being in the centre of the damage hole.

On a balance of probabilities, Brian Braidwood has concluded that:

- The damage in the car deck port side forward was caused by an explosion.
- The charge weight was between one and two kilograms of TNT equivalent.
- The explosive device was placed inside the space used to give access to the visor side locks.
- The device could easily have been placed by someone following the route taken by the crewman responsible for securing the manual side locks.
- The seat of the explosion was just above deck level as if the device had been resting on something, perhaps a pile of blankets, before it went off.
- The device may be have been placed on the forward bulkhead like the one on the starboard side, and been knocked off to fall onto some bedding before it exploded.

The complete Report is attached as Enclosure 34.7.435.

**34.7.1**  
***Supplementary Investigation Report***  
**by Brian H.L. Braidwood, MBIM, MIExpE, Weymouth/UK**

After the discovery of further unexplainable damage in way of the starboard front bulkhead of the wreck above and below B-deck, Brian Braidwood was requested to examine also these areas. His respective findings and conclusions are explained in the above mentioned report which is attached as Enclosure 34.7.1.435.1. As to the damage above B-deck level the expert has concluded on the balance of probabilities:

1. The condition of the port actuator was caused by damage when it ripped through the forward bulkhead on tearing away from its base plate.
2. The lack of damage to the starboard actuator means that the adjacent hole in the forward bulkhead must have existed before it passed through when it tore away from its base plate.
3. The hole in the starboard forward bulkhead was not caused by the starboard actuator.
4. The pattern of petals along the sides of the hole is characteristic of explosive damage.
5. The hole in the forward bulkhead was caused by an explosive device.
6. The damage to the bow ramp is indicative of an explosion.
7. The seat of the explosion was on the after side of the bulkhead.
8. It is possible that the damage above and below B-deck/upper car deck level was caused by the same explosive device.

As to the damage below B-deck the conclusion on the balance of probabilities are:

1. The hole in the longitudinal of the manual lock access space by the starboard side of the car deck was caused by an explosion.
2. The damage extending down the ship's forward bulkhead from the starboard side locks was caused by an explosion.
3. The damage to the starboard side of the bow ramp below the level of B-deck was caused by an explosion.
4. The damage to the lower part of the visor on the starboard side was caused by an explosion.

**34.8**  
***Defect and Failure Analysis of the Bow Visor Structure of the M. V. "Estonia"***  
**by the Laboratory for Materials Technology and Welding**  
**Techniques of the University of the Armed Forces, Hamburg**

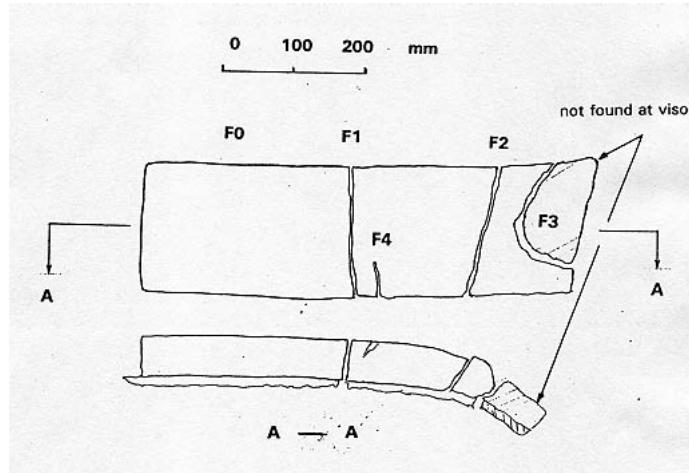
As a further consequence of the finding that the Atlantic lock would only be exposed to excessive loads if the visor hinges had partly or completely failed, the Laboratory for Materials Technology and Welding Techniques of the University of the Armed Forces, Hamburg was instructed to examine the hinge remains which had meanwhile been cut off the visor at Hangö and transported to the Royal Technical Institute (KTH), Stockholm.

The investigation was subsequently extended to the connecting and supporting structural elements between the visor and hull, i.e. in addition to the visor hinges also the visor actuator mountings on D-deck, the side lock locations between visor and hull, the Atlantic lock location between visor and hull and the visor stempost area were examined. The investigations also included a visual examination of the parts cut off the MARE BALTIMICUM ex DIANA II. The results of the difficult and long lasting examinations, partly carried out at KTH, Stockholm, shall be summarised as follows:

**(1) The visor stempost**

The welds between stempost and shell plating of the visor had failed already during normal service by a spectrum of cyclic loading providing tensile stress at the crack initiation points together with long term corrosive action of seawater after opening of the welds. As a consequence the stempost had not only been separated from the shell plating during normal service but the stempost being a vital part in its load-carrying function was in itself found to be split up into four parts by crack development well before the casualty. The drawing on the next page shows the cracks F1 - F4 of which F1 had penetrated the thickness of the stempost to about 40% and blue paint was found inside the crack. It could be verified that these traces of blue paint originated from penetration of the outside paint into the crack opening at the time the crack had penetrated the stempost already to the extent of about 40% of its thickness.

**Note:** Reference is made to Section 12.5 where the application of ice paint INERTA is explained in January 1994, when the ESTONIA had been in the shipyard for the last time, thus at that time the stempost was already cracked by ca. 40%.



The investigation of fracture F1 - F4 ascertained that all the transverse fracture had started and penetrated from the outside by corrosion assisted fatigue cracking. In addition, fractures F2 and F3 reveal major bending displacements of their flanks, in particular fracture F3 reveals a specific bending angle of about 70° combined with severe bending deformation following the original crack development.

#### (2) The Atlantic lock

The inspection of the original lug remains recovered from the wreck of the ESTONIA at KTH, Stockholm revealed that the failure of the Atlantic lock took place by rupture of the 3 lugs welded to the forepeak deck of the ferry, viz. at first to their circular welds to the housing/bushing, subsequently in the remaining cross sections by overload shear at about 40° to the mounting plane on forepeak deck, whereby also bending distortion prior to final cracking of the assembly was found.

The visor mating lug was found to be deformed by bending of about 15°-20° to starboard whereby apparently a crack had opened in the weld between the visor bottom plating and a vertical support stiffener.

The bore of this mating lug had an original diameter of 85 mm, however, which was measured to be 91 x 105 mm with an oval deformation towards forward indicating the main force direction to have been aft.

**Note:** This is a confirmation of the structural analysis of the visor by the FE method - see Enclosure 34.2.430 - according to which the force direction at the Atlantic lock was found to be **aft as long as the visor hinges were intact**.

Another downward bending movement of about 8°-10° was found which indicated forward tilting of the visor bottom prior to the failure of the lock.

**Note:** This is only possible if the hinges had failed already.

It was further found that the position and shape of the visor's mating lug did not fully comply with the available drawings, thus changes had been made during the life of the vessel.

Further examinations revealed that about 90% of the length of welds between the lugs on the forepeak deck and the bushing/housing had been pre-cracked by fatigue. The crack propagation together with the corrosion showed a similar picture as found on the visor stempost.

In summary of the above it can be concluded that the welding seams between the lugs on the forepeak deck and the bushing/housing as well as the welding seams between when the visor lug and the visor bottom have been considerable pre-cracked by fatigue.

Deformation indicate a sideways and downwards movement of the visor during final failure of the Atlantic lock.

#### (3) The side locks

The starboard lug has been torn off the visor bulkhead in such a way that the crack started at the upper edge of the weld between the lug and the visor plating, then propagation in a downward direction, being inclined to starboard by about 20° against the vertical, leaving a steel tongue at an angle of more than 90° to the bulkhead surface before final separation of the lug from the visor plating.

The port lug location indicates a more vertical down tearing movement during crack propagation without leaving a steel tongue before failure. No detailed investigation of the character of the fractures have been performed nor were the welding seam remains examined.

#### (4) Actuator mountings on B-deck

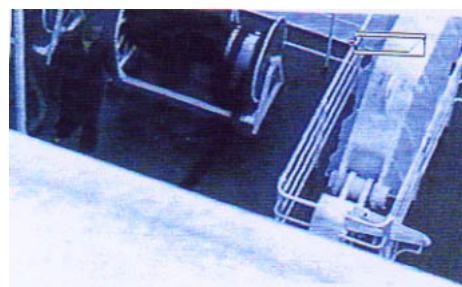
The starboard actuator was torn off from the supporting B-deck structure, whereby the welds failed first and the vertical stiffeners below the B-deck plating subsequently, leaving strongly deformed steel tongues behind. Inspection of the dismounted port actuator revealed a repair weld in way of the vertical stiffener at a location with possible high stress during the opening procedure. Investigation revealed the fatigue cracked area to cover 50-70% of the total load-carrying area of this weld.

#### (5) Actuator hinges at the visor arms

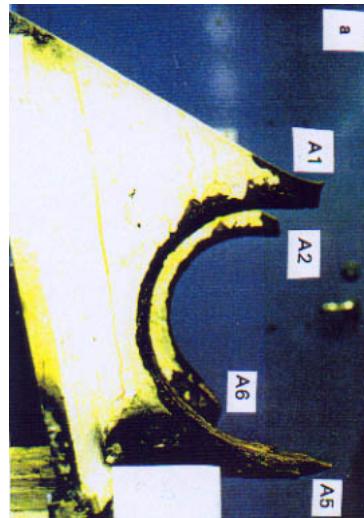
At a distance of 1300 mm forward of the visor's main hinges the actuator hinges (fastening) were fitted underneath the visor arms and permitted the actuators' sideways movements up to an angle of 15°. No specific structural failures could be found by visual inspection. Severe scratch marks were found with complete removal of the paint at an angle of 8-10° against the horizontal. At the linear forward edges of the lug plates deeper surface damage had been caused as compared to the curved aft edges. It can be concluded that these scratch marks are a result of the cutting process of the lug plates through the forecastle deck plating. The scratch mark inclination of 8°-10° against the visor arm would coincide with a forward rotation of the visor around the Atlantic lock while the lug plates were cutting through the deck structure and the side locks had failed already.

#### (6) The visor hinges

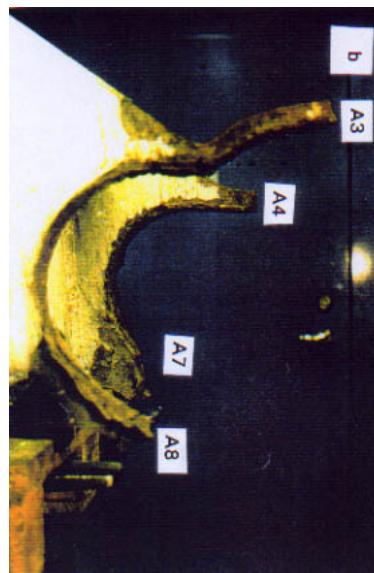
The visor's hinge system design consisted of the starboard and port side hinge arms fabricated from structural platings, with two attached lug plates on each side, carrying support bushings with bronze liners in the respective bore holes. The support bushings were welded to the lug plates with circular fillet welds. The visor hinge lugs were mated by deck hinge fittings, represented by lugs welded to the forecastle deck. The mechanical connection was one bolt on each side. The video image below shows the starboard hinge arm shortly before the accident.



The following picture shows the broken port visor lug plates with the fractures A1, A2, A5 and A6.



The outer port side shows a vertical to slightly horizontal bending to port side at the fracture at the lower part of the remaining bore. The inner port side lug and both starboard lugs - see picture below - did not exhibit significant bending deformations. The picture below shows the broken starboard visor lug plates with fractures A3, A4, A7, A8:



The failure of the visor hinges occurred by fractures A1-A8 of the visor lug plates together with the fillet welds to the support bushings. The bolts had been ripped out of the hinges, together with the bushings.

The four visor lug plates revealed various amounts of macroscopic deformation and necking at the fracture locations.

The fractures A1-A4 of the upper locations of the remaining bores were indicating considerable less necking as compared to the lower fractures A5-A8. In particular, the upper fractures A3, A4 of the starboard lugs exhibited only very small fracture edge contractions, yielding substantially identical cross sections of the fractures and the plates as taken from the design drawing. Fracture A4, shows delaminations originating from longitudinally to rolling direction orientated inclusions.

The respective upper fractures of the port side lugs A1, A2 showed visible necking with some reduction of local cross sections. the lower fracture of the outer port side lug A5, was considerable necked representing a typical shear failure.

The lower fractures A6 of both the inner port side and the outer starboard lug A8 were heavily deformed by bending and hammering. As a particular feature, the inner starboard upper fracture A3, was accompanied by numerous secondary cracks. Some of them even penetrated the lug plate in radial direction without significant macroscopic deformation. The visual investigation of the failed fillet welds between the hinge lugs and the support bushings revealed different cracking modes at the upper and lower fractures of the hinge plates. Close to the upper hinge lug plate fractures, A1-A4, the fillet welds had failed mostly by cracks parallel to either the hinge or the bushing surface.

The cracks propagated also very often below the respective base material surfaces. At the lower fracture areas of the hinge plates A5-A8, the fillet welds seemed to have failed more by a shear fracture of the weld metal, revealing thicknesses between 5 and 7 mm. However, there were also hammering effects on the weld crack surfaces in this area which was more subjected to compression than to tensile stress.

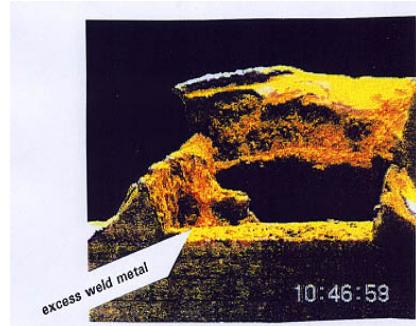
One bushing had been recovered from the wreck while the remaining visor hinge lug plates had been removed from the visor for investigation at the Institut för Hållfasthetsteknologi of KTH, Stockholm.

The fractures and cracks of the upper locations A1-A4 of both the starboard and port side hinge lug plates exhibit ratchet marks and fatigue bench marks which demonstrate the start of fatigue cracking from flame cutting marks in the inner bore of the lugs. This applies also to the lower fracture of the inner starboard lug, A8.

For further identification of the cracking mechanism, a section was removed from the inner starboard upper fracture A3 area containing the above mentioned secondary cracks. As from the metallographic investigation, fig. 46, the cracks developed stepwise and showed side branching with corrosion products being typical for corrosion supported cracking. The investigation of one of the secondary cracks (A3) revealed numerous smaller secondary cracks also starting from the inner asymmetrically applied deep flame cuts. The formation of respective ratchet marks can be clearly demonstrated at the crack initiation points, which show successive striation marks at various locations of the secondary cracks being created by stepwise crack propagation in radial direction of the visor hinges.

The fatigue cracks of the visor hinge plates did however also initiate from the outer surface of the hinge plates. The inner bore holes of the hinge plates were originally drilled by machining, however, the surfaces visible outside of these areas were noted as having been destroyed by inadequate application of flame cutting.

The fracture of the recovered hinge bushing was fitting to the fracture of the inner starboard hinge lug. It exhibits a gap of about 4-6 mm between lug bore and support bushing. This gap is almost entirely filled with corrosion products, presumably magnetite, which is also found in thick layers at a location where both hinge late and fillet weld failure are represented together with some excess weld metal, see arrow on the picture below which may have provided a local notch effect.



In another cross section, also severe corrosion inside the gap is identified and the surface of the hinge bore and the bushing exhibit a considerable misalignment, which, during welding of the left fillet weld, was overcome by a buffering layer. The misalignment corresponds to asymmetric burning marks, for example of the inner starboard hinge. For closer investigation only a small part of an adhering fillet weld of the support bushing was available. It included both a full crack of the hinge plate material and a secondary crack close to the weld metal and showed also the flame cut surface of the hinge plate bore hole. While the full crack revealed plastic shear at its flanks, the secondary crack had started from the heat affected flame cut surface and propagated close to the heat affected zone of the weld in radial direction.

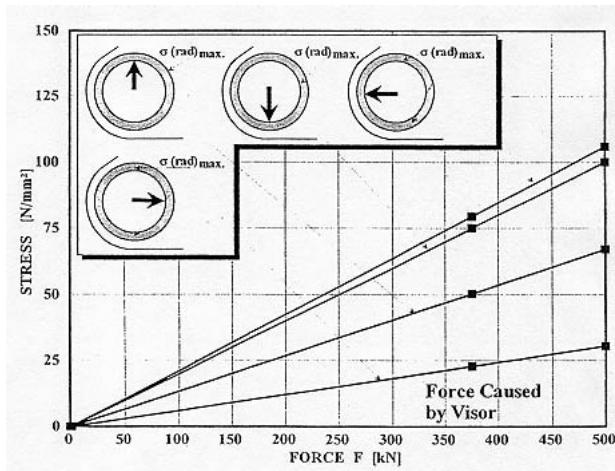
Based on the evidence provided by the above investigation, the following conclusions can be drawn:

- The fillet welds between the hinge plates and the bushings seem to have partially failed a considerable time before the casualty due to corrosion supported fatigue.
- The partial failure of these fillet welds provided access of seawater to the gap between the hinge plates and the bushings and caused reduction of load carrying capacity of the hinges.
- Both effects facilitated the start and propagation of extensive corrosion fatigue cracking of the hinge plates at another location which occurred also a considerable time before the casualty as demonstrated by the corroded appearance of the fracture of the inner starboard hinge.
- It has to be assumed that the inner starboard hinge may have failed first with only a small macroscopic plastic deformation at the edges of the fracture and without leaving bending of the rest of the hinge plate.
- As the port inner hinge plate was found to be bent to port and plastic necking at the fracture was noted, it has to be assumed that the port hinges failed after the starboard hinges.

The above explained investigation of the various parts of the ESTONIA visor system has provided sufficient evidence that the visor hinges, in particular, the starboard hinge lugs were severely precracked, before the casualty. There is also evidence that the fillet welds between the visor hinge lugs and the support bushings failed due to corrosion assisted fatigue.

In order to determine the required strength assessments, a Finite Element Calculation of the stresses in the above welds was carried out which considered four different directions of loads on the hinge lugs and established the location of the maximum fracture inducing radial stresses in the fillet welds for each direction and for various applied loads. The thickness of the fillet welds were taken as 7 mm.

For example, the normal visor opening procedure created a vertical down force of maximum 375 kN on each hinge lug based on nominal visor weight and respective leverages and resulted in maximum radial stress in the fillet weld found at the location as marked by the circle in the drawing below together with the stress distribution in radial direction. Accordingly the opening procedure would thus create a local radial weld joint stress of 75 N/mm<sup>2</sup>.



It is thus obvious that, during opening of the visor, the location of maximum radial fillet weld stress is found in the same region where fatigue cracking of those fillet welds initiated. However, also the other assumed directions of loads on the visor hinges would provide maximum radial stress locations. In particular, a similar stress range as for the opening procedure would result from an assumed afterwards force on the hinges. Such an afterwards load could have created the conditions for crack initiation and failure of the hinge plates, following the failure of the fillet.

From the present investigation the following conclusions are drawn:

- The ESTONIA bow visor system contained considerable amounts of fatigue cracking which was created by dynamic loads during normal service. The visor hinges showed the largest amount of pre-damage, together with the mountings of the hydraulic actuators.
- The failure of the bow visor hinges was initiated by failure of the fillet welds which were vital supporting joints between the visor hinge plates and the supporting bushings.
- The failure of the hinge fillet welds at locations of high stress was initiated by corrosion fatigue a considerable time before the casualty.
- The dynamically loaded hinge plates failed by fatigue cracking and subsequent plastic overloading of the remaining weakened cross sections. The fatigue crack initiation at the hinge plates was favoured by corrosion, reduced load-carrying capacity and burning marks.
- In addition to the visor hinges and the actuator mountings, there were various other pre-damaged locations, in particular, the stempost and the bottom lock area, which may have contributed to overloading of the hinge locations.

The complete Report is attached as [Enclosure 30.417](#).

## 34.9

**Evaluation of the Video Film made on 17.09.94  
by Means of Military Reconnaissance Methods  
by Bryan E. W. Roberts, Churchgate/UK.**

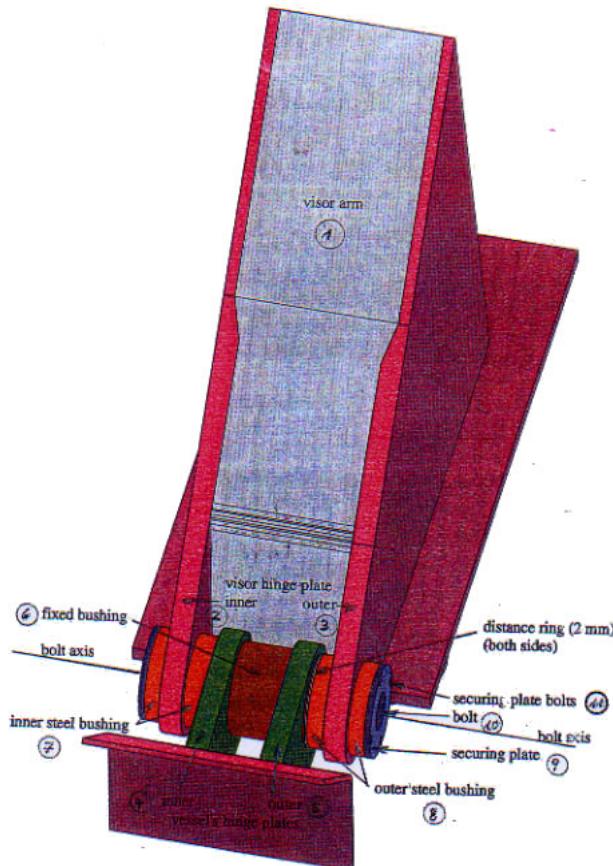
On the evening of 17.09.94, i.e. 10 days before ESTONIA's last departure from Tallinn, a Swedish passenger was standing on the forward open part of deck 7 and filmed the closing of the visor, the handling of the mooring lines by the deck crew and, finally, he zoomed in on the starboard visor hinges. The first copy of the original film was made available to this 'Group of Experts' and a first internal analysis revealed that the starboard visor hinge was in an absolutely disastrous condition as can be seen on the image below.



In order to have this condition properly and professionally evaluated an documented the English military reconnaissance systems consultant Bryan E. W. Roberts from Churchgate/Suffolk was requested to do this.

For explanation purposes a computer drawing of the hinge arrangement was made and the figures 1 - 12 point to the relevant components as outlined below:

- 1 Visor Arm
- 2 Inner Visor Hinge Plate
- 3 Outer Visor Hinge Plate
- 4 Inner Vessel Hinge Plate
- 5 Outer Vessel Hinge Plate
- 6 Fixed Bushing
- 7 Inner Steel Bushing
- 8 Outer Steel Bushing
- 9 Securing Plates (both sides)
- 10 Visor Arm Bolt and Bolt Axis
- 11 Securing Plate and 4 bolts (both sides)
- 12 Distance Ring (both sides)



The results are summarised in the *Report on the Loss of the Ro-Ro Ferry "Estonia"* - attached as Enclosure 12.5.180 and shall be briefly commented as follows:

The object of the report was to detect and identify any structural rupture or damage which could have contributed to the loss of the Ro-Ro ferry ESTONIA. For identification of components bracketed numbers, for example (5) in the text refer to annotations on the drawings, on the previous page. A detailed examination of the video tape showed the only damage to be identified limited to the starboard visor hinge.

The inner visor hinge plate (2) is correct and straight on its fore and aft axis other than a section of approximately 150 mm between the vertical centre line of bolt (10) and the aft end of the visor arm (1). This section has a clockwise twist which gives a downward inclination to the visor bolt (10) and the inner steel bushing surrounding it (7). This inclination of the bolt assembly (10) and the steel bushing extends from its inner end to the outer face of the vessel hinge plate (5). The video image does not allow a precise calculation of this angle, but the average of a series of measurements show it to be approximately 4 degrees which gives a downward misalignment of the axis at bolt(10) of approximately 25 mm at the starboard face of the vessel's outer hinge plate (5). In addition there are two unexplained dark marks on each side of the inner hinge plate (2) opposite each other at the point it joins the bolt assembly (10). These two marks appear to be joined by a thin line extending across this section of the inner Visor Hinge Plate.

An aft section of approximately 400 mm of the outer visor hinge plate (3) together with the outer steel bushing it carries has a significant rotation in an anti clockwise direction on its fore and aft axis. The whole assembly is visibly rotated to such an extent that both its inner and outer ends can be seen on the video image as an ellipse. This is in marked contrast to the inner bushing assembly (7) which is symmetrical to the axis of the bolt (10) as seen in Makers drawings 590/1106. There is another disruption to the bolt assembly, i.e. the outer steel bushing (8) is shown on the hinge plate (3) while the video print shows it to be misplaced outwards by approximately 80 mm. The steel bushing (8) extends further than the portion on the inner side of the outer visor arm although it should be identical as seen on Drawing 590/1106. Taking account of all these situations it is apparent that considerable disturbances have taken place in this area.

From the video image a significant linear difference is apparent along the axis of bolt (10) at its interfaces with outer steel and bronze bushing at the outer side of the vessel hinge plate (5). In this area the video image shows a significant fact. The base of the outer visor arm casing (1) can be clearly seen at deck level and can also be seen in a gap of approximately 25 mm between the vessel's outer hinge plate (5) and the outer steel bushing (8). According to Makers Drawing this should not be possible, as the bushing (8) should obstruct this view. In addition to this nothing can be seen of the fixed bushing (6) beyond the face of the outer vessel hinge plate (5) from which it should protrude by 5 mm nor can the 5 mm distance ring which should be between the outer hinge plate and the outer steel bushing. There is a further significant fact, approximately 150/160 degrees for the bronze and steel bushing (8) is missing from the lower section of the Bolt Assembly (10). From the video image it is clearly visible that the securing plate (9) is totally missing and that the bolt (8) is not in place where it should be, and that only 2 of the 4 securing plate bolts (11) are in position and are sticking out of the outer steel bushing (8). These are either studs from which the nuts have been forced off or bolts nuts with the heads broken off.

In summary the following has to be concluded:

This Report is based on Video Tape Images showing disruption to the structure of the Ferry "Estonia", especially in the area of the Starboard Hinge Plates (2) and (3), and on the Bolt Axis (10). This damage is very significant, especially so when the components involved form part of a load bearing assembly liable to operate in heavy sea conditions.

### **34.10 Structure Analysis of the Bow Ramp Hinges by the Technical University, Hamburg-Harburg**

The JAIC has stated on page 175 of their Final Report:

*»After the ramp had been forced open by the visor, waves may have caused the ramp to move between fully open and partly closed position, but generally a significant opening was available for waves to enter the car deck as further described in 13.5 below. The large amounts of water flooding onto the car deck caused the vessel to heel over and after a few rolling movements a significant list developed to starboard. This happened within the first minutes after the visor had separated from the ship. It is, however, the opinion of the Commission that full service speed setting was maintained right up to the time when the list developed.«*

This means that according to the JAIC the bow ramp had been fully open for some time when the vessel was still on full service speed at a significant wave height of between 3.5 - 4.5 m, which included the 7 m wave, from about 30° on the port bow.

Therefore the Technical University, Hamburg-Harburg was requested to calculate the water column necessary to break all four intact hinges of the bow ramp. The result was that a static load corresponding to 6 m water - but without the influence of about 14 kn speed - would break all four sound hinges. As the ferry was taking green water on the forecastle already at around midnight, it can be excluded that the bow ramp would have remained connected to the vessel by the hinges in particular if the vessel was making a speed of about 14 kn against bow seas.

As explained in the previous Subchapters 6.5, 12.4 and 12.5, however, the severely pre-damaged port outer hinge of the bow ramp had collapsed presumably already in March 1994 and the ramp became detached from the vessel and most probably subsequently also the port inner hinge broke, leaving the starboard inner and outer hinges. Calculations of the Technical University, Hamburg-Harburg have revealed that in case the ramp was just connected to the vessel by the port inner, the starboard inner and the starboard outer hinges a static load of 4 m water would have been sufficient to break off the ramp not taking into account the additional effect of a speed of 14 kn, and if the ramp had been connected just by the starboard inner and outer hinges - which was the most likely scenario - a static load of only 2.5 m is required to break off the ramp, again, not considering the effect of the speed.

As it has been proved with certainty - Subchapter 12.4 - that the port outer bow ramp hinge was broken and the ramp detached from the vessel many months before the casualty, which was confirmed by the damage picture of the ramp after the casualty, it can be concluded that the bow ramp would have broken off completely had it been fully open shipping water with a significant wave height of between 3.5 - 4.5 m (7 m) on the port bow and with the vessel making a speed of about 14 kn.

The respective calculations by the Technical University, Hamburg-Harburg are attached as [Enclosure 34.10.436](#).

### **34.11 Calculations of the Floatability of the Bow Visor by the Technical University, Hamburg-Harburg.**

The calculations revealed that the visor cannot float under whatsoever circumstances. It did sink immediately after having separated from the vessel. The respective calculations are attached as [Enclosure 34.11.436](#).

### **34.12 Breakload Calculations of the Deck Beam at Frame 159 by the Technical University, Hamburg - Harburg**

Breakload calculations by means of the Finite Element method revealed that the total force required for both sides was approximately 2000 KN, however to penetrate the deckbeam at frame 159 a force of about 2800 KN was necessary. It has thus to be concluded that it has theoretically been possible for the lugs underneath the visor arms to break through the deckbeam at frame 159. It has not been the subject of this investigation to determine whether breaking through the deckbeam is reflected in the damage picture of the lugs underneath the visor arms. The Report of the Technical University is attached as [Enclosure 34.12.438](#).

## **CHAPTER 35**

### **THE FOUNDATION OF THE JAIC**

In the afternoon of 28 September 1994 - the day of the casualty - the Prime Ministers of Estonia, Finland and Sweden met in Turku and decided among other things that a Joint Accident Investigation Commission (JAIC) should be set up "to investigate the capsizing of the ferry Estonia".

### 35.1 The Members

Each of the three countries had to nominate 3 members to participate in this investigation commission which subsequently became known as the "International Commission". As permanent "Accident Investigation Boards" already existed in Finland and Sweden, the chairmen plus each one nautical and one technical expert were nominated by their governments to represent their countries in the JAIC.

These were for

Finland:	Kari Lethola	- Master of law, director of the Accident Investigation Board
	Heimo Iivonen	- Rear admiral, director of the Finnish Life Boat Association
	Dr. Tuomo Karppinen	- Senior research scientist in the Technical Research Center of Finland, Manufacturing Technology
Sweden:	Olof Forssberg	- Master of Law, Director General of the Accident Investigation Board and a high ranking civil servant in the Ministry of Defence
	Börje Stenström	- Naval Architect, chief maritime technical investigator of the Accident Investigation Board - † 25.02.1997
	Hans Rosengren	- Master Mariner and lecturer at the Nautical Academy Kalmar, chief nautical investigator of the Accident Investigation Board

In Estonia such an organisation did not exist, but already early in the morning of the casualty day President Lennart Meri had decided that in Estonia an independent commission should be formed "to investigate the circumstances having led to the casualty and the government organisations". (The Andi Meister book: "The Unfinished Logbook".) This commission should consist of 11 members, mainly ministers and their representatives. Chairman to be was the Minister for Transport and Communication, Andi Meister, an engineer by profession. Captain Uno Laur, up to 1992 head of the navigation department of ESCO and now a maritime consultant, was appointed by the President to be his personal representative.

When Prime Minister Maart Laar returned to Tallinn that same evening and reported about the decision to form a joint commission, five names from the above-mentioned 11 member commission were selected and the embassies of Sweden and Finland were informed accordingly.

Also the same evening the Swedish JAIC members together with the Swedish observer, Captain Sten Andersson from Sjöfartsverket, flew over to Turku and met the Finnish members who had been on site since the morning already and the first discussions between these two groups took place.

On the following morning, 29 September, the Swedish and Finnish JAIC members met again and, after some further discussions, decided to invite the Estonians to come over for the first joint meeting straight away, which they did. By means of the Estonian Coast Guard plane the following persons flew to Turku:

Heiki Arike	- Minister of Internal Affairs
Andi Meister	- Transport Minister
Indrek Tarand	- Chancellor of the Ministry of Foreign Affairs
Jüri Kreek	- Head of Estonian Coast and Border Guard Captain
Enn Neidre	- Head of the Nautical Department of ESCO and Safety Adviser of Estline
Kalle Pedak	- General Director of E.N.M.B.
Captain Uno Laur	- Managing Director of C.N.N.

At 14.00 hours the first meeting of the three-nations JAIC in Turku commenced which was attended by the persons listed up in Enclosure 35.1.440. Among others things it was decided, that Estonia should have the lead of the JAIC because the vessel had been flying the Estonian flag.

Subsequently the three crew members considered to be key witnesses were heard by the joint JAIC. See Subchapter 37.1.

At the first meeting of the JAIC, also the head of the Navigation Department of ESCO and Safety Adviser of Estline, Captain Enn Neidre, was present, which apparently was considered to be normal procedure, viz. that the manager responsible for officers and crew inside the organisation of a shipping company is on-site when the survivors come ashore in order to talk to them and prepare them to give evidence to the police subsequently, that is to say, "to remind them of their loyalty to their company". That was actually done by Enn Neidre but he also attended the subsequent hearings of the key witnesses Silver Linde, Margus Treu and Hannes Kadak by the police and the meanwhile formed JAIC.

The so-called key witnesses and other uninjured crew members who returned to Tallinn on the evening of 29 September 1994 had already been interrogated in Turku. Some of them, considered to be able to give important evidence, up to three times, i.e. by the Finnish, Swedish and Estonian police respectively security police. Upon arrival at the Tallinn airport in the evening they were again interrogated by the Estonian criminal and security police.

Apparently it became obvious to the Estonians in the course of the following days what really had gone wrong with the ESTONIA and what it would mean for the reputation of the young state of Estonia if the evidence given by some surviving crew members about the real causes for the catastrophe would get to the public. It was thus decided to have somebody with authority inside the JAIC, who was respected and feared by the crew and who would - just by his presence - remind them of their "loyalty obligation" to ESCO. This was Captain Enn Neidre, the head of the Navigation Department of ESCO and safety adviser for Estline.

Although in an "*Immediate Press Release*" by the Foreign Ministry of Estonia on 10.10.94 at 17.00 hours - Enclosure 35.1.441 - Indrek Tarand is still mentioned as JAIC member, only half an hour later in a further "*Immediate Release*" by the same Ministry - see Enclosure 35.1.442 - his name was exchanged by that of Enn Neidre. Consequently the Estonian part of the JAIC consisted of

Andi Meister	- Minister for Transport and Communications and as such responsible for Estonian Sea Safety and matters including the E.N.M.B. and ESCO	Shipping
Captain Uno Laur	- up to 1992 head of the Navigation Department of ESCO and predecessor of Enn Neidre - directly by President Lennart Meri	appointed
Captain Enn Neidre	- head of the Navigation Department of ESCO and as such directly responsible for the qualification and training standard of the master, officers and crew of the ESTONIA in addition to being safety advisor of Estline	

So much for the newly formed/appointed JAIC for the time being. The conflict of interests was programmed from the very beginning and the members from Sweden and Finland were very much aware of it. "*Estonia will bear the main responsibility for the investigation*", said Carl Bildt at the press conference in Turku following the decision of the three Prime Ministers to form the JAIC, "*however in practice it will be a joint commission because Estonia lacks the resources to carry out everything alone.*"

### 35.2 The Experts

All three parts of the JAIC used a number of experts in different fields.  
These were in the beginning for Estonia:

August Ingerma	- structural integrity
Jaan Metsaveer	- naval architecture
Heimo Jaakula	- public relations E.N.M.B.

Finland:

Simo Aarnio	- master mariner (navigation) †22.01.96
Kari Larjo	- master mariner (navigation) as from 27.02.96
Klaus Rahka	- metallurgist, structural integrity
Seppo Rajamäki	- radio communication

**Sweden:**

Mikael Huss - naval architecture  
 Olle Noord - master mariner (navigation)  
 Bengt Schager - organisational human behaviour (psychologist)

In addition, particular parts of the investigation were entrusted to the Royal Technical High School (KTH), Stockholm, to VTT, Helsinki, to the model test facility SSPA in Gothenburg and to others for scientific examinations.

### **35.3 The Observers**

While the Swedish Sjöfartsverket did send their "observer", Captain Sten Andersson, already over to Turku on the day of the casualty, the 28 September 1994, and also the Estonian National Maritime Board (E.N.M.B.) was represented by the Director General, Captain Kalle Pedak, already at the first meeting on 29 September 1994, Finland took a bit longer, but as from 22.08.95 Jukka Häkämies attended all Commission meetings in his capacity as head of the Division of Maritime Inspection of the Finnish Board of Navigation. Consequently all three National Maritime Administrations, having been responsible for the proper certification and compliance of the ferry with SOLAS and other safety conventions were represented at all the meetings of the JAIC, where among other things the failures and omissions of their organisations were - or, at least, should have been - investigated and they even participated in the final drafting of the Report of the JAIC as will be shown later.

### **35.4 The Police Liaisons**

Estonia did send their policeman no. 2, Prit Männik, into the JAIC as an expert. Finland's police was represented in the JAIC by Detective Chief Superintendent Hari Rahikka and for the Swedish police this job was probably done by Olof Forssberg, who co-operated quite closely with the investigating public prosecutor Birgitta Cronier at the beginning and subsequently with prosecutor Tomas Lindstrand.

### **35.5 The Administrators**

These were for Estonia Aet Varik and Tiit Kaurla from the Ministry of Transport and Communication, for Finland Pirjo Valkama-Joutsen and for Sweden Gunnar Göransson, both from the respective Boards of Accident Investigation.

### **35.6 The Working Groups**

Within the JAIC some working groups were formed to make better use of the limited time available.  
 These were:

- the technical group headed by Börje Stenström (( 25.02.97) and Tuomo Karppinen
- the nautical group headed by Hans Rosengren
- the rescue group headed by Heimo Iivonen
- the editorial group consisting of Uno Laur, Olof Forssberg, Kari Lethola

### **35.7 The Documentation**

The Swedish and Finnish parts of the JAIC were obliged by law to keep a register - logbook (*dagbok*), into which the complete incoming and outgoing documentation had to be registered day-by-day.

It is unknown what Estonian law requires in this respect and how it was complied with by the Estonian part of the JAIC.

In Sweden a very detailed and accurate looking logbook system was kept from the very beginning, although it does not contain the complete documentation. In Finland apparently no system whatsoever does exist.

The Swedish documentation is contained in 9 files A - J, as far as it is known, in which the documents were registered with running numbers, in total more than 1000. The complete register is available to this 'Group of Experts', but not attached to this report. While working papers and other documents considered to be crucial for the investigation were kept "*classified*" until the Final Report was published, most of the documentation collected by the Swedish part of the JAIC as time went by was open to the public although this was realised by very few people only. After the publication of the Final Report everything should have been made public according to applicable regulations. They were however not complied with as certain documents known to have been in the possession of a member of the JAIC cannot be traced in the files nor are they registered. This refers especially to the repair lists from on board of ESTONIA in which the crew was - among other things - asking for repair of the broken port outer hinge of the bow ramp. According to Börje Stenström these lists have been in his possession.

## **CHAPTER 36**

### **OTHER ACTIVITIES**

Numerous activities by the Governments of the three countries involved, their various administrations and other organisations took place during the early days and following weeks with regard to the sinking of the ESTONIA and which were of relevance to the investigations of the JAIC. Some shall be explained below.

#### **36.1 Åke Sjöblom and Gunnar Zahlée**

On the day after the casualty, 29 September 1994, Chief Inspector Åke Sjöblom and Inspector Gunnar Zahlée returned from Tallinn to Sweden with their knowledge of the extremely bad condition of visor and bow ramp, the incompetence of the crew and finally the impossibility to stop the ferry from departing despite all their endeavours. See Chapter 15.

Already on the following day a confidential meeting behind closed doors took place which was chaired by the then head of Sjöfartsinspektionen, Bengt-Erik

Stenmark, with the heads of the Stockholm and Gothenburg offices of Sjöfartsinspektionen and their assistants attending. Åke Sjöblom informed those assembled about his real findings and his desperate but futile attempts to stop the ferry from departing. The very far reaching consequences were discussed, but then it was decided to inform the public that only minor deficiencies had been found, moreover that the inspection had only been on-the-job training and not a real PSC. See Chapter 15. This official version is upheld by Sjöfartsverket up to day and Åke Sjöblom and Gunnar Zahlée have confirmed it when being questioned by police and the public prosecutor.

It is unknown whether the members of the Swedish part of the JAIC were informed during a meeting in the Sjöfartsverket head office in Norrköping on 13 October 1994. It has to be assumed that Olof Forssberg and Börje Stenström were informed, because otherwise it would not be understandable that Börje Stenström in his capacity as chief maritime technical investigator did not take part in the questioning of Åke Sjöblom and Gunnar Zahlée at the office of the Swedish JAIC in November 1994, which was, at least officially, the only time that these two - being really key witnesses as to the ferry's condition before her last departure - have been interrogated by JAIC members.

Åke Sjöblom at the beginning wrote a draft version of his report concerning the "On-the-job training on the Estonia" - see [Enclosure 15.198](#) - and did send this draft by letter of 24 October 1994 - see [Enclosure 15.199](#) - to Willand Ringborg being in charge of the Sjöfartsverket project of the training of Estonian safety inspectors. Recently another copy of this letter with two hand-written notes to Börje Stenström on it was made available - see [Enclosure 36.1.443](#).

The note at the top reads - office translated - as follows:

*"Hi Börje, Attached is what I think should be roughly enough to have stopped her from sailing on 27.09.94. (Handwriting of Åke Sjöblom.)*

The 2nd note at the bottom in another handwriting reads:

*"If she would have been stopped on the 27th to correct all the 17, they would probably quite quickly have found the rest of the damages (failures) and in that case the ship would have been detained for a few weeks in Estonia. Best regards, L.A."*

Attached was a copy of the filled-in PSC form of the Swedish National Maritime Administration (Sjöfartsverket) concerning the inspection of the ESTONIA on the 27.09.94 by Åke Sjöblom/Gunnar Zahlée and their Estonian trainees. On this copy, which is signed by the "Head of National Ship Inspec. Division" Aarne Valgma, also the 3rd column referring to "references to conventions" is filled in, which is only required in case the vessel was detained which had, at least, been the intention as confirmed by the above quoted notes. Although this copy - attached as [Enclosure 15.200](#) - is recorded in the register of the Swedish part of the JAIC under A46b, it has not been attached to the Final Report of the JAIC as supplement, nor is anything of the above mentioned in this report. Instead the Estonian version of this "filled-in PSC form" is attached as Supplement 223 together with an explanation by the E.N.M.B. dated 31.05.96 which was translated by Uno Laur into English and reads as follows:

*"It is hereby reported that a Port State (PSC) training inspection was carried out by the inspectors of the Estonian National Maritime Board's Ship Inspection Department (with assistance of the Swedish Maritime Administration inspectors) on m.v. 'Estonia' on 27.09.94. The purpose of this inspection was to obtain experience for the Estonian inspectors in respect of large passenger ships and also to carry out a Port State Control (PSC) of this vessel. As a result of this inspection all shortcomings noted by the inspectors and instructors were fixed in the "Report of Inspection in Accordance with the Memorandum of Understanding on Port State Control". This Report was signed by the Head of National Ship Inspection Department A.Valgma. Later on this Report was used as a teaching aid on training of inspectors. The aim of this inspection was not to find out the knowledge and training of the officers or crew members because it is the task of other authorities. In course of discussions with the ship's officers the theoretical problems of stability were not touched since the inspectors were interested in technical condition and organizational level of the vessel.*

*Ship Control Inspectors / signature / Valgma*

*31.05.96 / signature / Buddell"*

The complete Supplement 223 is attached as [Enclosure 36.1.444](#).

This Estonian version does not contain the entries in column 3 and the explanation for this column at the bottom is illegible. Also the references to the Swedish Maritime Administration (Sjöfartsverket) have been deleted respectively were made illegible. The copy is also signed by Aarne Valgma, however as "Head of National Ship Inspect. Department". For more details see [Chapter 15](#).

The described manipulation of the documentation was a vain attempt to disguise the personal tragedy of the two Swedes who had on this occasion completely failed in their professional mission.

The members of the E.N.M.B. in the trainee team - in particular Aarne Valgma - had the authority to detain the vessel until repairs had been effected (see [Chapter 15](#)), whether this inspection qualified as a Port State Control inspection or not (see [Chapters 9.3., 15.](#)).

The two Swedes had no such authority and those who had in Sweden and were contacted by Sjöblom (see [Chapter 15](#)) did not live up to their professional duties. The reason may be the notorious lack of fantasy in bureaucrats. All they would have to do is to communicate to the Estonian authorities that the vessel would not be permitted to enter Swedish waters or ports in this condition. In the JAIC Report, Chapter 5.2, only the following is mentioned:

*"During the last day in Tallinn the vessel was used in a training programme for Estonian Maritime Administration surveyors in the conducting of a Port State Control in compliance with the Paris Memorandum of Understanding on Port State Control (see about Paris MOU in 9.1). The trainees made a thorough Port State Control inspection of the ESTONIA and were supervised and instructed by two senior inspectors from the Swedish Maritime Administration. The exercise was documented in protocol, set up in a form according to the Paris MOU. A copy of this protocol is included in the Supplement. The Swedish inspectors leading the exercise have been interrogated by the Commission and have stated that the vessel was in good condition and very well maintained. They found no deficiencies that would have caused detention or other serious remark, if the inspection had been a regular Port State Control. However, some deficiencies were noted, such as that the rubber seals for the bow visor were worn, had tear marks in some places, and were in need of replacement, and watertight hatch covers on the car deck were open and in a condition indicating that at least one was not normally closed. It was also stated during the interrogation that the Swedish inspectors had experienced "lack of respect for issues related to load line matters" in their contact with officers met during the exercise."*

See further in Chapter 41.

## 36.2 Early Indications of Something Unusual

Before turning to the direct activities of the JAIC, however, attention has to be drawn to certain developments in Tallinn and Stockholm throwing some light on the situation existing before the last departure of the ESTONIA, and the consequences thereof:

- The Estonian Estline Director, Johannes Johanson, told Reuters on the day of the casualty that *Estline had received warnings last year that an accident might occur in the Baltic Sea*. Thereafter security measures had been intensified.
- Since Enn Neidre was head of the Navigation Department of ESCO and safety adviser of Estline he must have known about this threat. It can therefore be assumed that he informed the other Estonian JAIC members about these threats. Whether Andi Meister being - in his capacity as Transport Minister - the highest representative of his country for sea safety was not already aware is unknown to this 'Group of Experts'.
- Members of the intermediate Estonian Commission - see [Chapter 35.1](#) - were also the Managing Director of ESCO, Toivo Ninnas, and the Traffic Director of Estline, Yrjo Saariinen, who definitely knew about the bomb threats and presumably reported them to the intermediate Estonian Commission. Both left this commission upon their own recommendation shortly after its foundation.
- Andi Meister writes in his book *"The Unfinished Logbook"* on page 21 among other things after the wreck had been found: *"On the recordings of the search vessel the front side of the vessel was flat and then for the first time the idea came up that the waves had torn off the visor and that water had penetrated the car deck via the bow ramp which was also confirmed by survivors. Another possibility seemed not to exist. On the other hand, a bomb could also not be fully excluded."*
- The watch A.B. onboard of the training vessel "LINDA", having been berthed in Tallinn on the evening of 27 September 1994, told SPIEGEL TV in December 1999 that he had overheard a VHF conversation between the ESTONIA and "Port Control", i.e. the Harbour Master's office. "Port Control" had asked the ESTONIA either shortly before or after the departure whether the search for bombs had brought any result. ESTONIA's answer was: No.
- Bomb threats against a ferry carrying on each voyage 1000 people or more onboard is with certainty a matter to be reported to the Board of Directors. It has to be assumed therefore that Sten-Christer Forsberg, Technical Director of N&T - see Subchapter 5.2 - and member of the Board of Estline was informed. It is most likely that he - in turn - informed the N&T management because at about the same time there were bomb threats against Silja vessels, which were considered to be so serious that drastic safety measures were introduced at the Silja pier in Stockholm.
- It was confirmed by Sjöfartsinspect's inspector Lennart Ahlberg to SPIEGEL TV in December 1999 that the Estonian as well as the Swedish criminal police and also Sjöfartsverket were informed about these bomb threats.

- In summary of the aforementioned it has to be concluded that relevant governmental agencies of Estonia and Sweden, and probably also Finland, especially their police organisations were aware that there had been recent threats to sink ESTONIA by bomb explosions and that the last threat dated 27 September, when the ferry had been searched but apparently without result. It has to be assumed that the JAIC members had the same knowledge as Olof Forssberg was a high ranking civil servant with the Ministry of Defence and Kari Lethola being part of the Ministry of Justice.
- It is unknown to this 'Group of Experts' whether the government agencies mentioned before also knew already on the morning of 28 September that there possibly had been explosions onboard of the ESTONIA because the technical facilities available to the Nordic countries and their partners to detect explosions at sea are not the subject of this investigation.
- But the way in which the JAIC members and the Finnish criminal police officers performed the interrogations of the survivors does indicate that they had knowledge of - at least - possible explosions onboard. The questioning of the German survivor Manfred Rothe by the criminal police in Helsinki may serve as an example. It was video-filmed and according to the transcript he was asked among other things:
 

"1. Mr. Rothe, could one think that the vessel was hit by a mine?  
2. ... and, no explosives at all?" (See the transcript attached as [Enclosures 36.2.445 / 36.2.445.1](#).)
- When the JAIC on their first joint meeting on 29 September in Turku questioned 3 crew members, among them motorman Hannes Kadak, who had been in the engine control room at the time of the casualty, he was also asked the following questions:

"11. Q: Did you look to the monitor?  
A: Yes, I saw water on the monitor. I don't know when it started to penetrate. The height of the water was above the roof of the personal cars.  
  
12. Q: Did you see whether the hatch burst open by explosion (was blown open)?  
A: Don't know. Was in control room and asked: Shall we leave? Went out through the watertight door. Did not close the door because certain personnel stayed behind."

Shortly afterwards Andi Meister ended the hearing of the witnesses abruptly and left with them for Tallinn. (See Subchapter 37.1.)

- Upon instructions of the Finnish JAIC chairman, Kari Lethola, one week after the visor had been placed ashore in Hangö paint samples were taken from the areas around the failed locking devices and the visor lug for subsequent examination for possible traces of explosions. (See Subchapter 32.1.) The JAIC Final Report contains on page 133 only the following:

*"The Finnish police have taken several paint samples from inside the visor. TLC (thin layer chromatography), LC (liquid chromatography) and spot test analysis of these revealed no vestiges of explosives."*

In this connection it has to be noted that the explosive experts of the Finnish criminal police apparently did not know that it was no more possible to prove by means of the above-mentioned methods whether an object had been affected by explosions which had been below water for 7 weeks. According to the explosives expert Martin Volk this is only possible by a metallurgical examination of the molecular structure of the affected metal. Such an examination, however, was not carried out according to available information.

In spite of the existing rumours about "possible" or even "actual" explosions in the foreship area which might also have caused a hole in the starboard hull - see the following Subchapter 36.3 - with respective influence on the casualty scenario, the official investigation was never directed in this direction. It has to be noted, however, that recent photos, taken of the visor since being in Söderläje, showed that a substantial part of the visor bulkhead plating around the initial location of the lugs for the side locks has been cut off at both sides. Initially it had only been small rectangular parts directly around the locations of the lugs.

### 36.3 The "Hole in the Starboard Side"

On 2/3 and 9/10 October 1994 ROV inspections of the wreck were carried out in the presence of Tuomo Karppinen of the Finnish JAIC. The hole in the forward part of the starboard hull seems to have been discovered which assumption is confirmed by the many cuts of the video footage of this area. The existence of this hole seems to have been known also to Sten Andersson, thus at a certain level within Sjöfartsverket, as well as to the JAIC members. This fact was consequently leaked out to the press, as is first shown in the article on 18 October 1994 in DAGENS NYHETER by Anders Hellberg, where he states:

#### **"Bow Visor Tore Up Holes**

Accident Commission convinced what caused the Estonia casualty. Estonia's bow visor tore up big holes in the hull, as it was torn off. Together with the partly opened bow ramp, those holes in the hull caused water to flow on to the car deck in such quantities, that the stability of the ship completely changed.

When the 50 to 60 ton heavy visor started to move the actuator tore traces (tracks) in the plating and holes were made in the hull, says Sten Andersson, observer of Sjöfartsverket in the JAIC who was not present at the Monday session in Tallinn.

Also from other very well informed sources DN has received the same information, that holes in the hull contributed to water getting into the ship so quickly. According to Sten Andersson, the three visor locks, two on the sides and one at the bottom, were ripped off. This can be seen from the new underwater pictures taken.

The DN's source, with substantial knowledge of the ship's construction, has difficulties believing that the sturdy lock at the bottom - the Atlantic lock - could have been ripped off by a force directed upwards. The source said: "I rather believe that the visor attachments on the deck have broken and that the 54.5 ton visor fell forward and broke the Atlantic lock. The bow visor then started to move forward/ aft tearing on the upper part of the ramp on which cars and trailers normally drive. The bow ramp hung on the visor and was finally dragged out a meter or two in its upper part. Here water came into car deck."

Note: This should be the other way round: The visor actually hung on the bow ramp, but it may be a misunderstanding.

But many experts have had difficulties to believe that this comparatively small opening of the ramp would have let in such huge amounts of water, that later sank the ship. More than 1000 tonnes have entered.

The two pieces of information explain how additional water came into the ship. When the visor finally broke loose the hydraulic actuators, that normally regulate the opening, tore big holes into the hull. The beam on which the actuator was fastened has, in its turn, ripped off part of the hull plating. There are pictures of those damages, that we just got from the new videos taken by the underwater cameras, Sten Andersson says.

Note: Such pictures are not visible on the video footage publicly available.

According to the source of DN this scenario gives "violent mechanical damages and big holes in the hull". Those holes will then be situated under the water line in the heavy sea.

Survivors have testified about several different bangs, that might explain how the bow visor first came loose in its lockings from the actuator attachments.

Those who stayed in the cabins under car deck in the foremost part of the ship have told about a scraping from the outside of the bottom, that is the outside of the ship. That sound might have been caused by the finally ripped-off visor drifting along the ship's side. The new conclusions of the JAIC changes the earlier picture, where the visor was ripped off and the bow port was instead pushed in by the violent sea.

The question then is of course whether the crew had any possibility to save the ship and alert the passengers. Probably the entire course of events - with the bow visor coming loose, the pushed-out bow ramp, and the ripped-up side of the hull - took place very quickly. The officers on the bridge didn't have many minutes until so much water had entered, that the ship was not possible to save.

Why, then, has not the bow visor been found in the proximity of the wreck? The Finnish Coast Guard has been looking along the route close to Estonia, but hasn't found anything. The Commission is convinced that the visor doesn't lie in the area close to the wreck, where one has been looking. A possibility is, that it all happened so fast that the visor simply lies under the wreck and therefore will not be found until the wreck - possibly - will be salvaged."

Note: Hellberg obviously means damage to the ship's hull not caused by the actuators when cutting through the front bulkheads and Sten Andersson's reply indicates that he refers to damage by which massive water ingress on to the car deck is possible. Hellberg has just a vague idea but confronts Andersson with information about big damage to the hull's side. If Andersson had not been aware about such damage he would have corrected Hellberg immediately. But Andersson did not reject it and let it pass. Thus it was published and stands up to day uncorrected. Hellberg furthermore writes in his article that "the scraping noises heard by survivors from the 1st deck might have been caused by the visor drifting along the vessel's hull side" which became indeed part of the JAIC scenario. This cannot have been possible because according to the "floatability Calculations of the Visor" by the Technical University, Hamburg-Harburg, the visor sank as soon as it became detached from the vessel - see Subchapter 34.11 - which was only when the vessel was heeling from 90° to upside down, i.e. approximately when the heel was 130°/140° - see Chapter 31 - the Casualty Scenario.

Although such a hole could have explained the sinking and, in particular, the way the ferry sank, it was completely ignored by the JAIC in their press conference and in all internal and external publications. However, not all of the relatives forgot about the Hellberg article in DN and especially those who had made own observations which could lead towards a hole in the side of the ferry remained very interested and followed this up whenever possible. This occurred for example at a big meeting at Karlberg Castle on 13 March 1996 when Johan Fransson from Sjöfartsverket was asked whether there was a hole in the starboard side. His answer was: "Yes there is a hole in the starboard side, but I don't know anything about it - please the next question!" This was said in the presence of many relatives, journalists, and survivors, among them Rolf Sörman, who reported on the meeting at the Styrelse for Psychological Försvar (Board of Psychological Defence) on 9 June 1999 when the survivors Mikael Oun, Sarah Hedrenius, Sten Jolind and himself met with Johan Fransson, Per Nordström from Sjöfartsverket and some people from the SPF. Rolf Sörman asked Johan Fransson again whether there was a hole in the starboard side and his answer was "yes": However the "hole" had disappeared to the public and was completely covered by the casualty scenario developed by Börje Stenström and his colleagues which was presented to the public.

#### 36.4 Other Information from Tallinn

The Estonian JAIC members, the Criminal Police and the Security Police obviously interviewed the crew survivors, the crew of the 2nd shift, the ESCO and the Estline employees as well as other persons with information regarding the ESTONIA, which was their duty. Therefore there was also detailed knowledge at an early stage already about the very bad condition of the ESTONIA. Such information, however, was apparently not passed on to the Finnish and Swedish JAIC members straight away which is demonstrated by the examples explained below:

- The Estonian JAIC members and their experts knew already rather early about the extremely bad condition of the visor and the bow ramp including the locking devices and the securing bolts from unofficial interviews with the crew survivors and members of the 2nd crew. See for example Enclosure 12.5.175 - the statement of Arvi Myyryläinen. Also in this context the expert Professor Heino Levald told the Tallinn newspaper SÖNÜMILEHT: "Actually the hinges and locking devices of visor and bow ramp were already damaged before the catastrophe. There were furthermore fatigue cracks in the metal, which indicates poor supervision and maintenance".
- The nautical student Rain Oolmets reported to the Tallinn police already on 3 October 1994 that he had seen big cracks in the welding seams of the visor hinges. The respective statement was brought to the knowledge of the Swedish and Finnish JAIC members only during the meeting in Tallinn on 16/17 March 1995.
- Both EPIRBs were recovered already on 2 October 1994 in switched-off condition, but the Swedes/Finns were only informed on 22 December 1994.

#### 36.5 The Hearing of the Survivors

The Finnish police took statements of all the survivors brought to Finland - sometimes two or three statements - during which one of the standard questions to the survivors was: *Did you note or feel explosions?* The Swedish survivors were interviewed by local policemen in their home cities or villages, who in most cases were not trained to ask the proper questions for a maritime investigation. This resulted in the disappearance of valuable evidence forever, a procedure which as such was accepted by the Swedish part of the JAIC as well as by the investigating public prosecutor. There is evidence that SÄPO (Security Police) officials tried to persuade survivors to change their statements in regard to particular matters. Some followed, very few did not. All the statements were in the early stage declared "classified" by prosecutor Birgitta Cronier, however, were declassified sometime in 1995. The statements were sent to Estonia on 17 October 1994 and were received by the Swedish part of the JAIC on 20 October 1994.

In Estonia the crew survivors were frequently heard by the Criminal Police, the Security Police and subsequently by a transport investigation office in addition to being heard several times by Estonian members of the JAIC. According to the statements available the Estonian passenger survivors however were heard only once.

The Estonian statements were sent to the Swedish and Finnish police and translated subsequently into the respective languages. The Swedish versions were received by the JAIC on 1 December 1994 and are available together with some of the Estonian originals to this 'Group of Experts'. A comparison of the Estonian originals with the translations revealed that the Swedish text is substantially shorter and relevant parts of the originals were not translated at all. It is, of course, unknown to this 'Group of Experts' whether this occurred just due to sloppiness of the translator or was done deliberately. The statement of Ain-Alar Juhanson taken by the Central Criminal Police of Tallinn, at Tallinn airport on 29 September 1994 at 17.10 hours shall serve as one of many examples:

The translation from the Estonian original reads as follows:

*"Before the catastrophe I was on Deck 2 in cabin 1056 of the ferry 'Estonia'. The vessel left her berth in Tallinn, at 19.00 hours. Our group consisted of 4 sportsmen. Myself, Anti Arak, Kristjan Rainend, Jaak Pehk are athletes. Ülle Karo was responsible for our massage. We were underway with a Mercedes bus without driver. Our bus was one of the last taken on to the car deck. I do not know how the bus was secured. The driver was K. Rainend who had driven the bus on to the car deck. We had a double cabin but we were 4. The cabin no. was 1056. Ülle Karo had bought a 1-person ticket for this cabin. We four others had deck tickets. The cabin was in the middle of the ship. I cannot define exactly, I was unable to orientate myself on the vessel. At the moment of the catastrophe we were in cabin 1056. Myself, Arak, Rainend and Ü. Karo. I do not know in which cabin Pehk was. We all slept.*

*There was a high sea state prevailing. The waves were beating against the vessel, there was strong wind. I woke up by a heavy metal bang. I felt that the vessel heeled immediately to the right side. I was sleeping on the floor. Prior to this metallic bang I did not hear anything in particular due to the noises of the engines. As a result of the bang we all woke up. It was clear to us that something particularly extraordinary had occurred. I took my Texas trousers, my shirt and left the cabin. All the passengers were already in the alleyway. It appeared that some water was already in the alleyway. All four of us then went up the stairs to the deck - I was the first one. The vessel continued to heel to the right. On the stairs there were only few people, but up at the doors it was quite full. There was full panic. Everybody was screaming: "What shall we do?" At this time everywhere the light was on and in my opinion also the engines were still running. Only very few managed to reach the railing. Not everybody managed to get out of the foyer. Myself, Arak and Rainend managed to reach the railing. After we had reached the railing I heard a female voice shouting over the loudspeakers 2 or 3 times the word "Alarm" in Estonian language. At this time there was still light. Arak and myself stayed for a while at the railing. There was a strong storm. Suddenly the vessel heeled heavily to the right, the heel reached almost 90°. Then we heard the siren and the light went out. We climbed on to the side of the vessel and tried, depending on the heel of the vessel, to have a firm hold beneath our feet. Together with us many people had climbed on to the side of the vessel. Rainend did put on a lifevest whilst holding on to the railing. There were many lifevests. Together with Arak we tried to fabricate a raft from lifevests. We succeeded but did not manage to lift the raft on to the vessel's side. There were a number of rubber boats floating around in the waves. I cannot say when the ship's engines stopped. Together with Arak we estimated that in case we would jump into the water to reach one of the lifeboats we would be smashed against the vessel by the waves coming in from this side. There was a heavy storm. We then moved towards the bow. We could see that the bow was damaged. At the bow I climbed along some sort of grids downwards together with Arak. To the water's surface remained some 10 m and hand-in-hand we jumped. We swam about 100 m away from the vessel to avoid being sucked down by the vessel. Due to the high waves we were unable to save ourselves on the rafts. We had both*

*put on lifevests when we were standing at the railing and now were swimming together until we saw a white cabinet. The doors of the cabinet were closed. We climbed on top of it. I do not know how long we were on the cabinet. We were able to hold ourselves to the handles of the cabinet. In the moonlight we saw the vessel. The distance was approximately 150 m. Finally we managed to reach a rubber boat. After about 3-4 hours we were picked up by a helicopter. Together with Arak I was rescued. I cannot say what happened to the others. I had not been on the car deck to check our bus during the catastrophe."*

The Estonian original and the German translation are attached as [Enclosures 36.5.446 / 36.5.446.1](#).  
Now the Swedish translation:

*"We were with a Mercedes Benz bus. Our bus was one of the last placed onto the car deck. I do not know how the bus was secured to the car deck. The bus driver was Kristjan Rainend. Ülle Karo had bought the ticket for cabin 1056. The other 4 had deck passenger tickets. The cabin was in the middle of the vessel, where exactly I cannot say because I could not orientate myself. All 4 of us slept. Out at sea there were high waves which were beating against the vessel, there was strong wind. Woke up from a heavy metallic bang. Before that nothing worth mentioning was heard in the engines ..... After the mentioned metallic bang the vessel began to heel to the right. The light was everywhere functioning when we jumped out into the alleyway. I had the impression that the engines were still running. Ülle could not come out of a door. Myself, Arak and Rainend reached the railing. There was heavy storm, the vessel heeled ca. 90°. Suddenly there was a loud siren, thereafter the light went out. There were many people up there. At the railing there were also many lifevests. In the sea there were many liferafts but we did not dare to jump from the side because the waves would smash us back against the vessel. I do not know when the engines stopped. We went to the vessel's bow which was damaged.*

*Hand-in-hand we did jump into the water which was about 10 m below. We swam about 100 m away from the vessel and were holding on to a cabinet which we met. There we were about 150 m away from the vessel. The moon was shining and therefore we could see the vessel. Finally we reached a rubber boat. Together with Arak I managed to get in. I do not know what happened to the others. I was not on the car deck to check our bus during the catastrophe."*

The Swedish translation is attached as [Enclosure 36.5.446.2](#).

It is quite obvious that the Swedish text by far does not contain the information stated in the original, thus the psychological expert to the Swedish JAIC Bengt Schager, who was to summarize all statements for the other JAIC members and experts, was not in a position to evaluate the full evidence of this important witness. He could therefore not question him further about his observations at the damaged bow.

It is evident that very important evidence remained unknown to the JAIC.

In any event, the JAIC relied on the statements of the survivors mainly taken by policemen untrained for maritime casualties and refrained from the taking of own statements.

As a matter of fact, the JAIC only heard a couple of the crew members whom they considered to be the key witnesses, which they actually were and still are, however, they did not tell the truth or, at least, not the full truth. They were - as it could be expected - very loyal to their owners ESCO and N&T. The many passenger survivors having made numerous valuable observations were not heard by the JAIC, except for one or two. Instead the psychological expert to the Swedish part of the JAIC, Bengt Schager, was instructed to make summaries from available statements which were then handed to the other members and experts and on the basis of which they formed their opinion about the developments onboard and about the casualty sequence of events. These summaries were compiled in such a way that for example water observed on deck 1 was not even mentioned in the first version.

When Karl Lethola was interviewed by Jutta Rabe of SPIEGEL TV in May 1996 and was also confronted with certain survivor statements, e.g. Carl Övberg, he stated that they (the Finnish part of the JAIC) did not have the complete statements, but just "Summaries" made by Bengt Schager. In the course of the further interview it turned out that the JAIC had not taken the statements of any passengers themselves. Nevertheless it turned out that Lethola knew the Övberg statement about the hydraulic noises heard, which, according to Lethola, were caused by the visor actuators when the visor was opening/closing after the locks were broken.

According to Stenström the noises were caused by the stabilisers. Lethola subsequently confirmed that the JAIC did everything to prove in the best possible manner that the hypothetical scenario developed by Stenström less than 4 weeks after the casualty is the real one and that consequently the locking devices of the visor, allegedly under-dimensioned, were the main cause of the casualty. In a subsequent interview after his resignation from the JAIC Bengt Schager told Jutta Rabe among other things:

*"Q: I was told that you were first asked to make summaries of the statements and then later again, more or less, to count statements which were talking about a detailed time line, so that one could know when there was water under the car deck, etc.  
A: Oh yes, when I made my first version we suddenly came across that new things were important, on which I had not put any emphasis before, for example, we have the reports about water on deck 1 and I knew there were reports about water on deck 1 and I was again re-reading this in a more thorough way and put it into my summary as it was said, because it could prove to be important after the shipbuilders report. I did not know, when I started my first version that this could be very important, that the actual wording had to be put there.*

*Q: Did it affect in some way?*

*A: No, it was more ... I knew at that time that we believed that the accident started with water on car deck. We had reports of small amounts of water, trickles really, on deck no. 1, but then people came out publicly and said that the accident started with water on deck 1 and then it is obvious that I had to rewrite it in a way that is clear that the data we have does not support such an idea.*

*Q: So, from the existing statements you did not get that impression?*

*A: That's correct.*

*Q: You have not been able to talk to passengers who had seen water under the car deck and asked them again?*

*A: No. "*

Had the JAIC questioned Carl Övberg and Carl-Erik Reintamm they would have become quickly aware that there had been a lot of water on deck 1, even before the big heel, and that the water had penetrated the 1st deck with substantial pressure from below - the 0-deck.

See the statement of Carl Övberg - [Enclosure 12.4.2.151](#) - and the statement of Carl-Erik Reintamm - [Enclosure 21.3.1.289.1](#). The "Summaries" made by Bengt Schager are available but not enclosed.

## CHAPTER 37

### ACTIVITIES OF THE JAIC AND SURROUNDING CIRCUMSTANCES AFTER THE CASUALTY TO THE END OF THE YEAR 1994

The knowledge about such activities and their surrounding circumstances is mainly based on documents copied from the files of the Swedish part of the JAIC, i.e. documents which became public only after the publication of the Final JAIC Report.

Further knowledge stems from information given to the Swedish media during the investigation especially by Olof Forssberg, Kari Lethola, Tuomo Karppinen and Börje Stenström.

37.1  
29 September 1994 - The Day After the Casualty

In the afternoon the JAIC met for the first time in Turku - see [Subchapter 35.1](#) - and after the preliminaries were established it was decided to jointly hear three crew survivors considered to be key witnesses. These were

Watch A.B. Silver Linde  
System Engineer Henrik Sillaste  
Motorman Hannes Kadak

No details are known except what was published in DAGENS NYHETER on 08.10.94, viz.

"Crew Reports About the Casualty DN had a look into the JAIC working papers with notes taken during the hearing of crew members at Turku on 29.09.94:

Kadak: motorman, 11/2 years at sea, first shift on 'Estonia', was on board 10 days

1. Q: Do you know how the visor functioned?
- A: Very little, not my job.
2. Q: Was it dark when you left 'Estonia'?
- A: Some light in the distance. Was swimming. Saw 'Estonia's silhouette. Frightening. Heavy list. Saved himself before the capsizing.
3. Q: Was the visor in place?
- A: Possibly, but not fully certain. The stern sank first. The vessel turned when the stern sank down. Much shouting. Completely dark.
4. Q: Did you see the bulbous bow above water?
- A: Cannot answer this (was close to being squeezed to death when rescued by 'Silja Europa').
5. Q: Did you see a black hole?
- A: Impossible to see.
6. Q: Have you been on watch?
- A: Yes, I was in the engine control room. Did not see anything unusual.
7. Q: How did the vessel behave?
- A: It was very stormy. Heavy movements. Heavy vibrations. No abnormal noises. Was in the control room when the engines stopped. Heel was then about 50°. Everything rushed to the side.
8. Q: How did you get out?
- A: Via the engine room and up through the emergency exit in the funnel.
9. Q: Which building no. did you have?
- A: Don't know.
10. Q: Did you go at full speed?
- A: I am certain. Not my job.
11. Q: Did you look to the monitor?
- A: Yes, I saw water on the monitor. I don't know when it started to penetrate. The height of the water was above the roofs of the personal cars.
12. Q: Did you see whether the hatch burst open by explosion (was blown open)?
- A: Don't know. Was in control room and asked: Shall we leave? Went out through the watertight door. Did not close the door because certain personnel stayed behind.
13. Q: Why did you leave? Heel or water on car deck?
- A: General feeling that something did happen. The emergency generator started when they pulled themselves up. 15-20 seconds after they came out everything became dark. Injured his hands at a hot boiler in the engine room when it was dark.
14. Q: How long did it take from everything normal until leaving the vessel?
- A: Ca. 30 minutes. From the bridge came as long as Kadak was in the engine control room: Can you correct the list? Are the engines OK?"

These question/answer notes were also published in SVENSKA DAGBLADET on 06.10.94, however, without the question whether the bow ramp was blown open by an explosion.

Much to the surprise of the Finnish and Swedish members the interrogations were suddenly interrupted by Andi Meister at this time, allegedly because their plane would be waiting, which was a poor excuse as the plane - owned by the Estonian Coast Guard - would have waited as long as required.

The manner in which Andi Meister chose to end the first meeting of the JAIC caused considerable irritation with the Swedish and Finnish members. This was reported in SVENSKA DAGBLADET on the next day - 30.09.94 - as follows:

*"Political manipulations disturb casualty investigation. Estonian Minister blamed for forcing important questioning of survivors. The Estonian chairman of the JAIC, Transport Minister Andi Meister, is committing political manipulations which have already done damage to the work of the JAIC."*

*"Due to the pressure resulting from forthcoming elections in Estonia he forced the first questioning of surviving crew members in Turku. "Therewith Meister, having absolutely no experience with casualty investigation, has already proved that he is unsuitable to lead the work", a source said.*

*"Both the Swedish and the Finnish members of the JAIC are irritated about the Estonian chairman's stopping the first interrogations held in Turku on Wednesday. The JAIC had selected 3 crew members who were considered to be the most interesting to be questioned:*

*- AB sailor Silver Linde, who went the last watch-round, just an hour before the casualty, and who subsequently received instructions from the vessel's command to go down to the car deck to find out what was happening there, just before the vessel took the heavy list and sank.*

*- Engineer Henrik Sillaste who saw on the TV monitor in the engine room that water was streaming onto the deck.*

*- the third witness was a motorman.*

*Interrogating the three has revealed valuable information. For the JAIC it was very important to hear their reports and to put forward their questions without haste and pressure. Therefore the behaviour of the Estonian Transport Minister "is, at least, strange", said one of the Swedish participants. "He made it understood, powerfully and determinedly, that the interrogation should be stopped so that he could go back on the plane waiting at the airport of Turku." The plane had been chartered by the Foreign Ministry to take survivors home to Tallinn. "We carried out the questioning as well as possible. Finally we understood that we were compelled to end the interrogation - the plane was waiting", said one of the investigators. Various different sources have confirmed the picture. In addition, the Transport Minister had made it quite clear that he wished a quick investigation. "He believes in his naïveté that the investigation can be finalised within two weeks". It was apparently the intention of the Minister to present the investigation report on the 'Estonia' casualty before the change of government in Estonia which was forthcoming. Upon the question of the Transport Minister Meister to Olof Forssberg, head of the three-man Swedish part of the JAIC, as to how long it would take until the investigation is completed, Forssberg replied: "About 1 year." "This answer left him considerably surprised", said one source. "No perspective, no experience. He obviously has never had anything to do with qualified casualty investigations", said another participant at the Turku meeting."*

*Note: When being interviewed by Jutta Rabe, Andi Meister said among other things: "I thought it was not the best decision to appoint me as chairman because of my position."*

Also the following statements were made to DAGENS NYHETER and published on 29.09.94:

Kari Lethola refused to make a statement as to the possible cause of the casualty, but said: "However, since there is a bulkhead between the port and starboard side of the car deck, shifting of cargo can be excluded ...."

Note: He means the centre casing.

Also Carl Bildt did not wish to speculate on the causes, but stated that "it could not just have been the heavy weather". He added that during the forthcoming investigation work "..... each stone will be turned".

"One master survived

There were two masters onboard the 'Estonia'. The acting master was Arvo Andresson who did not survive.

Piht was onboard to fulfil his examination to obtain the pilot licence for the Stockholm archipelago. "The 4 inspections carried out by the Swedish Sjöfartsinspektionen did not include the condition of visor and bow ramp. This had to be done by the French classification society Bureau Veritas."

"Henrik Sillaste, 25 years old, was working in the engine room when he saw on the TV monitor that water was penetrating the bow ramp." "We had 'Estonia' on the radar screen for exactly 8 minutes. Then she was lying stopped in the water. At 01.48 hours (Finnish time) she disappeared from the radar and we knew what that meant", said the Staff Commander of the Fortress Utö."

In the evening the Swedish Embassy in Moscow sent by fax an ITAR-TASS message from St. Petersburg with the following wording:

*"St. Petersburg September 29 TAS - by ITAR-TASS correspondent Lev. Rumyantsev: A Russian underwater expert believes people may still be alive inside the 'Estonia' ferry which capsized in the Baltic Sea on Wednesday and lies at a depth of 80-90 metres.*

*"Hundreds of people remaining inside the sunken ferry can be saved and should be saved." Anatoly Kuteinikov, designer general of the St. Petersburg based 'Malakhit' company told TASS on Thursday. The company is the leading Russian defence enterprise producing underwater craft.*

*He said that an "air cushion" always accompanies any shipwreck and may allow those remaining inside the ferry to stay alive for at least a week.*

*"One should not be scared by the excessive pressure. 80 metres are not too deep", Kuteinikov said.*

*He regretted that the Finnish and Swedish authorities had not requested the Russian rescuers to help with the 'Estonia' shipwreck. "We have a big experience in underwater work, as well as good and maybe the best equipment. It is a pity that we did not join efforts. Moreover, there are our citizens in distress", Kuteinikov complained. The chief designer believes that the main cause of the disaster was a poor training level of the crew. Besides, it is also clear that the ship had some design faults. "Ships of the 'Estonia' class do not sink in five minutes. They can overturn, but should stay afloat for several hours to a whole day", he said."*

## 37.2

## Activities to the End of 1994

On 30 September 1994 the Swedish and Finnish JAIC members met again in Turku and according to a memo attached as Enclosure 37.2.447 they dealt with the following matters:

1. Olof Forssberg: Discussion concerning the distribution of the areas to be investigated between Estonia-Finland-Sweden, the forthcoming operation/organisation: partly help from Swedish side.
- Cargo : Estonia and Sweden, possibly controlled by Sweden
- Passenger list : Finland
- Rescue services: Finland
- The Swedish part of the JAIC will hear the Swedish helicopter crews and rescue services.
- Weather : Estonia (however each country will obtain weather information from its own weather office).
2. Fax exchange between Finland/Sweden concerning important matters.
3. Next meeting proposed to be in Helsinki after the wreck has been filmed, thereafter preliminary report.
4. Each country keeps a separate protocol for its own file.
5. Estonia's concern about NATO/Russia's interference with the wreck.
6. Dealing with media.
7. Keeping record, archive.
8. Swedish JAIC members shall visit N&T the following day. Stowage plan.
9. Swedish JAIC members shall visit 04.10. Karppinen shall attend on behalf Finland.
10. Heimo Iivonen informed about air rescue in Finland. The Swedish part of the JAIC, LFV had informed the Swedish Rescue Services that they had questions as to the rescue services and the control center.
11. Heimo Iivonen has a good contact to Estonia: Kalle Pedak.
12. Börje Stenström points to the importance of hearing the masters' from 'Silja Europa' and 'Mariella' plus the 3rd engineer of the 'Estonia', Margus Treu.
13. Discussion concerning guarding the wreck.
14. Definition of the term "Skylight": Warning for the crew only (no warning for passengers).
15. Pirjo V. informed that the Finnish part of the JAIC had access to the 'Estonia' drawings.
16. Finally: A Helsinki newspaper is reporting that one of the Estonian JAIC members is involved in a weapon affair!

After the meeting the Swedes went home while Kari Lethola and his team stayed in Hotel "Marina Palace" in Turku.

In the late afternoon the wreck was located by the Finnish survey vessel "SUUNTA" and Kari Lethola advised (only) the Swedish part of the JAIC by fax on the same day:

*"The wreck has now been located:  
Latitude 59°23'  
Longitude 21°42'  
The wreck lies with the port side on the bottom. M.S. 'HALLI' with ROVs tries tomorrow at 10.00 hours to begin the work."*

The complete fax is attached as Enclosure 24.393.

1 October 1994 :

DAGENS NYHETER :

*"Estonia' located at 70 m depth.  
'Estonia' is apparently resting on her side at 70 m depth. The vessel was already located 2 hours after the survey vessel 'SUUNTA' commenced her search on Friday (1.10). A ROV can be sent down at the earliest on Saturday (2.10). ...  
The master of the F.B.N. survey vessel 'SUUNTA' refuses to analyse the sonar pictures of the wreck. ...  
The wreck was found pretty close to the casualty area.  
As soon as the wreck has been video-filmed, the commission shall meet in Helsinki to analyse the films. According to Kari Lethola the video films will not be shown to the public until the commission has completed its analysis carefully and quietly.  
Lethola does not make definite statements, however admits that a lot indicates the visor to have been the cause of the casualty. "We have a lot of indications pointing to this but no evidence. This we will only get after the wreck has been filmed on video. ...  
The commission has finalized the taking of statements from the survivors. On Friday they concentrated on collecting all thinkable information which might have a relation to the casualty. There is eyewitness evidence drawing the investigators' attention to the bow door. However Lethola does not exclude completely the possibility that the cargo might have shifted. "The many reports about banging noises from the car deck could indicate that the cargo did move", Lethola replied.  
The Swedish and Estonian parts of the commission have gone home and the commission shall first collect everything concrete to work with.  
"Now our work aims at filming the wreck. With the help of the video films we hope to be able to analyse and draw conclusions about the casualty", said Olof Forssberg. "Further investigations are required before we take position concerning possible diving." A preliminary report might come within a week after the JAIC has studied the video films .... ."  
The central criminal police in Turku have also been busy with trying to get a hold of the 2nd master Avo Piht who had been onboard the vessel. He was at first stated to have been among the survivors, but it is now most likely that also he lost his life. The commission has a special interest in hearing Piht's version of the catastrophe. ..."*

In the evening the Finnish part of the JAIC sent by fax sonar pictures of a large object - see Chapter 24 and Enclosure 24.394 - to the Swedish part of the JAIC only. Attached was also the radar plot of the Finnish Navy showing the tracks of 'SILJA EUROPA' as from 00.12 hours, 'MARIELLA' as from 01.16 hours (which is still before the "official" Mayday) 'SILJA EUROPA', 'TURSAS' and even of two unidentified vessels, however, of ESTONIA only at one position, namely the casualty position. - See Subchapter 22.3.

2 October 1994

DAGENS NYHETER:

*"Pictures Can Give the Answer.  
In Finnish newspapers it was reported on Saturday (01.10.94) that 'Estonia' may have had problems already one hour before finally the alarm was transmitted. The vessel may have deviated from her normal course and may have had problems with manoeuvring as well as with establishing the position and for a full hour deviated from her normal course.  
The Finnish JAIC member, Kari Lethola, denied very determinedly that the JAIC should work with such a theory. According to Lethola there was no "normal" route for the 'Estonia'.  
"Vessels do not always move on the direct line between two positions. Good seamanship requires the selection of the most advantageous route", said Lethola.  
"There are no indications that 'Estonia' should have deviated from her course or should have had problems establishing her position already that long time before the catastrophe. The misunderstanding was probably initiated by the vessel having been one hour behind schedule ... ."*

*"Water Penetrated from the Car Deck.  
The JAIC puts big confidence on the failure of the visor that caused the casualty. (The JAIC strongly believes that failure of the visor caused the casualty.)  
Water from the car deck penetrated the cabins on deck 1 below ...  
This was reported to the JAIC by the watch A.B. Silver Linde.  
This new evidence supports the theory that water rushed on to the car deck past the bow visor and past the inner bow ramp.  
"We are pretty sure that this is the way it must have happened. Otherwise the development of the accident could not have been that quick", said the observer for Sjöfartsverket, Sten Andersson. .... Linde returned to the bridge, where everything was normal when one of the telephones rang. The mate said, that some unknown person, maybe a passenger, reported that something had happened deep down in the vessel.  
Note: A passenger cannot phone the bridge. Silver Linde was sent down at once. Down on the lower decks he met passengers rushing up*

and heard persons shouting that water had entered into the cabins below the car deck.

Note: Water on 1st deck before the big heel. "It was so congested that Linde could not go deeper, thus he turned round and rushed to the information desk to telephone the bridge."

Note: What about his walkie-talkie? "When he was standing there, however, the 'Estonia' heeled and took a heavy list." ... "At about the same time the watch engineer and the technician Henrik Sillaste were in the engine control room. On a monitor they saw water streaming past the bow ramp."

Note: The bow ramp was still in place though slightly open after the big heel.

According to Sten Andersson they also saw water on the car deck. ... Sten Andersson refused to speculate about what caused the failure of or damage to the visor. The JAIC does not yet have sufficient documentation to draw secure conclusions. It is hoped, however, that the video films from the wreck will allow this.

"We hope that the films shall bring us the final evidence", said Sten Andersson.

Note: On this day the ROVs filmed the wreck officially for the first time. See Subchapter 25.1.

Sten Andersson: "By the end of next week, if everything goes according to plan, the commission shall complete a first preliminary casualty report."

Note: The above information about the initial testimony of Silver Linde must originate from the first questioning by the commission of the three crew members Linde, Treu and Sillaste in Turku on Thursday, 29 September 1994, which was abruptly ended by Andi Meister. Obviously Sten Andersson in his capacity as observer for Sjöfartsverket did already attend this first hearing (as well as all the following ones).

3 October 1994

DAGENS NYHETER:

"New Pictures from the Wreck Point to the Visor.

Everything points to the visor located in front of the bow ramp to the car deck to have been the cause for the casualty. Dr. Jouko Nuorteva, who analysed the sonar pictures taken when 'Estonia' was located, could give them on Sunday a new interpretation. According to Nuorteva the vessel is turned towards East, i.e. not in the course direction as it was believed in the beginning. At the bow there is a large object which was either torn loose or is hanging on the bow. The object could according to Nuorteva be the damaged visor or part of the visor. The video pictures shall deliver the information in case the visor should have sustained such a big damage. The investigators now have access to as many video films as still pictures from 'Estonia'. The pictures were taken in black/white and colour.

"The pictures are of a high quality, so much we can say," said Kari Lethola.

"At first the JAIC shall come together to analyse the pictures and thereafter we shall decide what can be published", Lethola said. "After weather improvement we shall try to film as many details as possible. We are going over the vessel 'screw by screw'", Lethola advised. The JAIC decided already yesterday to meet in Turku, today, Monday. ... "

"Estonia is Prepared to Exchange the Chairman of JAIC.

Estonia's President, Lennart Meri, is fully prepared to exchange the Estonian Transport Minister Andi Meister, who is jeopardized by Sweden and Finland in the joint investigation of the 'Estonia' casualty. There must not remain the slightest doubt that Estonia wants complete certainty about the catastrophe."

This was stated by the President in an interview last Sunday in Stockholm ...

The 65 year old President has taken it very personally that there was so much mistrust against the Estonian crew and the Estonian JAIC members expressed recently by several Finnish and Swedish civil servants.

He listened politely to the questions, nodded but did not want to become polemical about them. He said slowly, very slowly and with very much self-control after having pointed to all the flags outside the hotel being put on half-mast:

"There was the best trained personnel one can think of on the 'Estonia'. They did their work exemplarily and did everything to avoid that panic broke out. Captain Arvo Andresson, this experienced sailor, stood all the time on his bridge and never left it. He followed the vessel also into the depth. Everything went so fast."

The last days had added doubts about the Estonian Transport Minister Andi Meister as chairman of the JAIC. Among other things the Swedish sea safety experts questioned his competence.

"In this context I can only say that in case there should be indications of a conflict of interest for any Estonian person, we shall exchange him", Lennart Meri replied.

Confidence

He pointed out spontaneously that he himself had appointed a personal representative (for the JAIC), who, with his 40 years in the sailor profession, stood for competence and experience. He has the President's full confidence and he is member of the JAIC.

Note: He means Uno Lauri.

The President explained that two Estonian representatives had already left the JAIC and were replaced. He added that they had wished to leave ... "

Note: These were Toivo Ninnas, Managing Director of ESCO, and Yrjo Saariinen, Traffic Manager of Estline.

See Subchapter 36.2.

LLOYD'S LIST reported on the front page:

"'Estonia' Visor Broken Away Evidence of catastrophic failure as submersible finds bow 15 m from sunken ferry

By Jim Mularan, Shipping Editor

Sonar images of the wreck of the 'Estonia' last night suggested the ferry may have sustained catastrophic damage to her bow doors.

Pictures transmitted to the Finnish government vessel "HALLI" from an unmanned submersible suggested the visor bow door was lying 15 m from the hull. The underwater survey tended to confirm fears that the failure of the outer visor may have caused the casualty. There was still no indication as to whether there had also been a devastating failure of the inner watertight doors."

The JAIC met in Turku on this and the following day and viewed the video material produced by the ROVs from the "HALLI". It has to be assumed that it was then decided that the visor had to be considered "not yet found", although somebody must have told Lloyd's List before that the visor had been found. The reasons for such a tactical manoeuvre are obvious: The visor next to the wreck implies a longer sequence of events and rules out a rapid development undetected by the crew until it was too late. The visor close to the wreck also rules out the possibility that the visor might have pulled open the bow ramp when the vessel was still at full speed or, at least, making headway.

4 October 1994

DAGENS NYHETER:

"Film Pictures Show the Visor to Have Been Torn Off

Video pictures show that the whole visor was torn off 'Estonia' ... and that the watertight ramp at its inside was about 1 m open. Therefore the car deck became quickly water-filled and the vessel capsized. .... The experts cannot say whether a heavy wave or fatigue of the material have caused the catastrophe. The video pictures demonstrate without doubt that is possible on a modern ferry that the whole visor weighing many tons can simply be torn off. This could be the explanation for the 2 bangs many survivors have heard. ...

The visor was pushed upwards with such force that it broke loose from its hydraulic locking devices and left big holes in the steel plates. ... The visor has still not been found although ROVs have been used in addition. The reason for this is certainly that the visor fell off more than an hour before the vessel sank. The bow ramp is in position but its locking devices are also damaged. The bow ramp has to ascertain/maintain watertightness even if the visor is damaged, however, it is about 1 m open. The JAIC draws the conclusion that the water quantities which ingressed through the open ramp were sufficient for the vessel to lose the stability and to capsize.

Why the visor was torn off and why also the locking devices of the bow ramp are damaged the JAIC cannot say for the time being. "We need time for us to find the answers why the visor became loose", said Olof Forssberg. According to Forssberg this could be for example a heavy wave, too high speed under the prevailing conditions and too high load.

The JAIC members warned not to draw conclusions with regard to other car/passenger ferries. They would now investigate whether the 'Estonia's' construction would deviate from the construction of other comparable ferries. According to naval architect Börje Stenström, JAIC member, it is already clear that the ferry traffic shall have to face serious consequences even if the answer to the question what caused the casualty should not be found.

"It has to be emphasized that the Atlantic lock of the 'Estonia', which is an additional locking device for heavy weather, had been engaged," said Stenström.

**Failure of Material Far-fetched**

*Stenström does not want to speculate completely about the causes why the lock mechanism failed, however, he stated that failure of the material seemed to be far-fetched. "Then you may rather imagine overload."*

*Technology Doctor T. Karppinen ... stated that the sea state had influenced the tearing off of the visor. According to Karppinen the pictures of the open bow ramp did support the reports of two engineers that water ingressed through the bow ramp. That they had seen on a monitor."*

**SVENSKA DAGBLADET:****"Estonia's Visor Torn Off**

*Pictures of the wreck of 'Estonia' published Monday evening by the JAIC do confirm that the bow visor had broken off the vessel ....*

*Thereby the theory is supported that the damaged visor caused the casualty .... The JAIC gave some preliminary explanations of the video pictures taken during the first ROV examination, but was careful when commenting the cause of the accident. "Today we are able to say what approximately happened, but we are far away from being able to state why it happened", said Olof Forssberg."*

*"Olof Forssberg: "Today we can approximately answer the question: What happened? However, we cannot answer the question: Why did it happen?"*

**DAGENS NYHETER:****"Norwegian Mini Submarine Can Help**

*A Norwegian special-purpose vessel for deep sea photography can be engaged for the examination of "Estonia".*

*The vessel's name is "Seaway Commander" and it is equipped with 3 remote-controlled mini subs. It is one of the most modern vessels of this type in Northern waters.*

*The vessel arrived Monday p.m. in Nynäshamn after having left Haugesund on Friday.*

*"It speaks a lot for the vessel to proceed to Hangö during the night", said Leif Aspen, operations manager of the Norwegian offshore company Stolt Comex.*

*According to Aspen they are in negotiations right now with the Finnish Coast Guard and the JAIC to obtain the order to examine "Estonia".*

*The 3 mini subs differ in dimension. The two bigger ones weigh ca. 4500 kg each and the small one just 200 kg.*

*"The two big ones are equipped with cameras and manipulators, these are special robots with claws that can pick up objects from the sea bottom", said Leif Aspen."*

*Note: The "Seaway Commander" left the area after several days of futile waiting because the Finns and Swedes engaged exclusively government respectively navy vessels in the operation until the visor had been recovered and whatever else had been clarified.*

**SVENSKA DAGBLADET:****"Officer's Statement Supports Video Film**

*Six days after the catastrophe the only surviving officer having been on duty spoke at a press conference in Tallinn. The 3rd engineer and watch-keeper Margus Treu was in the engine room of the vessel at the time of the casualty. In the case that his evidence is true it is once and forever established that "Estonia's" sinking was caused by the tearing loose of the bow visor.*

*In spite of Treu being an experienced sailor it was difficult for him to explain what actually happened.*

*- "At 01.00 hrs. I saw on my monitor in the engine room that an AB sailor went his control round and that he was just forward at the bow ramp."*

*This information, however, does not conform with the statement that AB sailor Silver Linde made during earlier interrogation by the Commission. Linde testified there that he had completed his round already at 00.30 hrs. by turning a control key behind the bow ramp.*

**Heard Hard Bangs**

*Between 01.12 and 01.15 Margus Treu heard 2 to 3 strong bangs in the vessel.*

*"These were not the waves. They did not sound like from waves even if the waves are very strong. I thought that trucks had started to move and crashed against the shell plating."*

*He switched his monitor to the effect that he could see the truck. Thereafter he changed the camera and had a look at the bow area. "There I saw that water rushed onto the car deck. Then the vessel had already taken a list. Simultaneously the mate called from the bridge asking:*

*"Can we restore the balance of the vessel again?" Treu tried to pump water over to the other side which failed. The mate asked again:*

*"Is it possible to pump out freshwater to regain the balance?" Treu replied:*

*"This is not possible, this is technically impossible."*

**The Engines Were Running**

*He also denied information that the engines had stopped long before the vessel sank. No water entered the engine room as long as he was there.*

*"At 01.25 hrs. I tried to start the port one but it failed. The starboard engines kept running for some minutes more. Then they also stopped."*

**Washed into the Sea**

*Thereafter he crept up to the 8th deck and pulled himself to the aft just when the sinking was interrupted.*

*- "Then I was washed into the sea by a giant wave. I succeeded in pulling myself up into a lifeboat."*

*From there he saw that the bow visor had disappeared when "Estonia" disappeared into the deep.*

*After the press conference Margus Treu criticised the interrogations by the Estonian police. The Estonians went very far with their ambitions to clarify the causes for the casualty.*

*On Friday (30 September, i.e. 2 days after the casualty) all passenger lists and Estline's complete documentation concerning "Estonia" were confiscated by the Estonian Security Police.*

*Note: On 5 October N&T declared the withdrawal from the Stockholm-Tallinn ferry service (which remained a declaration only for the years to come because they continued until 1998). On Monday, 03.10., also Sten-Christer Forsberg, technical director of N&T, went very far when he strongly attacked the Swedish Ship Engineers' Association:*

*- "Their categorical allegations against the Estonian engine room crew is shameless and insulting. The purpose is to make use of the situation for own policy."*

**LLOYD'S LIST reported among others:**

*"Asked whether the video tapes would help to establish the cause of the disaster, Kari Lethola said: "I hope so, but this is not the only method we use."*

*Speculation that the bow door had been torn off... heightened yesterday with a Finnish News Agency report that sonar pictures of the 'Estonia' showed a large object lying 10 to 20 m from the wreck. Tuomo Karppinen said: "We have not seen that kind of large object."*

*Marine geologist Jouko Nuorteva, who located the wreck on Friday (30.9.) using a sophisticated sonar device, told the Finnish News Agency (STT) yesterday: "The observation of a large object is certain. It was seen on all the 4 sonar pictures that were taken from 'Estonia' on Friday."*

5 October 1994

**LLOYD'S LIST reported among others:**

*"Swedish JAIC member Olof Forssberg said the film showed what had happened, but did not say why. "The hardest question remains to be answered: Why did the locking mechanism fail? The big question is, why did the bow visor break off. Before that is known, we cannot establish the cause", he said. "We are at the start of a very long road. We still don't know where the visor is. We will start looking for it immediately." Questioned about possible causes why the visor became loose, Lethola said: "They can be technical, they can be human, but they can be also because of the sea conditions with extremely high waves."*

**SVENSKA DAGBLADET** published an article with the headline:

*"Sabotage Theory Written Off Mate reports about last hours onboard. Tallinn, SvD."*

a copy of which was faxed to the Finnish by the Swedish JAIC upon instructions of Olof Forssberg. On his request Gunnar Göransson (the Swedish administrator) wrote the following remark on the faxed copy: *"I want this evidence to be followed up! Olof."* See Enclosure 37.2.448.  
The article reads as follows:

'Estonia' had a problem with the bow visor already before departure from Tallinn harbour. Such a theory can be found in the investigation material of the Tallinn police according to the experience of SvD made in Tallinn. However according to mate Einar Kukk, who was trainee onboard the 'Estonia', those in command on the bridge did not receive any information that this should have been the case. Kukk was on the bridge between 20.20 hrs. and 00.40 hrs. local time. "During this time a possible failure of the visor was not discussed", said Einar Kukk to SvD. The Tallinn police have interrogated 58 survivors, of whom 33 are crew members. Many of them state that they heard a distinct metallic noise before 'Estonia' got the list. "But none of them took the view that this resulted from a collision", said the investigator Väino Karmi. The investigation by the police, which runs parallel with the investigations by the International Commission and the Swedish police, indicates that the theory about sabotage can be probably written off. "No such information did come up", said V. Karmi. He is upset about accusations that the Estonian security police did try to hide important witnesses. "When the survivors of the catastrophe arrived at Tallinn Airport we guided them away from the intensive shadowing by the media. Even you journalists have to understand that people having just escaped a tragedy should not be exposed to questions."

#### Fraud with Cargo Weights

Väino Karmi is well acquainted with MV 'Estonia' since the Tallinn police initiated an investigation into fraud with cargo weights earlier this year. The trigger off factor was the smuggling of 64 Kurds who were hidden in a Swedish truck. Karmi is of the opinion that many freight forwarders systematically stated lower values to avoid high customs fees. "Each time the Estonian customs made spot checks they found wrong declarations." SvD did scrutinise the "Estonia's" cargo manifest. The 39 trucks contained everything from furniture and timber to frozen fish and fashion clothes. Two trucks were declared empty, but the Tallinn police has no confirmation of some rumours that refugees should have been onboard.

Note: There were actually 40 trucks onboard. See Chapter 17.

#### Trainee Mate

Mate Einar Kukk was onboard the 'Estonia' to gain practical experience before taking up his normal duty as 2nd mate on "Estonia's" sister vessel 'Vironia,' the previous 'Diana II'. 'Vironia' shall take up the traffic at the beginning of November. Kukk reports about the last hours onboard:

- "I left the bridge at 00.40 hrs. Then everything was under control. I went to bed just before 01.00 hrs. After ca. 5 minutes I heard a strange noise which I had never heard before at sea."

Kukk went up to see what happened. When he was still in his cabin the vessel started to heel over seriously. Kukk's statements also indicates that 'Estonia' took a list already 30-35 minutes before the casualty. ..."

#### DAGENS NYHETER :

##### "Vessel's Command Criticised by the JAIC "

After the visor broke off the 'Estonia' was doomed if the vessel was not turned rather quickly which was not done." That's the way Tuomo Karppinen expressed himself. The JAIC came out with a preliminary report about what caused the casualty after their meeting in Turku on Tuesday.

According to the JAIC the casualty one week ago had been caused by water on the car deck which ingressed via the forward ramp. Why the visor broke loose is not explained. The JAIC declared that it could have been caused by fatigue as well as by one single overload of the locking devices. Thereafter the visor broke off and the inner bow ramp was exposed to such wave loads that the locking devices gradually gave way and the ramp opened some meters.

This had been sufficient to take in so much water on to the car deck that the vessel became unstable, heeled to starboard and capsized.

How fast this developed after the visor broke off the JAIC is unable to say.

#### One A4 Page

It is also unknown "which information about the immediate danger did exist on the bridge", as they expressed themselves. One A4 page with short factual comments is all that the JAIC has achieved so far in the investigation of the human tragedy without comparison in Europe after the war.

Many of the experts and members of the JAIC to whom DN spoke did agree in one matter: It is considered to be more or less impossible that ferry proceeded on against the prevailing sea conditions with the 15000 ts heavy ferry without noting that the visor and also parts of the foreship were torn/broken off.

"They should have seen from the bridge that the visor had disappeared", said T. Karppinen.

"It is for me not understandable that one can proceed against 8-10 m high waves without noting that the visor has disappeared", said Sten Anderson who has sailed as master for 17 years and is now observer for Sjöfartsverket to the JAIC.

"It is very difficult to understand that they proceeded on without visor for another hour", said Börje Stenström.

All these comments mean subliminally that those in charge on the bridge after midnight were not competent. Another possibility is that the visor was torn off and the inner ramp damaged by one single wave which did not give the watch officer time to react.

#### Different Versions

The statements from the surviving crew members, however, do not confirm the above version of a development within seconds after which the vessel was doomed to capsize. The JAIC's hearing of the crew did clearly reveal that the watch A.B. Silver Linde made his last watch round at 23.30 hours Swedish time. At this time he had turned a key which confirms that he did make his round. Then he heard a loud bang from the ramp and had to hold himself fast not to be knocked off his feet on the car deck. He did nevertheless not draw the conclusion that something dangerous had occurred as the vessel continued to pitch in the heavy seas. Exactly this indicates that what Linde heard was a part of the casualty scenario: He was used from many times before holding himself against the vessel's movements and would not have paid attention unless something special occurred.

"Everything normal".

When he came to the bridge half an hour later there were the 2nd and the 4th mate. At the same time also Captain Arvo Andresson appeared. According to Linde everything was normal on the bridge. Thereafter the phone rang and somebody advised that there was something wrong down in the vessel. Apparently now large quantities of water were penetrating.

Only 24 minutes after Linde and the master came up to the bridge the emergency call "Mayday" was sent. About 20 minutes later the vessel disappeared from the radar screen of "Mariella". If the heavy bang heard by Silver Linde on the car deck at 23.30 hrs. had been caused by the breaking off of the visor, the vessel must have proceeded on for at least half an hour without bow visor and also without those on the bridge noting what had happened. Ab-solutely clear is that the master really tried to save his vessel after he understood what had happened, it is however unclear when this was.

- The pictures from the wreck show that the rudders are almost on hard astarboard and the propellers are in a position indicating that the speed had been reduced, said Tuomo Karppinen. It is, however, unclear when this manoeuvre was made and how long the speed had been reduced. Sten Andersson pointed to the fact that the reducing of speed in the prevailing wind and sea conditions was the only professional way to handle the vessel.

- However none of the surviving crew members from the engine room talk about speed reduction for any longer period of time. It is extremely important to adjust the speed, this is of particular importance for a vessel with bow visor. According to Sten Andersson the crew "did not judge the circumstances properly" during that night. Karl-Johan Hagman drew attention to the fact that Estonian vessels with 'Estonia's' engine power are unusual.

- The crew probably did not realize how dangerous it is to proceed with full output of 24000 hp against the heavy waves, an output that was needed to break half meter thick ice.

If the visor should be found near the wreck everything points to a very quick development. The visor then broke loose shortly before the vessel took such a list that all 4 main engines stopped due to lack of oil pressure.

If, however, the visor should be found a longer distance away from the wreck, this would indicate that the vessel proceeded for some time against the heavy waves without visor. The competence of the crew has to be questioned. Then the JAIC's chairman, the Estonian Andi Meister, does not believe anything of this at all:

- According to my opinion the catastrophe was caused by a material failure. "I cannot blame the crew".

Note: When being interviewed by Jutta Rabe on 01.05.97 Andi Meister stated among other things that "the JAIC had decided to use this casualty to set an example by teaching the shipbuilding industry a lesson." This required a casualty scenario permitting a cause consideration pointing to the shipbuilder, i.e. the building yard - Meyer Werft in Papenburg.

The TÄGLICHER HAFENBERICHT (Daily Harbour Report), Hamburg published the following:

"The JAIC has yesterday published a preliminary report after having analysed the video films from the wreck and after having interrogated the survivors. The report reads as follows:

1. The JAIC is of the opinion that the casualty was doubtless caused by an accumulation of water on the car deck.
2. The JAIC is also convinced that the water penetrated the car deck through the forward ramp.

3. It was established that the bow visor was lost at a certain time. The bottom lock has been identified by ROV. The lock turned out to be broken. It could not be established whether the failure had been caused by fatigue or overload.

4. After the visor had fallen off, the inner ramp was exposed to the pressure devices of the ramp to fail in steps and the ramp did open to some extent. Thereby water could penetrate the car deck. It could not be verified whether the locks of the ramp were out of function, i.e. were damaged or whether the ramp moved forward out of a locked position. It has not been possible to clarify whether the damages to the hull in consequence of the tearing off of the visor did cause further leakages.

Note: Item 3b of the Smit Tak report after the diving survey in December 1994 reads: "b. Construction damage. Except for some minor buckles in the superstructure at the stern near deck 8, damaged/broken railing and broken davits on the deckside, the lost bowdoor and damaged forward ramp some broken windows/ port-holes including the cuts made by the divers during the internal inspection, there is no constructional damage to the ship observed." As the videos were cut at the relevant areas the conclusion is unsupported by evidence, leave alone that the mudline video shows holes, however not caused by physical impact but by corrosion. See Subchapter 29.5.

5. The development in time of the different occurrences could not be determined.

6. It has not been established whether faults of the hydraulic of the locking devices could explain why the locks of the ramp did open at a particular time.

7. It could not be established so far which information about an immediate danger had been available on the bridge before the casualty and which measurements had been incurred onboard.

8. No signals from the EPIRBs of the vessel were received. It could not be established whether the transmitters in some way fell off the vessel or if the lists prevented their functioning."

Note: At the time of the writing of this 'preliminary report' the Estonian JAIC members knew that the EPIRBs had been found along the Estonian coast in "switched off" condition. This information was, however, passed to the Finns/Swedes only 21/2 months later. The preliminary report dated 04.10.94 is attached as Enclosure 37.2.449.

#### 6 October 1994

Kari Lethola reported to Olof Forssberg (only) about the search for the visor - see Chapter 24 - and was requesting the assistance of Swedish navy vessels. The Norwegian vessel 'SEAWAY COMMANDER' was still in the area and the public apparently was demanding from the Finnish and/or Swedish Governments to make use of this very sophisticated vessel, which was obviously not planned, but increasingly caused concern to Kari Lethola and his colleagues.

Lethola also reported that debris was found near the wreck which indicated the drifting direction of the ESTONIA. Also on his fax of 06.10. the area then searched is marked, i.e. 1 nm to the West, 2 nm to the East and 1 nm to the South. As the visor was finally "found" according to the logbook entries of the 'NORDICA' about 1400 m to the West of the wreck, the visor must have been in the above described area.

Otherwise SvD reported about complaints of the Tallinn police about the lack of co-operation by the Swedish police in the following article published on 6 October:

#### SVENSKA DAGBLADET :

##### "Estonians Not Satisfied with Swedish Police

The Estonian police require new information and help from Sweden to be able to carry out the work necessary to investigate the 'Estonia' catastrophe. The highest police management is disappointed that no better assistance is provided by the Swedish police and other authorities. Finland, however, has supported the Estonians on different occasions already without the Estonians having to beg for it.

Priit Männik, Deputy Manager of the Central Intelligence Department of the Estonian police said that he hoped for an improvement during next week. Then the leader of the preliminary inquiry by the Swedish police, Chief Prosecutor Birgitta Cronier, shall come to Tallinn together with several Stockholm police investigators. Männik, a powerful guy ... has his desk in the head office at Pilksgatan, where also previously the head office of the KGB had been.

##### Difficult to get Information

- It has been difficult to obtain information from Sweden and the Swedish police did not get in contact with us up till now. The Finnish police, however, have been much more active, said Priit Männik. The information he is lacking deals among other things with the passengers who had been on board and who were delivered into Swedish hospitals, with 'Estonia's' technical equipment and with information from the Swedish Shipping Inspection (Sjöfartsverket).

- We have no access to the Swedish inspection made before the last departure here in Tallinn on 27 September in connection with the training of Estonian inspectors, he said. Transport Minister Andi Meister, chairman of the JAIC, criticised for not having allowed the first hearing of survivors to be performed the way required, said on Wednesday that the Estonians had still not been informed who is in Swedish hospitals although many days have passed since the 'Estonia' casualty.

##### Invitation to the Swedish Police

Police chief Männik would like the Swedish police to come to Tallinn and participate in the investigation. He and his investigators have now taken the statements of all 61 Estonian survivors. On Wednesday they commenced analysing the statements. They are working in accordance with 3 main theories why 'Estonia' could have sank, but Priit Männik is like a clam if he is asked questions in this regard.

- I have agreed with the JAIC not to go public before their preliminary results are clear. The technical aspects have to be carefully considered in our investigation. Estonia has so far not put forward any suspicion for a criminal offence.

- According to Männik the witness statements from the surviving Estonians are very contradictory. One of the problems is to find the time when what happened.

- He sighs about the confusion which continues to exist about who had really been onboard of the 'Estonia' and refuses to state any number: "This is changing every day."

#### 7 October 1994

On this day INTERPOL Tallinn sent out by fax an urgent message to the INTERPOL offices in almost all the European capitals to search for and locate the missing 2nd master of the ESTONIA, Captain Avo Piht.

Note: This INTERPOL initiated search implies that Avo Piht must have been saved and that he had evidently been ashore.

The message with photo of Avo Piht is attached as Enclosure 37.2.450. Also the expert for military operations in the Swedish JAIC, Rune Lundin, informed the Finnish JAIC about the names of the Swedish mine hunters being on standby in case the Finns wanted to use them.

Furthermore DAGENS NYHETER reported:

##### "Debris from 'Estonia' Found

The crew of 'Tursas' has found small pieces of metal debris from 'Estonia' when analysing the sonar pictures taken on Thursday.

- The pieces, however, are so small that they hardly show the way 'Estonia' was drifting. The visor we have still not found, said Kari Lethola. When the search was discontinued on Thursday 'Tursas' had been between 1 and 1 1/2 nm distant from the wreck. During the search 'Tursas' had found a wide ranging area with a very thick layer of mud. ...

##### Object Squeezed into Ramp Opening

Films from the wreck show some sort of red material near the open bow ramp through which water ingressed to the car deck. The object looks like a mattress. "This is a mattress which you see on the pictures", said Kari Lethola.

"We have discussed this and came to the conclusion that something is jammed in at the bow ramp. This detail has to be filmed again."

"We have studied the drawings and there is a bed-clothing store located right inside the bow ramp." Kari Lethola does not dare to say whether somebody has tried to seal the gap between ramp and bulkhead by means of mattresses or if the mattresses visible on the video film could have floated up and got squeezed in after the vessel sank."

Also SVENSKA DAGBLADET reported :

##### "Damage to Visor Locks is the Main Question

The JAIC is now focusing on the question whether the locking device systems holding visor and bow ramp in place were faulty or damaged.

"This is one of the main questions we are concentrating upon", said Uno Laur. As soon as the weather permits the 'Suunta' shall send the ROV's down again, this time for a special documentation of the locking devices. The combination of the broken off visor and the open ramp confuse the experts, simultaneously it does point to the locking systems being a weak point in the sequence-of-events.

"The visor broke off completely or in parts which could have been caused by damaged locks. Thereafter huge water quantities were smashing against the bow ramp, the inner door. This has to be watertight and has strong hydraulic locks."

According to Johannes Palmgren, expert in Shipinspec., the ramp should withstand the waves, even if the visor should be gone - at least

*for the time it takes the crew to realize that the visor has disappeared.*

*The videos from the sea bottom show that the ramp is about 1 m wide open at the upper side. The gap continues at both sides and narrows continuously.*

*"Nowhere do you find an answer to the question why different locking systems failed almost simultaneously", said Uno Laur. On Thursday the experts of the Estonian part of the JAIC commenced looking at the 16 hours of video film available. SvD received permission to join the marine experts while viewing the videos.*

*Sharp pictures.*

*Remarkably sharp pictures from 'Estonia's' propeller triggered off an intensive discussion. The question what speed was she making on her way to disaster is most relevant. The 15 kn which were the rule in heavy weather could have been too much. Nevertheless, what happened after the crew discovered free floating water on the car deck?*

*Was the speed reduced to minimize the water ingress or did it come too late?*

*"There are relations between the angles of the propeller blades which indicate the speed of 'Estonia' just before she sank. On the film a rather small angle is visible which indicates rather low speed", said Uno Laur.*

*However the picture of the propellers do not say anything about the earlier speed. Most important: Did they lower the speed after 3rd engineer Margus Treu had reported to the bridge that there was water on the car deck just after midnight (Swedish time), i.e. 35-40 minutes before 'Estonia' sank?*

*The Angle Controls the Speed.*

*- Those in charge on the bridge can reduce the speed directly by changing the angles of the propellers (blades). The engineer has nothing to do. The four main engines can continue with unchanged revolutions, Laur pointed out. It is nowhere documented that those in charge on the bridge actually did reduce the speed after Treu's alarming them, said Laur. The combination of the damaged or torn off visor, open ramp and excessive speed might have been the death sentence for 'Estonia'.*

*No Questions from the Owners*

*The Estonian part of the JAIC, of which Uno Laur is the member directly representing the President has difficulties receiving the required information quickly which is probably due to the politicians trying to influence the investigation heavily. Already on the 29th September they requested drawings, sketches and calculations for different parts of the 'Estonia'.*

*After six days, yesterday was Thursday, there was still no reaction. From B.V. the JAIC received a letter on Thursday with the offer to help.*

*The letter was sent by normal mail and was thus only received after 6 days.*

*Finally fax contact has been established with Paris and the Estonians have requested all relevant information from the classification society B.V., which surveyed 'Estonia' in the beginning of 1993, which included also the visor and the bow ramp.*

*"They are frustrated that nobody has access to the drawings of visor and locking devices", said the marine engineer Heimo Jaakula, one of the Estonian experts and advisors. ..."*

9 October 1994

Kari Lethola sent by fax the following message to the Swedish JAIC:

*"Message: Good morning! Due to bad weather the search for the visor was discontinued during the whole day, but now Nuorteva has further analysed the pictures. At the location on the sea bottom, where "Estonia" on basis of the object did capsize, there is a 10 m long and 5-7 m broad object on the bottom. It is probably of metal. The form fits well with the visor. Depth is 70 m, the bottom is hard. Karppinen, Aarnio and the ROV I team go onboard of "Tursas" at Nagu at 11.00 (Finnish time) and the work starts at ca. 13.00 hrs. They shall video film at first the "large object". Attached please find a sonar picture including an enlargement of it."*

*Note: Again they indicate that the visor is lying next to the vessel and even that ESTONIA on basis (or because of) the object (the visor) did capsize. For details see Chapter 24.*

10 October 1994

Kari Lethola to the Swedish JAIC:

*"Message: Good morning! The large object turned out to be a steel plate. The search for the visor has again been discontinued due to strong wind. Nuorteva is of the opinion that it is not useful to continue the search without having drawn up a probable plan. It does not make sense to drive around at sea into the blue. It takes a few days to make up the plan. This is the reason to consider whether the Swedish vessels should come along. What do you think about it?"*

*Note: Now the probable visor next to the ship is a steel plate of 70 m<sup>2</sup> adjacent to the wreck. How did it get there and why, is it never mentioned again?*

The Swedish JAIC replies as follows:

*"Thanks for the fax. From Sweden Hans Rosengren, Sten Andersson and Börje Stenström are coming to Turku. ... Concerning the question about the participation of Swedish vessels Olof shall revert soonest. He is in a meeting right now."*

The reason for the trip to Turku was the arrival of 'DIANA II' at the Turku Repair Yard where she was prepared for flag change from Swedish to Estonian flag and name change to 'VIRONIA', which was subsequently changed to 'MARE BALTIMICUM'. Onboard of 'DIANA II' were some of the ESTONIA survivors and a number of members from ESTONIA's 2nd crew. Moreover 'DIANA II' was a near sister to ESTONIA with more or less identical visor and bow ramp constructions including the locking systems. All this was to be closely inspected by the Swedish and Finnish JAIC members and the Sjöfartsverket observer Sten Andersson. The detailed photo documentation existing in the files of the Swedish JAIC was made during those days.

Tuomo Karppinen sent the following fax to Börje Stenström:

*"Börje, Thanks for your fax and the good pictures of visor and ramp. We changed our plans and went out already on Sunday because we thought that we had found the visor by sonar. We could not find the visor by ROV. We filmed again visor and ramp by ROV. A summary of our observations is attached. I will have the video film with me and we can look at it on Monday evening at Nådendal if this should suit you."*

*Note: This is confusing because Karppinen states on the one hand that they could not find the visor by ROV, but says on the other hand that they filmed again visor and ramp.*

In Stockholm the Swedish JAIC members met with the prosecutor Birgitta Cronier and her assistant.

11 October 1994

The Swedish JAIC sent by fax to the Finnish JAIC the following information:

*"Good morning, Kari. Here comes a fax from the embassy in Tallinn with information about the newly formed Estonian commission and its members."*

The fax from the Embassy reads as follows:

*"To the Foreign Ministry,  
re: M.S. 'Estonia':*

*Estonian average commission The Estonian Government decided on Friday, 7 October, that the government commission under Transport Minister Andi Meister shall be dissolved. He had been instructed by the government to co-ordinate all operations in connection with the sinking of the 'Estonia'. At the same time another average commission was formed which shall represent Estonia in the joint Swedish-Finnish-Estonian Commission. Also the newly formed commission is headed by Transport Minister Andi Meister. The other members are:*

*The Tallinn Harbour Master Eduard Hunt*

*The General Director of the Border Control Tarmo Kouts*

*The Managing Director of CMM Uno Laur*

*The General Director of the Sjöfartsverket (E.N.M.B.) Kalle Pedak*

*The Under Secretary in the Foreign Ministry Indrek Tarand*

*The Vice General Director of the Rescue organisation Kalev Timberg  
The Director of the Labour Inspection Mati Jarvis"*

The note by BNS dated 07.10.94 is attached as Enclosure 37.2.451.

12 October 1994

Fax Kari Lethola to Olof Forssberg:

*"Message: Heimo Iivonen has now investigated the possibilities of continuing the search for the visor. We are ready to commence the search on Monday, 17.10. We will receive assistance from Navy forces. Dr. Nuorteva is employed by them. If it suits you, we are requesting that Sweden sends an expert in mine searching by Friday, 14.10. He could come along with the Finnish reconnaissance vessel and simultaneously he could prepare himself for the situation, in case assistance from Swedish vessels should be required. Assistance might become actual at the beginning of week 43, i.e. as from 24.10.94.*

*If our proposal suits you, we kindly ask you to inform us of the name of the expert and contact details."*

*Note: Now they receive assistance from the Finnish Naval Forces with whom the sonar expert Dr. Nuorteva is employed. Nevertheless they need the help of a Swedish mine hunting expert already by Friday, 14.10.94, although the search for the visor was scheduled to commence only on Monday, 17.10.94.*

In Stockholm the Swedish JAIC informed the heads of the Ship Owners Association and other shipping organisations about the information then available.

Up to now the extensive exchange of information or rather a more or less continuous stream of information just went from Finland to Sweden, Estonia was bypassed. Only on 12 October, when the Finnish and Swedish experts were already onboard of "DIANA II" Olof Forssberg informed Kalle Pedak, General Director of the Estonian Sjöfartsverket (E.N.M.B.), by the following fax:

*"MV ESTONIA Accident*

*I am assuming that you are the coordination point for the communication about accident investigation matters and I am therefore forwarding the following information to you.*

*Note: Forssberg knew of course that Andi Meister being the chairman was the point of entry but politeness is not known to be one of his virtues.*

*1. A few technicians of the Swedish and the Finnish parts of the investigation board are visiting the shipyard at Nådendal in Finland on 11 October to study the Diana II, sister ship to Estonia. The visit is primarily for general familiarization, including study of ramp detail. The bow visor is unfortunately welded shut so the visor and ramp function cannot be examined in detail."*

*Forssberg then continued with other matters:*

*2. We understand from newspaper articles from Tallinn that you are disturbed by Nordström & Thulin not providing you with desired technical information. According to our agreement on division of the work the Swedish side has the responsibility to collect drawings, technical reports, etc.*

*Please let me know what information you are looking for and we will provide such information if readily available to us.*

*3. We understand from various information sources, primarily newspapers, that some additional crew members, besides the four we knew about on 29 Sept, were rescued. We would appreciate if you can confirm if that is the case and give details for our general information.*

*4. We would appreciate if you could send reports of the hearing of Estonian witnesses. We will make the translation."*

In response Pedak advised by phone that two professors from the Tallinn University would also attend on the 'DIANA II' and that they had been promised by B.V., Paris that they would supply them with the required documentation.

In summary of the information submitted so far on the previous pages, it can be concluded that the Finns and Swedes co-operated quite closely in matters concerning the wreck, the visor and whatever else might have been on the bottom of the sea in this area, however without informing the Estonians at all. On the other hand, the Estonians did withhold information, at least as long as possible, in all matters throwing a bad light on the ferry, the crew and/or the E.N.M.B. and the ESCO/Estline organisations including possible explosions onboard. Thus already from the very beginning the JAIC was split into two groups of interest, i.e. the Finns and Swedes on the one side and the Estonians on the other, and it is quite obvious that it would be most advantageous for both sides if a casualty scenario and a cause consideration could be found which was simple to understand, close to reality and which did not affect the interest spheres of any of the three countries represented in the JAIC, but could be used "to set an example by teaching the shipbuilding industry a lesson" (Andi Meister).

13 October 1994

On the day the Swedish JAIC met Sjöfartsverket in their Norrköping head office. Details are unknown.

14 October 1994

Kari Lethola reported to Olof Forssberg by fax:

*"Message: Good Morning! Attached please find the morning news from Finland. I hope they are legible, it is a question of fax to fax.  
Regards Kari*

*1. Attached I am sending you the previously mentioned summary of the Kikuts interrogation.*

*2. As Börje certainly did report the crew of "Vironia" (previously "Diana II") is now here in Nådendal. There are dozens of persons having for one year or so worked onboard of "Estonia". They know a lot about the vessel's matters. Among others there is also mate Kukk, who shall possibly be heard by us in Tallinn. "Vironia" shall stay at Nådendal for 2 weeks. Is it useful to hear these men by the Commission, e.g. by the end of next week? Will you be sending a representative from your side to here? Part of the men only speak Estonian. We could arrange for a proper tape recording at Nådendal. (Handwritten note on the left side: To be taken up in Tallinn 17.10.)*

*3. I have asked an expert at PCIMA, a teacher at the Institute of Technology Kotka, Seppo Rajamäki, to help us analyse the radio communication which took place here in Finland. He is teaching radio communication to ship officers. It is the intention that to begin with he will correct the original transcripts of the tape recordings which were typewritten and to attach a time table to the text.*

*4. PCIMA's expert in navigation electronic, Asser Koivisto, has met some Russians. They reported that a NAVISAILOR 2000 ECDIS chart system of Russian make had been installed on "Estonia" which registers the covered route, speed and the like. It is possible to take out data from the installation even after it has been in sea water for sometime. In case Sweden should decide for reasons of ship-technical investigations or for other reasons to have the wreck examined by divers, the above-mentioned installation should be brought up, according to Koivisto, the matter should be given a relatively high priority and should be speeded up. The Swedish pilot Benny Pettersson, who frequently piloted "Estonia" knows the exact location of the installation on the bridge.*

*5. We hope to make video images of the key areas on the new video films. It is our intention to send a series of colour copies to each country before Tallinn. In addition we are preparing several copies for an eventual press information. I assume that a similar number of journalists will be coming to Tallinn as were at our last meeting in Turku. The really international press will hardly come at all. Yesterday when we published the Mayday tape there was only one journalist present who did not understand Swedish and Finnish.*

*6. Finland's police have collected in Hangö Freeport the liferafts from "Estonia" that floated ashore and delivered by various vessels. There shall subsequently be an inspection report on each raft. FBN inspector Jan Jansson, who is also expert to PCIMA, had a look at them. There are also rafts in Estonia (some of them have already been stolen)."*

17 October 1994

This was the day of the 3rd meeting of the JAIC, this time in Tallinn. At the meeting the questioning of the key witnesses from the crew was continued respectively started again from the beginning. According to the notes of Tuomo Karppinen the 3rd engineer Margus Treu, the watch A.B. Silver Linde and the trainee mate Einar Kukk were heard. As usual with this commission it was not an organised taking of statements, but the witnesses were

questioned in the presence of the whole JAIC and everybody asked what he wanted to ask.

This time Treu's evidence had changed because he did not mention water on the car deck at 01.00 hours again which he previously said to have reported to the bridge, but now saw Linde at 01.00 hours on the car deck "coming from the pumping station for visor and ramp", although according to his own statement Linde was at 01.00 hours on the bridge and according to Kukk the vessel abruptly heeled to starboard at this time. It is unknown whether this remained unnoted by the audience or whether attempts were made to clarify these differences. The 2nd Interim Report of the JAIC reads as follows:

*"At its meeting in Tallinn on 17 October 1994 the Joint Accident Investigation Commission (Sten Andersson did not attend) reviewed new information available to it as a result of additional video films taken from the sunken ship and confirmed the following conclusions of the First Interim Report."*

Note: The visor was still not found "officially".

*"I The bow visor was lost underway."*

Note: The JAIC believed that the visor was lost when the vessel was proceeding at full power against 4.5 m significant wave height which includes 8-9 m seas. This position was maintained all the time and is part of the scenario of the Final Report.

*"If Water entered the car deck at the forward ramp."*

Note: This is true because it was observed by Treu, Kadak and Sillaste on the monitor and the ramp was found to be open at the wreck.

*"The Commission also assumed the following positions regarding the details and one of the most probable causes of the accident:*

*1. The bow door (visor) has separated from the ship as a result of failure of all three locking mechanisms. According to the observations made by members of the crew this happened at about 01.15 when water was simultaneously observed on the TV-monitor, entering the car deck from openings along the vertical sides of the forward ramp. The failures have taken place, in case of the two side locks in the welding of the locking eye plates to the bow visor and in case of the centre lock (as previously shown) by failure of the lugs carrying the locking plunger unit."*

Note: Already on the ROV videos from 02. and 09.10.94 the extremely thick welding seams of the side lock lugs are visible, which were created by cutting off/reworking of the lugs several times as it was observed by many truck drivers - see Subchapter 12.5 - however this is not mentioned by the JAIC.

*2. "Following the failure of the locking arrangements the bow visor has opened up under the wave loads. The deck mounted hinge points have eventually failed as a result of the uncontrolled movement of the 55 tons visor, leaving it attached only by the hydraulic actuating cylinders.*

*3. During the subsequent unrestrained movement of the bow visor it hit the bow ramp in several modes, including hits from the rear to the upper protrusion of the ramp, causing it to become dislodged from its locking arrangements and to move to a partly open position. The bow visor has ultimately separated from the ship and disappeared overboard."*

Note: Apparently at this time JAIC had not yet realised the interlock between visor and bow ramp, i.e. that the upper part of the ramp was extending into the ramp house being part of the visor, which means that if the visor would move forward the ramp would get in contact with the aft part of the ramp house. As long as the visor was empty however and the ramp properly locked and secured, nothing could have happened because the empty visor was unable to break the locks and hooks of the ramp as long as they were intact. Unfortunately neither was the case. See Subchapter 29.2 and Chapter 30.

*4. "Partial opening of the ramp had allowed water to enter the car deck due to the heavy sea. Collection of water on the car deck eventually led to loss of stability and capsizing of the vessel."*

Note: The JAIC does not yet say that the ramp was fully open but just states "partial opening". Nevertheless, the JAIC seems to believe that the opening was big enough to allow the penetration of a sufficient quantity of water within a very short time 01.15-01.30 hours, i.e. 15 minutes from visor off to vessel on the side.

*5. "After the vessel had turned over to almost 90 degrees starboard list, which is estimated to have taken place in less than twenty minutes after the damage to the forward ramp, it started to sink with the stern first. The ship disappeared from the radar screen of a Finnish surveillance station at 01.48.*

*6. The vessel turned during the phase of losing stability and landed on the sea bed with an almost easterly heading. It is assumed at this stage this movement was partly the result of an attempt by the officers on the bridge to turn the ship around and partly by the wave action after the ship had lost propulsion power."*

Note: They did not yet say whether the vessel turned to port or starboard.

*7. "The locations of the EPIRB-s have not been found during the video documentation and their status is therefore not known at the present time."*

Note: At that time both EPIRB-s had been found in switched off condition already 15 days before, but this as well as the location of the visor were kept secret.

*8. "Emergency MAYDAY signals were sent by ESTONIA at 01.24 and were received by ships in the area and the MRCC at Turku."*

The complete 2nd Interim Report of the JAIC is attached as Enclosure 37.2.452.

18 October 1994

In spite of the Report by the JAIC, which was published on 17 October, Hellberg wrote on the following day, 18 October, in DAGENS NYHETER:

#### **"BOW VISOR TORE UP HOLES**

*Accident Commission convinced what cause the Estonia shipwreck. Estonia's bow visor tore up big holes in the hull, as it was torn off. Together with the partly opened bow ramp, those holes in the hull made water flow on to the car deck in such quantities, that the stability of the ship completely changed.*

*When the 50 to 60 ton heavy visor started to move the actuator tore traces (tracks) in the plating and holes were made in the hull, says Sten Andersson, observer of Sjöfartsverket in the Accident Commission, who was not present at the Monday session in Tallinn. Also from other very informed sources DN has received the same information, that holes in the hull contributed to water getting into the ship so quickly (...) According to Sten Andersson the three visor locks, two on the sides and one at the bottom, was ripped off. This can be seen from the new underwater pictures taken.*

*DN's source, with very good insight in the ship's construction, has difficulties to believe that the sturdy lock at the bottom - the Atlantic lock - could have been ripped off by a force directed upwards. I rather believe that the visor attachments on the deck has broken and that the 54.5 ton visor fell forward and broke the Atlantic lock." According to the source of DN this scenario gives "violent mechanical damages and big holes in the hull". Those holes will then be situated under the water line in the heavy sea."*

See Subchapter 36.2. As stated before at least the Swedish and Finnish JAIC members knew what Sten Andersson assumed, namely that there seems to have been a "big hole" in the side of the vessel which, of course, would have influenced the sinking. Nothing thereof however was mentioned to the public by JAIC.

On the same day the visor was found by the Finnish Coast Guard vessel "TURSAS" about 1 nm to the West of the wreck. See also Chapters 24 and 26.

19 October 1994

Börje Stenström apparently had been interviewed by CNN the other day and told his scenario based on the visor position being East of the wreck. After the visor had now been found West of the wreck he hastened to assure that this, of course, had no effect on the main reason for the accident, being the failure of the locking devices of the visor.

He wrote:

*"CNN, London - 19 October 1994 - Fax nbr 00944 71 637 6868*

*Attn Ms Margaret Lowrae -*

*ESTONIA Accident*

*Further to our exchange of information yesterday, you have probably noticed that the bow door has now been found and identified. It is located on the seabed about 1 nautical mile west of the wreck itself. This seems to indicate that the captain has attempted to turn the ship around at an early stage of the development of the accident, however without success in the end result. This will slightly change our picture of the sequence of events during the first 15 minutes but not the main reason for the accident as such. The above may have some bearing on the article you are writing."*

24 October 1994

The Swedish JAIC met the insurance company which had insured ESTONIA - Trygg Hansa - and subsequently Nordström & Thulin at their office. Börje Stenström wrote a Status Report (not for publication) which was distributed only to the Swedish members and Sten Andersson. The administrator Gunnel Göransson was about to fax the report also to Kari Lethola and Andi Meister, but was stopped by Olof Forssberg - see [Enclosure 37.2.453](#). The following shall, however, be quoted:

*"The following is a summary of the hypothesis regarding the sequence of events judged most probable at the time of writing. It is intended to serve as a basis for verifying a joint understanding of the likely cause and for identifying known and missing facts. It is, in summary, judged that the ship's speed, the sea condition and the strength of the bow visor latching mechanism may each one and independently have been the final cause for the accident or could have been able to prevent its happening. Information/lack of information may have been a fourth parameter. Further work is needed to qualify the significance of these parameters during the actual circumstances."*

Note: This illustrates how the JAIC worked: First a hypothesis is established, which serves as a basis for the verification of known or missing facts. It follows that facts which do not match the hypothesis cannot be verified.

Börje Stenström finalised the Status Report on 28 October and it is interesting to note how he changed, for example item 12 referring to the stabilizer fins:

Draft Version 24.10.94:

*"12. The stabilizer fins were according to witness observation in extended position during the sinking, despite they seem to be in retracted position in the wreck."*

Final Version 28.10.94:

*"12. The stabilizer fins were according to witness observation in extended position during the sinking. The port side one seems to be in retracted position in the wreck, this could possibly be explained by the fin having retracted by gravity after failure of the hydraulic system."*

The draft version states that "both fins seem to be in retracted position" while the final version states that only "the port side one seems to be in retracted position". This implies that Stenström knew that the starboard fin was not in retracted position, but apparently also not in extended position which should be the case created by gravity if the fin would have been intact. Since the starboard fin was apparently neither retracted nor extended, it has to be assumed that it was missing.

The final version of the Status Report dated 28 October 1994 is attached as [Enclosure 37.2.454](#). It has to be noted that Kari Lethola and Andi Meister were again deleted from the distribution list, although Tuomo Karppinen stayed on.

Olof Forssberg also sent the following fax to Kari Lethola:

*"Attached please find my fax to Andi Meister.  
I have also spoken to Johan Fransson of Sjöfartsverket about recovery of the visor. He said that it could become actual in connection with the diving inspection of the wreck in order to get an idea whether it is possible to recover the bodies. In case it should be decided to have some form of diving investigation carried out Fransson said that the investigations should then be coordinated with lifting the visor. I shall revert to this question as soon as possible. I understand from certain material that I received via the Foreign Ministry (attached) that the Estonians are interested in hearing Kikuts. As far as I am concerned the police statement is sufficient. We know that the visor came loose and through other statements also the time. If you others should consider it necessary to hear Kikuts once more I will follow you. Regards Olof"*

Note: The reader may wish to consider, whether such attitude towards essential evidence complies with the duties of a leading investigator or appeal judge.

Also on this day the Swedish JAIC did meet with the Stockholm pilots and subsequently with the masters of 'MARIELLA' and 'SILJA EUROPA' onboard their vessels.

As a matter of fact, when Kikuts was heard by a member of this 'Group of Experts' he stated never to have seen the visor moving up and down - see his statement [Enclosure 20.246](#).

27 October 1994

On this day LLOYD'S LIST reported among other things:

*"In an interim report the JAIC reveals that the bow visor smashed into the inner watertight ramp. The report circulated to the British ferry companies confirms that a failure of the locking mechanism of the bow visor triggered the disaster ... According to the report the initial failure to the bow visor occurred when its three locking systems failed simultaneously ..."*

Also on this day Börje Stenström and Tuomo Karppinen visited Meyer Werft in Papenburg for the first time and according to the notes made by Dr. Holtappels they informed the yard as follows:

1. Bow visor came loose at lower end
2. Broke away upper end of ramp
3. Water came in
4. Speed 15 kn
5. Wave heights 5-6 m significant/max. 10 m
6. Wind: SW turning W
7. Wind speed 25 m/s mean value
8. max. significant wave ever measured in the Baltic was 7 m in 1983
9. Course 282° N.
10. Uneven load, despite all trimming at port still 1° starboard list when leaving, first reaction from bridge more ballast on port side or release starboard freshwater
11. Hinges on deck - both sides - not torn out
12. Atlantic lock broken due to overstress, locks at the visor: movement to port but finally separated to starboard (ramp pulled out port upper side)
13. Ramp damaged upper port corner, port hinge damaged
14. Why did the visor move forward?
15. Load assumptions and design criteria for visor and locking devices required
16. Various other requests for documents"

The notes are attached as [Enclosure 37.2.455](#) and by letter of 02.11.94 - attached as [Enclosure 37.2.456](#) - in total 32 drawings and other documents were simultaneously sent to Stenström and Karppinen by Meyer Werft.

During the month of November the Swedish JAIC spoke to:

- the previous masters of the 'NORD ESTONIA' Per Ringhagen and Sten Levander, and further with the Stockholm pilots having piloted the ESTONIA frequently,  
- the employees of Sjöfartsverket's Stockholm Shipinspec office,  
- the management of N&T and Estline. From 9 to 18 November the visor was searched and finally lifted by the Finnish multipurpose ice breaker 'NORDICA' assisted by the Swedish mine hunter 'FURUSUND'. See Chapter 26. During the lifting operation Tuomo Karppinen and Klaus Rahka from the Finnish JAIC were present on board of the 'NORDICA'.  
The visor was landed ashore in Hangö and put on blocks in upside down condition at the premises of Messrs. Levator Oy where it stayed in the open air until it was shipped to Sweden by the Swedish Navy in December 1999. The visor was closely examined by members and experts of the JAIC from all three countries and it was subsequently decided to have the bulkhead parts in way of the torn off lugs of the hydraulic side locks cut out and transported to the Royal Technical High School (KTH), Stockholm. This was carried out after the 23 November because when representatives of Meyer Werft inspected the visor for the first time on that day these parts were still in position and are thus visible on the photos then made.  
Andi Meister writes in his book "The Unfinished Logbook" about the visor inspection as follows:

*"On 2 December the inspection of the visor in Hangö took place. In addition to the other acknowledged experts also the scientists of the Estonian Shipping Company (ESCO) and of the Technical University of Tallinn, August Ingerma and Jaan Metsaveer, participated. It was now also established by means of squeezed steel parts that the visor had pulled open the ramp and that the ramp had been completely open until becoming partly closed again when the vessel turned upside down."*

The Swedish Government had instructed Sjöfartsverket already on 3 October to develop possibilities to recover the bodies out of the wreck and it was thus decided to have the wreck examined by divers. A description of the work required was drawn up in the form of tender conditions which were sent to 14 contractors - see also Chapter 27 - and the job was finally awarded to Smit-Tak/Rockwater, i.e. Smit, Rotterdam, the world's leading salvage company. The contract was signed on 29 November and the work began on 1 December, however, was delayed due to the wrong wreck position stated in the tender conditions - see [Chapter 27](#).

Also the JAIC was given the opportunity of having parts of the wreck examined and taken up. In order to make the necessary decisions Börje Stenström (and most probably Tuomo Karppinen) attended on board the diving support vessel 'SEMI I' while the Estonian side was represented by Aarne Valgma, the head of the Sea Safety Division of the E.N.M.B. and the man who could have prevented the last sailing of the ESTONIA (and consequently her sinking).

As the JAIC had made up their mind already what had caused the sinking of the ferry, their interest remained restricted to the bow area and to some limited extent to the bridge where allegedly three bodies had been found (although there were at least 5), which were allegedly not identified although some of them were wearing uniforms. The cabins of master, chief engineer, radio officer and the owners' cabin all located directly below the bridge were allegedly not examined. At least nothing is mentioned in the official reports. There was however another "unofficial" diving investigation going on at the same time - see [Chapter 27, Subchapter 34.6](#) and the Disengagement Report in [Enclosure 34.6.434](#), - the result of which regrettably has never been made public. It is certain however that the work of this "unofficial" diving team was executed with the consent - if not on instruction - of a certain Swedish government authority. A number of objects from the wreck were recovered by divers and brought to the surface, among others the lugs of the Atlantic locks burnt off in a rather unprofessional way, i.e. each lug was burnt off instead of burning off the whole deck part to which the lugs were welded. Due to this way of burning, the bottom parts of the lugs - say the lower 20-30% were missing - which made the lugs look rather small. Also the sensor plate fitted next to the lugs was burnt off but thrown to the sea bottom by the diver and thus disappeared forever.

Note: The examination of this sensor plate ashore would doubtless have proven that the holes for the screws having previously held the sensors were corroded to such an extent that it would have been obvious that the sensors had been removed already several months before the casualty, a violation of the class requirements which would have forced B.V. to withdraw the class of the ferry in hindsight with substantial consequences for the owners. In addition to the sensor plate also the sensor cables were clipped off and thrown to the sea bottom by the diver obviously for the same reason, because on the video footage it is clearly visible that these cables were cut and not broken by being torn off, of which N&T tried to persuade B.V. and the JAIC in endless argumentation and writings. Obviously with success because B.V. did not withdraw the class nor did B.V. ever criticise N&T/ESCO and the JAIC just noted on page 128, Subchapter 8.6.6 of their Final Report:

*"The magnetic-type position sensors for the bottom lock were not in position on their mounting bracket according to pictures taken during the ROV and diving investigations. The electric cabling that had been part of the sensor installation and the ends of the cables were visible in the area. The mounting bracket for the sensors appeared to be intact or possibly bent slightly aft. No other signs of any mechanical action could be seen on the bracket. The 12-millimetre-diameter bolt holes for the originally installed mechanical switches were empty. It is not fully clear how the magnetic sensors had been installed on the bracket. The magnet which was part of the bottom lock position indicator was after the accident visible on its mounting bracket in the locking bolt. According to information obtained from the electrical engineer who installed the magnetic sensors and the magnet in the mid-1980s they were of the Siemens 3SE6-type."*

Note: According to a member of the 2nd crew the sensors had been dismounted and the cables were cut at the end of the ice winter in April 1994. The sensors were not reinstalled as the crew members had to go down anyway and open respectively close the bolt of the Atlantic lock by hammering, as this was no more possible hydraulically due to the severe misalignment and distortions of the lugs. Therefore a remote control was no more required. See [Subchapters 12.5, 29.2](#).

The Atlantic lock bolt, however, a most important piece of evidence in the JAIC's chain of argumentation, was brought to the surface but, much to the surprise of the outside world, thrown back into the sea by Stenström, allegedly after having measured its thickness and found it to be undamaged and straight, a statement, which is apparently false, as must be concluded from the rather good video footage available - see [Subchapter 29.2](#). It has to be assumed that Stenström very well realised from the explanations and pictures of the diver that the lugs of the hydraulic side locks could do substantial damage to the JAIC scenario when brought up to the surface and subsequently being examined ashore. The extremely thick welding seams would have proven that they consisted of several welds on top of each other, i.e. frequent cutting off/re-welding had taken place. Furthermore it would have become known that the missing bulkhead parts to cover the holes in both aft bulkheads of the visor (where the lugs had been sitting) were not attached to the lugs (apart from a tiny piece). This meant that the lugs had no more been welded to the bulkheads as original but had just been stuck through pre-cut holes and then welded on to the remnants of previous welding seams. All this was naturally combined with a substantial reduction of the initial load carrying capacity of the locks. Stenström decided to leave the locks in the wreck.

The recovery of the visor hinge bolts which had already been ordered to the divers was stopped also. A close examination of these bolts would have brought results - see [Subchapter 29.2](#) - for the JAIC casualty scenario.

By fax of 06.12.1994 to Andi Meister, Stenström briefly reports on the diving inspection (see [Chapter 27](#)) and concludes:

*"Findings in the bow area generally confirmed the earlier hypothesis of the development of the accident. Broken lugs of the bottom lock of the visor were recovered for detailed examination. One hinge for the visor was also recovered. Damages on the bow area and the ramp were documented."*

*"The findings support the hypothesis that the visor broke loose from the ship due to high sea loads in combination with inadequate strength of the locking devices. Detailed investigation of the design and the classification society rules valid at the time of the construction is being carried out."*

*"The deck hinges of the visor broke subsequently and the visor started to move. The visor thereby forced the ramp open due to mechanical interference. The visor probably brought the ramp to fully open position at the time it was leaving the ship. The visor tumbled forward over the bow at that instant."*

In a memo of the same date he goes more into detail on his hypothetical assumptions:

#### **"A. Damages**

##### **1. Ramp hinges.**

Number 1, port side. Outer eye on ramp lower beam bent, inner one broken, hull mounted part intact, hinge separated.

Number 2. Both lugs on ramp lower beam broken, hinge separated.

Number 3. No damage, some play at pin.

Number 4, starboard side. No damage, same play at pin."

Note: Stenström does not state that the port outer hinge was found to be bent and misaligned, with the bolt moved to starboard, both securing plates missing and the port "outer eye" (lug) slipped off the bolt. He also failed to mention the mattresses, bed-clothing, blankets and rags squeezed between ramp and bulkhead at the port outer ramp hinge, although this had become public knowledge (see DN of 07.10., page 59 above).

##### **2. Ramp front side.**

*Heavy damage at lower end, most at starboard side.*

*Ramp beams damaged at lower ends and in centre line at mid length (possible contact with fore peak deck locating horn)."*

Note: Stenström does not mention that the ramp is bent longitudinally, is resting on the starboard bulkhead with a gap existing between the port bulkhead and the ramp, i.e. that the ramp has been exposed to pressure from port to starboard, which had led to very severe deformations of all the transverse beams, except for the lower ones and to deformation of the longitudinal beams in the lower area which he interpreted to have been caused by contact with the forepeak deck. See [Subchapter 29.2](#).

##### **3. Ramp inner side.**

*Some damage at top."*

Note: He means apparently the damage to the port outer beam which was bent and distorted at the upper side, but the severe damage to the inner ramp plating in the upper third with burnt and distorted plates and also the distorted flaps in way of the centre line at the top and the bottom of the ramp are not mentioned. See [Subchapter 29.2](#).

##### **4. Ramp actuating cylinders.**

*Port side one found extended, rod end failed."*

Note: The videos clearly show that the port ramp actuator was sitting in retracted condition inside the bulkhead opening with the piston rod broken at the lug fitted to the lugs at the ramp side. These lugs at the ramp side were missing. The videos also show that the starboard ramp actuator was also broken, once at the lug, same as the port one, but again at the piston rod because this part was found by the diver to be jammed in between ramp and bulkhead recess. The remains of the piston rod and the actuator were noted inside the bulkhead in

retracted condition. The lugs at the ramp side are missing, the fastening of these lugs was found to be blown open and distorted. See Subchapter 29.2 and Chapter 32.

**"5. Ramp locking plungers.**

*Starboard side ones, both in extended position, mating boxes deformed. Port side ones, upper one in fully extended position, mating box deformed, lower one partly extended, no visible damage to mating box."*

Note: Stenström does not mention the diver's report that there was a misalignment of 21/2 inches = 10 cm at port side between the plungers (bolts) and the mating boxes which also existed between the ramp hook and the mating lug. He also did not mention that both port mating boxes as well as the mating lug and the ramp hook were found to be intact which means that the entire port side of the bow ramp had not been secured at all upon departure from Tallinn (and numerous voyages before already). See Subchapter 29.2.

**"6. Visor bottom lock.**

*Failed lugs on fore peak deck removed and recovered for examination of welds.*

*Plunger of bottom lock recovered and examined, measured general diameter 78.2 mm, 77.8 over contacting surface with visor lug."*

Note: See the comments on page 81 in this respect.

**"7. Visor side lugs.**

*Remain in front bulkhead. Estimated play, both sides, max. 10 mm. Failures in bulkhead plating around weld bead (part of bulkhead plating attached to lug bottom side but not over the entire area).*

Note: See the comments on page 70. He states failures in bulkhead plating although only a very tiny part of the bulk-head, less than 1/10 of the contact area, was found to be attached to the lugs and the diver reported that no bulk-head parts were attached to the lugs at all."

**"8. Visor hinges.**

*Deck lugs intact, no visible twisting. Design deviates, however, from that shown on drawings. Starboard side one has been beaten by visor arm more than the port side one. One hinge bushing recovered for examination.*

Note: No word about the bolts standing on the adjacent rails with the starboard one without bushing and the port one with the inner bushing attached. Both bolts could have been recovered without big problems by the crane of 'SEMI I'. At this time the cracks in the welds of the visor hinges had already been known to the Estonians for 2 months, however, the Finns and Swedish JAIC members were not informed.

**"9. Front bulkhead.**

*Not much damage except around port side locating horn and ruptures caused by visor hydraulic rams."*

Note: The starboard front bulkhead was found to be open in its upper part to such an extent that the diver could move through it and the lower side was found cracked off the hull and bulged forwards. See Subchapter 29.2 and Chapter 32.

**"10. Fore peak deck.**

*No damage except some around centre line and in way of rubber seal."*

Note: No word about the rubber packings missing and damaged in about 70% of the channels partly extending up to the front bulkheads (also noted by Åke Sjöblom and Gunnar Zahlée - see Chapter 15). Also the severely hammered stempost area is not mentioned.

**"11. Bulbous bow.**

*Heavy scratch marks on ice breaker horn, clear evidence on front and bottom of bulb from contact with visor."*

Note: This is correct, however, the marks and even damage are only proof for contact with some object, not necessarily the visor.

**"12. Navigation bridge.**

*One Shipmate GPS navigator recovered for possible retrieval of data. The navigation PC could not be found. The engine control levers on port side bridge wing and on centre console were in full astern position."*

Note: The examination of the bridge - under the aspect of accident investigation - was totally unacceptable, for example Stenström failed to have the divers establish:

- (a) course on the gyros which would have indicated the heading of the vessel at the time the auxiliary engines stopped;
- (b) whether the auto pilot was switched on/off which would have indicated whether they were steering manually already;
- (c) whether the stabilisers were activated or not;
- (d) the identity of the bodies by means of their ranks indicated on their uniforms and the type of clothes of plain clothed bodies.
- (e) whether any documents were still possibly legible (Stenström most likely knew that the logbook had been recovered already in the early days of October 1994 by Swedish Navy divers).

*"The controls for the watertight doors were found to be push button switches and no information about ordered positions of the doors could therefore be found. The watertight door checked by the divers was in closed position."*

Note: The door closed from port to starboard, thus closed anyway by gravity due to the starboard list of the wreck.

**"13. EPIRB beacon.**

*One casing for an EPIRB beacon was found on top of the bridge, the other position was inaccessible for the diver. The casing was open and empty. The casing was recovered for further investigation."*

Note: At this time both EPIRBs had already been in the possession of the Estonians for more than 2 months, but the Swedish and Finnish JAIC members were still not informed.

The "likely sequence of events" followed in line with the previous statements of the JAIC. The complete memo is attached as [Enclosure 37.2.457](#).

It is quite obvious that the JAIC was dominated by technicians, in particular by naval architects like Börje Stenström. Thus also the investigation was performed from the technical points of view of shipbuilders. It is unknown whether the master mariners Hans Rosengren and Olle Noord were always happy with the rapid development of the cause consideration and casualty scenario in which the surrounding circumstances, in particular the nautical ones, were often grossly neglected.

On 6 December 1994 Börje Stenström, accompanied by his assistant Mikael Huss, also naval architect and lecturer at the KTH, Stockholm, visited Meyer Werft in Papenburg for the second time. They had brought the starboard and centre lugs of the Atlantic lock with them for demonstration purposes. According to the notes of Dr. Holtappels Stenström explained the following:

1. Bottom lock (Atlantic lock) failed due to overload, no fatigue.
  2. Side locks have not taken much load due to lack of structure.
  3. Wind 20m/sec., significant wave height 4-4.5 m, single waves 7-8 m; speed 14-15 kn.
  4. Port deck hinge broke.
  5. Visor pulled left side of ramp while still hanging on starboard hinge and in hydraulic system.
  6. Banging on bow visor.
- Weak welds of Atlantic lock
- Ramp: first movement port side but totally torn open
- Hydraulic cylinder were pulled through decks and deck beams
- Trim aft only

The notes are attached as [Enclosure 37.2.458](#).

This time the failure of the Atlantic lock was assumed to have been caused by overload and the side locks were considered not to have taken much load due to lack of structure, although no metallurgical examination had yet been carried out.

On 13 December 1994 the Ethic Council of Sweden recommended to the Government not to have the ESTONIA raised and instead to declare the wreck to be a permanent graveyard where private diving should be prohibited and the area should be protected respectively guarded.

On 15 December 1994 the next JAIC meeting was held and, although no examination had been carried out, Börje Stenström presented a working paper - not for publication - to the audience which is attached as [Enclosure 37.2.459](#). The heading reads:

*"M.V. ESTONIA - Summary of Technical Findings and Technical Evaluation of the Probable Sequence of Events and Cause of the Accident. The investigation of technical facts related to the accident has continued with high priority. The findings and conclusions reported and agreed on during the meeting on 17th October in Tallinn are essentially still valid but various additional findings have been made and the related probable development of the accident has been further clarified and modified...."*

*The summary below describes the technical findings and also the effect these may have had on the development of the accident.*

*1. All evidence found so far confirm the hypothesis that the mechanical failure started with failure of the lower locks of the visor. Most probably the bottom lock failed first. The mounting lugs for this lock have been recovered from the wreck. They indicate that the failure in the lugs has been caused by overload and also that the actual welding of the locking plunger housing to the lugs has been less extensive than presumed in the engineering calculations. The total load carrying capacity of the mounting of the bottom lock has therefore been less than intended. The internal work routines of the shipyard relevant for this condition are being discussed with the yard."*

Note: 1. Failure in the lugs has been caused by overload:

The subsequent investigation by Prof. Hoffmeister - see Subchapter 34.8 - Enclosure 34.8.436 - proved that the welding seams between "locking plunger housing" and lugs were up to 90% penetrated by fatigue cracks.

2. Welding of the "locking plunger housing" to the lugs has been less extensive than presumed in the engineering calculations:

The welding seams found were about 3 mm thick while according to the Meyer yard welders having done the job, they were 7-8 mm thick originally which was also in conformity with the yard's standard welding rules when welding a 15 mm thick component to a structure. In such case each weld had to correspond to 50% of the thickness of the component to be welded. Thus it has to be assumed that the welds and probably also the lugs were not original and definitely the rather poor repair welds of the starboard lug did not originate from the yard. - See Subchapter 12.5. - The JAIC was not interested and arranged for a paint analysis of the starboard lug only in December 1996.

3. The total load carrying capacity (lcc) of the bottom lock has therefore been less than intended.

According to Stenström's own calculation the lcc of the Atlantic lock had been only 70-80 ts. while actually a subsequent break test with 3 m welds revealed a break load of 220 ts. See Subchapter 34.3 and Enclosure 34.3.431.

*"2. The side locks at the same moment or immediately after the bottom lock. Inadequate rigidity in the mounting of the lugs of the side locks have reduced the ability of these lugs to pick up load at the same rate as the bottom lock, indirectly contributing to overload of the bottom lock."*

Note: The findings of the divers were apparently ignored - see page 81. The "inadequate rigidity in the mounting of the lugs", actually was always existent. It was caused by the frequent rewelding on top of existing welding seams around the 2 lugs which were just stuck through existing openings in the aft bulkheads of the visor.

*"3. The hinges at the visor pivoting points on upper deck have also failed due to overload."*

Note: By this time the disastrous condition of the starboard hinge having been almost penetrated by fatigue cracks initiated by deep burning marks was known to Stenström and his colleagues by their visual inspection of the broken hinges at the visor in Hangö and by examining the recovered bushing with the part of the broken visor arm still attached. According to Prof. Hoffmeister the lcc of the starboard hinge was reduced to a mere 20% of its original and this did not yet take into account the consequences of the subsequent findings demonstrated with the passenger video received in April 1996 - see Subchapter 12.5 - and Enclosures 12.5.180/12.5.181.

*"8. When the visor left the ship it left behind it the ramp in fully open position, initially allowing large amounts of water to enter the car deck within a short period of time. This is believed to explain the reported rapid initial generation of starboard list."*

Note: If the ramp would have been fully open it would have broken off. See Subchapter 34.10. This is in particular valid if the vessel would have continued to proceed with 14-15 kn against the waves as alleged by the JAIC at all times including in their Final Report, see Subchapter 13.2, page 171, ff.

*"10. In total it is considered to be verified that inadequate structural strength in the visor locking mechanisms has been the under-laying condition for development of the accident. The sea loads on the visor generated by an irregular wave condition with occasional high waves in combination with the speed of the vessel is considered to have been the ultimate factor, triggering the structural failure in the particular instant."*

Note: Not a single of these hypothetical assumptions corresponds with proven facts and/or the law of physics known to the members of the JAIC.

After the meeting a press conference was held and the Press Release - attached as Enclosure 37.2.460 - was distributed. It reads in part:

*"2. The Commission agreed that most of the work was still in progress and needs further detailed substantiation before conclusions should be drawn and made public.*

*"3. The Commission confirmed, however, its opinion that the strength of the locking devices for the bow visor in combination with the sea loads on the visor in the prevailing wave condition and headway of the ship is the main cause of the accident."*

Note: It is apparent that the application of logic was also not one of the habits of the JAIC because 3 contradicts 2. It is stated in other words, that the locking devices of the visor were too weak to withstand forces normally encountered during heavy weather. That the vessel had traded in the area with similar weather conditions for no less than 14.5 years was simply disregarded by the JAIC. Why apply common sense?

No one took notice that in item 5 the JAIC stated that *"the diving investigation carried out on the wreck has revealed that the ramp was locked in closed position prior to the accident"*. At this time the JAIC positively knew from the videos that the complete port side of the ramp cannot have been locked prior to the accident. See Chapter 29.2.

16 December 1994

On the day before Sweden's Prime Minister explained before the House of Parliament the decision of his government not to raise the wreck of the ESTONIA for "ethical reasons".

By letter of 19 December 1994 to Meyer Werft - copy is attached as Enclosure 37.2.461 - Stenström did send a *"copy of the video recording from the divers investigation of the bow area of the Estonia. The length of the film is about 65 minutes and it contains all the substantial observations made during the 10 hours of diving for the accident investigation (the remaining time being divers search for the areas to be investigated etc.)"*.

Stenström did not mention that the film contains all the substantial observations made during the 10 hours of diving for the accident investigation which the JAIC wanted Meyer Werft (and the public) to know. The real substantial parts were cut out respectively are not contained in these 65 minutes. Stenström wrote further:

*"We have initiated an examination of the lugs for the bottom locking device with regard to any signs of old cracks in the fracture surfaces or defects in the welds. We expect the preliminary investigation in this respect will be completed during this week. We will inform you about the findings from this examination."*

The KTH, Stockholm confirmed that there were no old cracks in the fracture surfaces or defects in the welds, a statement which they had to withdraw when Prof. Hoffmeister presented his findings (see Chapter 30).

## CHAPTER 38

### THE YEAR 1995

The JAIC continued their endeavours to confirm their hypothetical casualty scenario and to improve the argumentation and evidence in favour of it. It was planned to publish a detailed technical Part-Report as soon as possible. Regular press statements in line with the above strengthened the public opinion in the Nordic countries that the main blame for the catastrophe rested with the builders, Meyer Werft in Papenburg.

This caused the Managing Director of the yard, Bernard Meyer, to instruct his lawyer, Dr. Peter Holtappels, to form an own team of experts to investigate the real causes for the sinking of the ESTONIA. See also PREFACE.

#### 38.1 The German 'Group of Experts'

Dr. Peter Holtappels, senior lawyer with the law firm Ahlers & Vogel, Hamburg, became the chairman of the new team and engaged Prof. Dr. Eike Lehmann from the Technical University, Hamburg, to perform the investigation from the Naval Architect's point of view and Captain Werner Hummel, Marine Consultant and Managing Director of Marine Claims Partner (Germany) GmbH, Hamburg was engaged to investigate the visor condition, the ESTONIA berths in Tallinn and Stockholm and collect all information relevant to the casualty. In addition, Captain Håkan Karlsson from Mariehamn/Åland Islands was engaged in his capacity as one of two masters having been in charge of the ESTONIA for about 12 years. Simultaneously Meyer Werft nominated a member of its Design and Construction Department, Naval Architect Dipl. Ing. Tomas Wilkendorf as co-ordinator of the internal yard investigation and link to the 'Group of Experts'. Already the first of three inspections of the visor in Hangö revealed:

- that the visor, although well painted from the outside, was in an extremely bad maintenance condition; - that the starboard visor hinge had been in a very poor condition already before the casualty with deep burning marks and fatigue crack propagations in way of the broken parts of the visor arm and elsewhere;
  - that numerous water marks inside the visor indicated that the visor had been water-filled at sea up to different levels obviously depending on the outside water height, i.e. that the visor had not been weather tight;
  - that the (lowest) 3rd stringer was covered with oil on which fresh footprints were visible indicating substantial activity inside the visor after the water had left the visor the last time before it was lifted ashore in Hangö, i.e. before the last arrival at respectively after the last departure from Tallinn.
- The areas in the aft bulkheads of the visor, where the lugs of the hydraulic side locks had been located, were already burnt out and taken to Stockholm. The starboard hooks of the manual side locks were crushed while the port ones were intact and just bent slightly together.

The big lug fitted to the after part of the heavily damaged visor bottom was in place but almost cracked off the visor. This lug was part of the Atlantic lock. For further details see [Chapter 30](#).

In brief, it was very obvious that this was not a normal and properly maintained visor, but a misaligned, leaking structure with poorly treated and thus considerably weakened hinges and manual locks, which apparently had not been engaged. The numerous footprints on the 3rd and to some extent on the 2nd stringer indicated quite some activities inside the closed visor which is unusual because the only installation inside the visor, the Atlantic lock, was normally operated remote controlled from the car deck.

Two days later at a fortuitous meeting with Uno Laur in his Tallinn office, he explained the following:

- the visor was leaking and at sea full to the outside water level;
- the hydraulic installation of the Atlantic lock was leaking as "did all hydraulic installations on older vessels", thus hydraulic oil was swimming on top of the water surface inside the visor when the vessel was at sea;
- the hydraulic oil caused the water marks inside the visor and, when the speed was lowered, the water left the visor through the gaps in the bottom and the oil settled down on the stringers, frames and on the bottom - see also Subchapters [12.4.4](#), and [12.5](#);
- as the Atlantic lock had suffered badly during the last ice winter (January to March 1994) when the crew had to hack to pieces the ice inside the frozen visor, it could no more be opened and closed by the hydraulic cylinder, but this had to be done manually by hammering;
- therefore each time before arrival at Tallinn two crew members went down and hammered the bolt open and after Tallinn they hammered the bolt closed - see Subchapter [12.5](#).

Note: At that time it was unknown to this 'Group of Experts' that the sensors had been dismantled because they were also damaged by the ice hacking and as long as crew members were going down to hammer open or closed the bolt of the Atlantic lock it was not required to renew the sensors, which were anyway hindering the hammering. This was at least the opinion of N&T as technical managers of the ferry. Had it been known, Uno Laur would certainly have been asked as well and he would probably have told the real background. Now it took some months longer before a Finnish engineer with a friend among the 2nd crew of the ESTONIA relayed the information that the sensors had been dismantled because they were damaged and were causing short circuits in the electrical system of the car deck and as each time when the Atlantic lock had to be opened or closed the crew members went down to do the job, the sensors were not needed. Before this background it is of course understandable that Stenström threw the already recovered bolt of the Atlantic lock back into the sea, because it clearly showed the hammering marks and also two different contact marks indicating that the bolt had sometimes been fully closed and sometimes only partly closed which has nevertheless been clearly established from the available video footage. It is also understandable that Stenström ordered the divers to burn off the sensor plate and to clip off the cut ends of the sensor cables and subsequently throw both to the bottom of the sea consisting of soft clay where they disappeared forever (see Subchapters [12.5](#), [27.1](#) and [29.2](#)).

In any event, it was now quite clear that the publications and statements by the JAIC were, if at all, only part of the truth and that the crew and possibly also owners/technical managers of the ferry had had difficulties with exactly these locking devices which - according to the JAIC - had triggered off the casualty sequence-of-events by their failure.

The new information was evaluated and discussed and by fax of 20 January Dr. Holtappels suggested a meeting with the JAIC to which Börje Stenström replied on 20 January among other things:

*"Appreciate the opportunity to get views from a group of experts from your side, the commission is certainly open for any constructive comments on the development of the accident. For your information the full commission will have a meeting in Helsinki on 26-27 January. We do not expect to have any press conference but questions from media are unavoidable. The official view of SHK was published in a news release via the Swedish press news agency a week ago, stating that the report of the commission was delayed because more time had been allowed to the yard to complete their investigations, metallurgical investigations were still going on in Stockholm and the commission had initiated a second look at the weather conditions and in particular any specific wave conditions at the site of the accident."*

On 26 and 27 January 1994 the JAIC met in Helsinki and from the protocol the following items are quoted:

#### *"4 Bow Visor*

*Börje Stenström presented a status report on the technical findings and technical evaluation of the probable sequence of events and cause of the accident. Several supporting investigations are still going on. Comments from the shipyard have not yet been received. The members and experts are working on the report concerning the bow visor. When the draft report is ready it will be sent to the commission members and experts. Tuomo Karppinen presented SSBA model experiments. Simulations will be continued.*

*5 The Estonian delegation presented material on the adequacy and qualifications of the crew of M/V "Estonia".*

*6 All the lifeboats and liferafts of M/V "Estonia" which have been found after the accident in Finland and Estonia have been photographed and examined by the technical group for the Finnish Central Criminal Police with the assistance of an expert from the Finnish Maritime Administration. A copy of the report (including a selection of pictures) of one liferaft examination was presented.*

At a subsequent press conference the present status was presented to the international media.

On 30 January the first meeting of the German 'Group of Experts' was held during which the forthcoming meeting with the JAIC scheduled for 16/17 February in Stockholm was prepared. A model of the foreship with moveable visor and bow ramp of VIKING SALLY built by the yard was presented.

#### February 1994

On 2 February Börje Stenström sent his revised "Assumed Sequence of Events" with illustrating drawings - see Enclosure 38.1.462 - which repeated his earlier expressed thoughts.

By fax of 7 February Stenström requested the following:

*"1. The bottom lock. You indicated that the assembly consisting of the locking plunger housing and the lugs should have been a shop assembly, properly welded. As far as I recall one of the engineers attending our last meeting at Papenburg (presumably a shop engineer) confirmed the weld was a normal installation weld. We have no detailed drawing of the bottom lock assembly except as shown in drawing number 49111-373. In case there is a shipyard drawing showing such an pre-fabricated assembly, including welding details, we would much appreciate a copy.*

*2. The side locks. We have no dimensional drawing of the side lock lugs except that shown in drawings 49111-372. If there is a more detailed drawing we would like a copy. We would also like, if available, a copy of the design calculations for the attachment to the visor and the associated weld joint.*

*3. Damage to rubber seals. As far as we understand, the heavy stem post on front of the visor rests against the fixed continuation on the stem/bulbous bow. This determines the vertical position of the visor in closed position and any change of the steel work at the rubber seals would not change the vertical position of the visor. In checking with inspectors who had been onboard shortly before the accident there had been no signs of changes to the rubber seal installation."*

By fax of 10 February this 'Group of Experts' submitted what should be discussed at the meeting:

#### • Atlantic Lock

According to information from Tallinn the bolt of the lock could not be opened/closed hydraulically since some time before the casualty. This was given to us as explanation for the oil spill inside the visor and the many footsteps on the 2nd and 3rd stringers. We were also told that ever since then the bolt was closed and opened manually.

We have spoken with a number of ex crew members about this, but everybody feels it difficult to believe that the bolt can be handled manually the proper way. We would like to discuss this with you and, if possible, read the relevant statements, e.g. from the witness who had reportedly seen the green lamps on at a time when the visor - at least - was making upward and downward movements.

#### • Bureau Veritas

We understand that you have inspected the complete class records at BV office in Paris. We would like to discuss the result with you.

#### • Bolt and eyes of Atlantic Lock

and other cut-off parts We would like to photograph these parts and discuss findings/ consequences with you.

#### • Further subjects to be discussed

#### 1. Speed

- 2. External damage to visor due to casualty
- 3. External damage to visor before casualty
- 4. Wave conditions south of Utö Island
- 5. Radio messages
- 6. Radar pictures
- 7. Casualty Scenario
- Future cooperation
  - 1. "Diana II" now "Mare Balticum"
  - 2. Sundry"

In the course of a telephone conversation on 15 February Börje Stenström informed about the following:

1. The participants from their side will be:

from Estonia: Captain Uno Laur  
Professor Metsaveer  
1 further expert

from Finland: Tuomo Karppinen - VTT, Helsinki  
Klaus Rahka - Metallurgist

from Sweden: Börje Stenström - Naval Architect  
Mikael Huss - Naval Architect

2. They are expecting a solely technical discussion and from the German side the answers to the questions raised by them already in November.

3. Video material: At first the Finns had sent down a ROV to the wreck which took better pictures than the divers did. The video sent to the yard does not contain ROV pictures which will, however, be made available, if requested. The film sent to the yard had been made by an English diving team having examined the wreck for 80-90 hours from a Norwegian semi-submersible (belonging to the Norwegian Smit-Tak subsidiary) by order of the Swedish Maritime Administration. The aim was to obtain material for a feasibility study in respect of the lifting possibilities. Subsequently the divers were available to the JAIC for another ca. 10 hours for examination of the foreship. Thereby Stenström has personally directed the divers via a monitor and had a close eye on them all the time. He excludes that the divers have dismounted the sensors of the Atlantic lock (therefore it is established that this must have occurred before the casualty).

4. Recovered objects: The divers have dismounted respectively burnt off the well known parts including the bolt of the Atlantic lock. When they were preparing the helicopter flight back some parts had to be left behind due to weight restrictions. As the bolt did not show any changes except for some notchings, it was left behind on the diving support vessel. He assumes that the bolt has been thrown overboard in the meantime (weight ca. 25 kg). The other parts will be shown to us tomorrow. We will receive name and contact of the owners of the diving support vessel and shall find out where the bolt actually is.

5. Surviving crew members: in total about 30, of whom only 4 were on watch, i.e. 1 engineer, 2 motormen, 1 decksmen (name: Silver Linde). He was sent twice from the bridge to the car deck to check whether the ramp was still tight. The last time was shortly before the catastrophe, the green lights were always on.

6. Atlantic lock: As it had been assumed already they had not spent much thought on it. The lugs are obviously broken and that is sufficient for them, they thought. They have not yet realised that:

- the sensors were obviously dismounted before the casualty;
- the actuator as well as the bolt were turned about 90° towards aft;
- the port hydraulic hose was torn off.

They have no explanation for the oil spill on the lowest stringer of the visor nor for the many footprints (also the technicians from N&T do not). On the other hand, it is not in doubt that the heavy weather securities were not engaged.

7. 2 Swedish inspectors have indeed inspected the vessel on the departure day together with 9 Estonian trainees, however, they cannot give relevant information.

Note: This means that Stenström began the "cooperation" with this 'Group of Experts' with two untrue statements, namely:

- (a) he alleged to have left the bolt onboard, although actually he had personally thrown it overboard; and
- (b) he stated that the two inspectors had no relevant information, although at that time he had known for more than 3 months that those inspectors had found such grave deficiencies on the ferry that they had tried to stop her from sailing - see [Chapter 15](#) and [Subchapter 36.1](#).

## 38.2 The February Meeting

The meeting took place in Stockholm on 16/17 February and was attended by the persons mentioned on the previous pages.

Stenström advised that it was not the aim of the JAIC to blame somebody for the casualty, but to establish the facts, i.e. the causes, and to issue recommendations for the future which should avoid a repetition. He emphasized that the Swedish part of the JAIC - Statens Havarie Kommission - is completely independent and comparable to the U.S. National Transportation Board, while the Finnish part, headed by its permanent chairman Kari Lethola, was attached to the Ministry of Justice and the Estonian part was formed exclusively for this investigation.

Stenström further informed that the next JAIC meeting was scheduled to take place in 4 weeks in Tallinn when the basis for the subsequent final report was to be decided in respect of

- causes
- sequence-of-events
- conclusions

which should be published at the end of March/beginning of April by means of a preliminary report. This report should be amended in the course of the year, however, not as regards the three above-mentioned items - causes, sequence-of-events, conclusions, which would remain unchanged and taken over in the final report to be published by the end of the year.

Note: This means not more and not less but that the JAIC had considered its investigation as to the causes, sequence-of-events and conclusions finalised, no matter what would come up in the course of the year. As a matter of fact, that is what the JAIC upheld until the Final Report was finally published in December 1997. This also means, however, that the JAIC had established its firm opinion on the causes, the sequence-of-events and the conclusions already before 17 October 1994, as on this day the causes, the sequence-of-events and the conclusions, though in slightly different wording, were submitted to the public for the first time. The reader is reminded that this was on the 19th day after the casualty and prior to the visor being lifted and brought ashore. The reader is left with his own conclusion on the merits of such investigation by Swedish authorities into an accident which has cost hundreds of fellow citizens their life.

The open questions concerning the locking devices of the visor were discussed in detail and in every thinkable direction, however, whenever maintenance matters were discussed uncertainty came up especially on the Estonian side.

Upon a respective question the Finnish and Swedish JAIC members explained that interrogation of the Estonian crew members as well as all questions concerning the vessel, the shipping company, the organisation and operation were exclusively dealt with by the Estonian JAIC member, Uno Laur, because the other two members were the Transport Minister and the Head of the Navigation Department of ESCO who could not - or only restrictively - participate in the daily work.

The results are obvious: Only that information was passed to the Swedish/Finnish JAIC which did not affect Estonian interests or which was already public. It was thus not surprising that the same Uno Laur who had explained to a member of this 'Group of Experts' only 4 weeks earlier - in the presence of one of his Finnish clients - why the footprints were in the oil on the stringer, now tried to convince the audience that the Atlantic lock had been operated hydraulically up to the end. It became obvious in the course of the two days that the JAIC had not even considered to investigate the condition of the vessel before her last departure and was content with their hypothetical cause consideration and casualty sequence-of-events which - "so sorry" - did put the blame almost entirely on the builders.

During the meeting, the personal talks with the Finnish participants and, in particular, with Börje Stenström were very open in response to the many questions concerning the circumstances of the casualty, the route, weather, crew and all the many relevant details of which this 'Group of Experts' knew practically nothing, but which were of crucial importance for the investigation. The Estonian participants in the discussions tried to do everything to avoid the creation of a bad impression of vessel and crew. When for example the subject "ice damage to vessel and visor" was raised because the visor had obviously at least two quite heavy old damages, Uno Laur said: "It was a very, very mild winter. What should have happened. Moreover the vessel had ice class 1A." Actually the Gulf of Finland and the Middle and Northern Baltic were covered by thick ice from the end of January to the beginning of April 1994 - see Subchapter 12.4.2 - and the ferry had frequently been used as an "ice breaker".

The hypothetical scenario of the JAIC had, however, serious weaknesses and some of them became very apparent at the meeting. These were mainly:

- (a) the condition of the locking devices as found;
- (b) the uncertainty whether the locking devices were still original;
- (c) the apparent fact that the maintenance and damage history of visor, bow ramp, its locking devices and hinges had not been examined at all before arriving at and going public with their scenario and the conclusions therefrom;
- (d) the apparent fact that visor seals were missing/damaged and the visor had been full of water to the outside level at sea with (then) unknown consequences.

Being so sure about their scenario the Finns for example agreed to the visor condition as explained under (d) above, while Stenström and the Estonians smelled trouble and were reluctant. In any event, Karppinen and Rahka fully agreed that the visor had always been full of water at sea, however later withdrew from this admission completely, when they realised what consequences water in the visor had in combination with a damaged bow ramp: water on the car deck.

At the JAIC meeting in March in Tallinn among other things also the protocol of the statement of the nautical student Rain Oolmets to the criminal police in Tallinn made already on 03.10.94, i.e. 6 months before, was handed over to the Swedes/Finns. The reason for the long delay in presenting this important statement to the JAIC is obvious: It dealt with up to 10-cm long cracks in the welding seams of the visor hinges observed by the student only some weeks before the casualty when he was the member of a working team. See Subchapter 12.5 and Enclosures 12.5.177 - 179. It was agreed that the man should identify the cracks at the hinge remains of the visor in Hangö and Enn Neidre took over the arrangements (apparently no one told him that the hinge remains had been cut off from the visor already in January and were now at the KTH in Stockholm). In any event the Swedish chairman, Olof Forssberg, wrote to the Estonian chairman, Andi Meister, on 20 March among other things:

*"We agreed in Tallinn to question two witnesses about the observation of cracks ....."*

Andi Meister replied on the following day, 27 March, among other things:

*"Referring to the Protocol of Interrogation which was discussed by the Commission on the last meeting ... Rudissaar, whom Oolmets claims he told about the matter, knows nothing about it or has only heard people talking about this matter. There is a Mr. Gunnar Kull, who should know more. Captain E. Neidre, member of the commission, shall arrange the trip to Helsinki for Oolmets and Kull. He will be in Helsinki with Oolmets and Kull in the morning of Friday 24th, and they will go to Hanko by car."*

The gentlemen met at the visor in Hangö, however the hinges were no more there. See Subchapter 12.5 and Enclosure 12.5.178. Rain Oolmets was obviously attending, however, Gunnar Kull never showed up and has not been mentioned again anywhere thereafter.

### 38.3 Investigation and Communication

In the course of the following days tank conditions and cargo distribution - then known by the JAIC, but later proven to be incomplete - the Finnish videos made by ROVs in the early days, and some stability calculations and other documents were received.

In a subsequent letter Börje Stenström wrote to Dr. Holtappels, the chairman of this 'Group of Experts' among other things:

*"I had the opportunity to see part of your instructions to the team members and noted with appreciation that they are instructed to work unbiased. I also feel that we were able to do so during our meeting. I do disagree, however, with your little indication that the international commission should not be unbiased. I would like you to rest assured that the commission has only three goals, to establish what happened, why it happened and how it can be prevented from happening again. I am speaking for the Swedish part of the commission in this matter since we have a firm policy in this regard established by law. I take it that our policy will also be valid for the entire commission as we do, in reality, have the lead."*

Note: The "little indication" that the JAIC might not be entirely unbiased refers, of course, to the Estonian JAIC members Andi Meister and Enn Neidre. The apparent fact that the Swedes had the "lead", although the Estonians had been awarded the chairmanship, reflects the factual situation.

The communication and exchange of documentation and information with JAIC, in particular with Stenström, went on and by fax of 28 March among other things the so-called "Explanatory Note" was received - see Enclosure 12.5.172 - which was apparently meant to be the Estonian answer to the allegation of this 'Group of Experts' that the sensors of the Atlantic lock had been dismounted some time before the casualty. The note, however, merely states that the sensors on the ESTONIA were magnetic and not mechanical - as stated on the drawings - and that during the time under Estonian flag the sensors had not been changed, moreover that it was believed that these sensors had been installed at newbuilding already because there were numerous others of this type on other installations. In other words: the drawings of the yard were wrong. This was not the case as was subsequently established when previous Finnish electricians declared when and why they had changed the initial mechanical sensors against the magnetic ones. See Subchapter 3.3.6, pages 42/43 of the Final JAIC Report.

By fax of 29 March Stenström sent among other things the Cargo Manifest by which he considered "*the truck loads to be properly documented and the truck loads to look quite harmless*". It is revealed from the fax prints on top of the pages that it had been sent on 27 September 1994 at 18.38 hours from Estline-Tallinn and that Stenström had received it on 29.11.94 from N&T. See also Enclosure 17.1.211 and Subchapter 17.1. The manifest contains 39 trucks of which the last one was added in handwriting although there were actually 40 onboard according to the Customs List - see Enclosure 17.1.213. This list had been in the hands of the Finnish police since 14.10.94 already, however it is unknown when it was sent to Sweden.

In any event, Stenström must have had in the early days some other manifest or list or information because by fax of 30.11.94 he informed SSPA (Ship Model Testing Facility) that there had been 34 trucks/trailers onboard only - see Enclosure 38.3.462 and this went into the weight calculations for the first model tests in the tank to establish the wave load on the visor/and the locking devices.

In this connection attention has also to be drawn to a further mistake made in this above-mentioned fax about weight distribution because Stenström wrote: "*tanks 13 + 14 (starboard and port heelings tanks) 183 ts*". He means though - according to his own statement during his first visit to Papenburg on 27 October 1994 - that the port heelings tank - no. 14 - had been completely filled with 183 ts., while the starboard tank had been left empty - see also Subchapters 17.1 and 29.5. In a stability and trim calculation received earlier, performed by Ship Consulting Oy, Turku on behalf of the Finnish JAIC and dated 01.12.94 - see Enclosure 38.3 - both heelings tanks are stated to have been filled completely with 185 ts each plus 34 trailers.

By fax of 10 March Börje Stenström had already distributed his "Draft Technical Report", the forerunner to the Part-Report, among other things also to Dr. Holtappels. Already on the following day the conclusions - pointing, of course, to Papenburg - could be read in "DAGENS NYHETER" and the Berlin paper "TAZ". It revealed subsequently that the Sea Safety Director of Sjöfarts-verket, Bengt-Erik Stenmark, had given a copy to DAGENS NYHETER and the Estonian JAIC member Uno Laur had sold a copy to TAZ.

On the same day Jutta Rabe from SPIEGEL TV interviewed Börje Stenström in his Stockholm office and after respective questions Stenström admitted to have personally thrown overboard the bolt of the Atlantic lock - see also the Subchapter 37.2.

In the course of the further interview he was asked whether they had examined the visor and the wreck for ice damage and his reply was: "*We had no indications for ice damage: it was a rather mild winter (he had been shown the ice charts only 3 weeks before) and there were no indications for such damage. At least, as far as we know*", and further: "*Anyway, I believe that possible ice damage has not been examined, however, I am not quite sure. A good question you are raising. We should possibly check that.*"

In this context it has to be mentioned that a member of this 'Group of Experts' attended the hearings of several crew survivors as technical consultant of a German TV team and this was the first time that direct questions could be asked to key witnesses. One of the results was the drawing made by the survivor Henrik Sillaste about his observations on the monitor in the engine control room after the big heel. The drawing - see Enclosure 21.2.4 - shows the bow ramp in slightly open condition with water pressing through the gaps at both sides under pressure, however, more at starboard side. The drawing, confirmed by the other two survivors from the engine control room, Margus Treu and Hannes Kadak - see Subchapters 21.2.3 and 21.2.5 - proved that the bow ramp had still been closed or almost closed after the big heel, while according to the casualty scenario of the JAIC, the big heel was caused by huge water quantities having entered the car deck after the bow ramp had been pulled completely open by the forward tumbling visor. This was evidently wrong because the bow ramp was still been in the almost closed position when Sillaste and Kadak left the engine control room at a list of 30°/40°. From the very beginning of their testimonies Treu, Sillaste and Kadak have testified this water penetration at both sides of the bow ramp after the big heel. This was also reported in SVENSKA DAGBLADET and DAGENS NYHETER during the early days, however, unfortunately was ignored by the JAIC.

Back to the "Draft Technical Report" of the JAIC which was analysed in detail by this 'Group of Experts'. After considerable discussions it was agreed not to comment on this draft report since it was out anyway and, in particular, since the JAIC was under no circumstances prepared to change its substance in preparation of the Part Report due to be published in early April. Instead Dr. Holtappels gave an interview to Lloyd's List which was published in the 17 March issue and reads as:

*"German Yard inquiry finds lock system was altered MEYER WERFT HITS BACK ON 'ESTONIA' An investigation into the loss of the Baltic ferry 'Estonia' by the German yard which built her is set to counter Swedish press claims that a weak lock was responsible for the disaster. Meyer Werft, which is due to publish its first findings early next week, will claim that safety indicators had been tampered with and that the 'Estonia' was operating on a route where she would not have been. Lawyer and former shipowner Peter Holtappels, who heads the commission, said the findings would shed a very*

*different light" on the tragic accident than the impression given by parts of the report of the international commission published by the Swedish media. The preliminary German report claims that the safety indicators on the bridge showing whether the bow visor was locked had been tampered with to display permanent "green". It also alleges that the sensors on the major device, the Atlantic lock, had been removed. Dr. Holtappels declined to comment further on the claims but insisted that "the ship set sail from Tallinn in an unseaworthy condition"*

On 6 April the representatives of the relatives were informed in Stockholm by the Swedish JAIC about the contents and conclusions of the Part-Report, i.e. that the sequence-of-events which led to the capsizing and sinking of the ESTONIA had been initiated by the failure of the locking devices of the visor, in particular the Atlantic lock. Allegedly the locking system had been 50 per cent under-dimensioned.

Any questions concerning speed, behaviour of the crew, organisation of owners/managers were not answered with reference to the Final Report to be published by the end of the year. On the following day the Part-Report was introduced simultaneously in press conferences by the JAIC parts in Tallinn, Helsinki and Stockholm and copies were distributed to the media. In the introduction letter to the Part-Report Stenström states among other things:

*"The full report, covering also operational aspects and other outstanding matters is expected to be published in the autumn of this year. The Commission is fully aware of the disadvantages of publishing a part report that deals with only one segment of the circumstances contributing to the accident. It has, however, been assumed to be of value to make the present findings available at an early stage to all sectors of the maritime world, working with various aspects of the safety of passengers ships."*

The conclusions of the "Part-Report Concerning Technical Issues on the Capsizing on 28 September 1994 in the Baltic Sea of the Ro-Ro Passenger Vessel M.V. Estonia" reads as follows:

- *"The bow visor locking devices failed due to loads generated by the hydrodynamic forces on the bow visor at the prevailing speed, heading and wave conditions.*
- *The visor locking devices were constructed with less strength than required according to calculations. It is believed that this discrepancy developed due to lack of sufficiently detailed manufacturing and installation instructions for certain parts of the devices.*
- *Following failure of the locking devices the visor pounded heavily on the stem structure before it separated from the hull. This pounding was clearly noticed by crew members and passengers.*
- *The failure of the bow visor caused the ramp to be forced open due to mechanical interference between the visor and the ramp, inherent in the design. This design arrangement had crucial consequences for the development of the accident."*

The previous hypothesis had become "conclusion" now and the JAIC made it quite clear in the Preface to the "Part-Report" that it was not their intention ever to change these "conclusions" when they stated:

*"The Commission has previously concluded that the accident was initiated by the locking devices for the bow visor being unable to withstand the loads imposed during the prevailing speed, heading and sea conditions. This conclusion is still valid. This part-report covers main technical findings and conclusions. The final report to be issued later will cover also all other factors and circumstances found to have contributed to the development of the accident. This will include inter alia operational practices, certification and inspections, stability information, weather conditions and training. Rescue operations and resources will be covered as well."*

In other words, whatever the investigation ahead, for example of "operational practices" and "inspections", might reveal *"it is anticipated that all facts and conclusions reported herein (the visor locking devices were calculated with less strength than required according to calculations) remain unchanged in substance"*. "Operational practices" for example includes the forcing of ice barriers several meters high at sea with full speed and the respective effect on the locking devices, the hinges and the visor structure in general, just to mention one example. For more examples see Subchapters 12.4 and 12.5.

And Stenström continued with considerable energy to distribute his "present findings" - the term in itself implies that the findings are not final - to the maritime world by giving papers, for example at the IMO meeting on 31.10.94 and at the Marine Safety Seminar of the Cologne Re in Rotterdam - in 1995 - when he submitted his "present" findings as firmly established facts. He said in Rotterdam under the heading:

#### *"MS Estonia*

##### *1. Aspects of Human Shortcomings*

*Sorting out the various contributory factors, it is obvious that the structural strength of the bow visor, the sea conditions and the speed of the vessel all contributed, and any one of these factors could be seen as triggering the catastrophe or could have prevented it. In the prevailing sea conditions two basic factors remain: The design of the locking device of the bow visor was too weak, and the speed of the vessel was too high under the prevailing conditions. The systems' inadequacies may be divided into three groups: Technical inadequacies, regulatory inadequacies and operational inadequacies.*

##### *2. Technical inadequacies*

*On the technical side, the classification rules valid at the time, and in particular those according to which the ship was built, were not very detailed and did not contain sufficient guidance for the design of the visor attachment devices. The shipyard designer did the best he could with the advice available and the result of his work would have been reasonably acceptable, albeit at the lower end of the scale. The manufacturing side of the shipyard, however, acted on quite different and unqualified information and built locking arrangements for the visor which had less than half the strength of the outcome of the calculation work. The visor attachment arrangements therefore had a total strength to failure of about one third to one half of what it should have had based on the knowledge of the sea loads at the time. The locking devices then failed under conditions equivalent to the assumed design load conditions. Such loads existed as extreme values under the prevailing speed and sea conditions. If the shipyard had had a quality assurance system similar to the current requirements under ISO 9000 there would have been routine procedures ensuring that the manufacturing was carried out on the basis of correct information."*

Regardless of all this the exchange of information, the communication between this 'Group of Experts' and the JAIC, especially Stenström, continued and was even deepened during the coming months after Prof. Dr. Hoffmeister had become a consultant to this 'Group of Experts' in metallurgical matters.

The main reason for the engagement of Prof. Dr. Hoffmeister of the University of the Armed Forces in Hamburg was the obvious attitude of the JAIC to state that the fractures of the locking devices and hinges had been caused in the overload mode while even the layman could see fatigue cracks at different vital places. Another reason was that the visor had to be examined in detail by a qualified metallurgist. In the course of the following weeks Prof. Hoffmeister closely inspected the visor and the parts already cut off and recovered from the wreck. After some time a relatively close co-operation developed with Prof. Kjell Pettersson from KTH, Stockholm, who had performed the metallurgical examination on behalf of the JAIC. The results of the investigations by Prof. Hoffmeister were laid down in draft reports nos. 1 to 4. Draft report no. 4 is still valid, because Prof. Hoffmeister is still expecting parts from the wreck for examination which would enable him to make final conclusions.

Note: The owners have repeatedly refused to let Prof. Hoffmeister have the parts in their possession for his examination. Simultaneously the exchange of views and information with Börje Stenström continued more or less uninterrupted. On 21 April there was a further meeting between Stenström and a member of this 'Group of Experts' when a complete set of photos made of the visor and the foundations of both visor actuators were handed over to Stenström with interpretation. Stenström's attention was drawn to the accumulation of oil in the forepart of the 3rd stringer indicating that either the vessel must have had a forward trim more or less all the time and/or the visor had been misaligned in relation to the vessel possibly due to a pressed in stempost. Furthermore Stenström's attention was drawn to the fact that the port visor actuator was no more connected to the B-deck at the time of the casualty. He was only mildly interested, but told the story of the Landvetter meeting instead:

*"All the main witnesses were questioned again - especially watch A.B. Silver Linde - however, in the presence of Enn Neidre, the superior of all ESCO sailors, which was regrettable but unavoidable because Neidre insisted and he was a JAIC member. The main aim of this meeting had been to find out what had happened on the bridge, why they had been so passive. According to Silver Linde the 2nd and 3rd officers had left the bridge after 01.00-01.05 hours, thus at that time they considered everything to be normal and routine. About 5 or 10 minutes later the vessel suddenly took a starboard list of about 20° and started a sharp port turn which increased the starboard heel. It seemed possible that the 2nd and 4th mates, then on the bridge, were knocked off their feet and became unconscious. Then probably the (other) 2nd mate and the 3rd mate returned to the bridge, transmitted "Mayday" and "Mr. Skylight" to No. 1 & 2" and asked the engine room whether it was possible to pump over water to the high side. Survivors have confirmed that the lee side was the high side. A port turn has also been confirmed by the position of lost objects found on the sea bottom. Silver Linde had stated that when he was ordered to check the ramp to take the boatswain with him. The passenger who heard the hydraulic sound was midships on 4th deck - they believe he heard the stabilisers. There are no indications that they used the hydraulic actuators to hold down the visor."*

So much for the Landvetter meeting. See also Subchapters 21.2.2, 21.2.3, 21.2.5.

Furthermore, the Part-Report was discussed and Stenström's attention was drawn to the many mistakes, e.g. the *"disappeared stempost"* and the impossibility that the control lights were all green if the port lower bolt of the bow ramp had not engaged the pocket, etc. Finally Stenström was asked, why did they state in the Part-Report that *"in all probability the sequence of events and cause consideration will not be changed"* because evidently they had not even covered 10% of the required investigation extent. After some thinking, Stenström said: *"These are our instructions and please don't ask us any more questions in this respect. We had to draft our report to the effect that the blame is more or less entirely resting with Meyer Werft, however, in the Final Report we shall draft it so vaguely that there will be not enough evidence to commence legal action against the yard, in other words, after our Final Report has come out, nobody can be blamed and the case will be closed shortly afterwards".*

In the course of the following weeks and the ongoing exchange of views and information Stenström admitted that his Part-Report was wrong in some respects, however, when it came to water in the visor, which evidently had been there, he was not prepared to give in. After this 'Group of Experts' had written, on 16 June:

*"As to water in the visor which was flowing out once the vessel had reduced speed and the bow-wave became smaller we do not mean the crewmen of the pilot boat, but some Stockholm pilots who have observed the above, and they are not talking about just 150 litres. On the other hand the fact that at sea the inside of the visor was filled up to outside level with water due to poor or missing rubberseals was admitted by Ulf Hobro at our discussion in your presence mid February."*

Stenström replied already on 22 June:

*"I think there is nobody claiming that the space inside the visor was dry. It is not even required to be watertight by their rules. In a seaway water will be pushed in through any leaking seals at a higher rate than it would flow out when the bow rises out of the water and some water may have been there in bad weather. Please consider, how-ever, that the ramp seals were probably not 100 per cent watertight either, in particular not at the lower edge due to some play in the hinges and the fact that one locking wedge had not found its way fully into its female part. Any steady level of water inside the visor should therefore undoubtedly leak past the ramp into the car deck area. The area was inspected regularly, even shortly before the accident, and there was no water in the ramp area. Have therefore difficulties in believing in the existence of any large amount of water in the visor that could have influenced the dynamics of the visor in a seaway."*

Of course Stenström could under no circumstances accept large quantities of water inside the visor because at that time he knew already of the partly open bow ramp at the port lower corner which meant water on the car deck which evidently had been the case already in 1993 - see Chapter 12.4.4, especially the statement of pilot Bo Söderman - Enclosure 12.4.4.161.

Also another principle matter was seen differently by Stenström and this 'Group of Experts', viz. the non-recorded respectively non-documented repairs.

#### *"4. Visor Structure"*

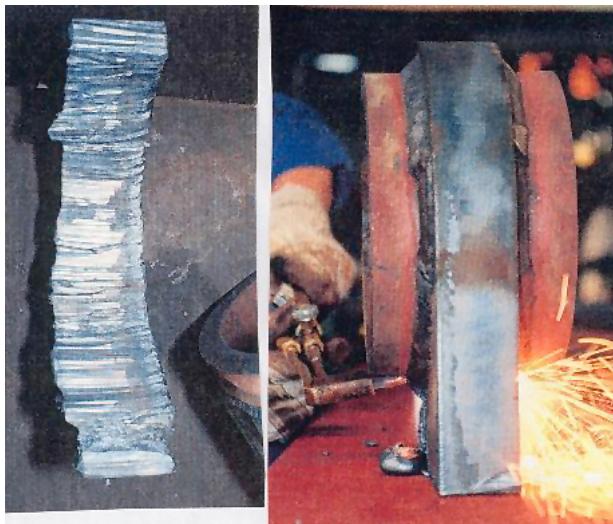
*You might have good control about the documented repairs ,but what abut the ones not documented? Who has and when carried out the highly insufficient repairs to lower lugs at B-Deck of the port actuator (hydraulic cylinder), just to mention one example? These repairs as well as changing of bushings of the visor hinges e.g. are subject to class inspection and repair approval, which, as you know, has not been the case."*

Stenström replied:

*"It is quite possible, and normal onboard any ship, that small defects are repaired onboard, e.g. the crack in the stiffener underneath the port side platform for the lifting actuator. Replacing a hinge bushing is a different things, that would be a considerable undertaking even at a shipyard and can certainly not be undertaken whilst in service. There are no indications in all the records we have examined of such a repair, superintendents and other people who have followed the ship also deny that any such work should have been carried out. Why should it have been done secretly if there had been a need??? In case there had been a need to remove the bushing, burning off the old weld would undoubtedly have resulted in burning marks in tangential direction on the plating around the weld. There are no such marks. The cutting marks in the holes are perfectly perpendicular to the plate and cannot be generated by burning on an existing completed installation. Had there been a need for repair due to play, the old bronze bushing would undoubtedly have been removed by local machining. This is shipyard standard practice for relining any worn shaft bushing from propeller shaft bearings down to small diameters. As all four visor arm side plates have identical appearance, would you suggest that all four bushings were replaced by the crew in secrecy? The hinge bushing was inspected by Professor Hoffmeister last week and we had a few more sections cut and examined according to his desire. I hope he got the information he was looking for, and will appreciate a copy of his report. The extra work has been done on behalf of the SHK as it is in our interest as well to find maximum amount of facts."*

Stenström made it quite clear that the JAIC was of the definite opinion that the deep burning marks were caused by the yard already at newbuilding and did not hesitate to tell that also to the media. He was, however, wrong in almost all respects, because:

- at the starboard hinges were indications of tangential burning marks although covered by the welding seams;
- the perpendicular burning marks can very well be generated by burning on an existing completed installation as it was proved by a respective test carried out by Meyer Werft in summer 1995 - see the photo below and see also Chapter 30 - S3/P3.



- all four arms do not have identical appearances as it is evident from the two photos below, the left one shows the port outer visor arm and the right one the starboard inner visor arm.



Evidently the starboard visor arm plate looks identical to the test burnt installation part - see the photo above - and the port one is smooth without burning marks at all. A detailed inspection even revealed indications of circumferential drilling marks as initially the holes were drilled at newbuilding - see [Subchapter 2.4.6](#). Therefore this 'Group of Experts' has always taken and still does take the view that the port bushings were still original while the starboard ones were very unprofessionally replaced. How gross negligently this replacement was carried out became fully clear when a passenger video was made available to this 'Group of Experts' in 1996 - see Subchapter 39.2.

#### 38.4 The August Meeting

The investigations went on and after some time it was felt that another meeting with the JAIC should be held, preferably in Hamburg, however due to the health problems of Börje Stenström it was agreed to have it in Stockholm when among other things also Prof. Hoffmeister would present his findings. The date was set for the 3 August and the following persons attended:

for Sweden:	Börje Stenström - member
	Mikael Huss - expert (KTH)
for Finland:	Kari Lethola - member
	Klaus Rahka - expert (VTT)
for Estonia:	Tuomo Karppinen - member (VTT)
	Enn Neidre - member (ESCO)
	Prof. Jaan Metsaveer - expert
	Dr. August Ingerma - expert
	Heimo Jaakula - expert (E.N.M.B.)
for German 'Group of Experts':	Dr. P. Holtappels
	Prof. R. Herber
	Prof. Dr. Hoffmeister
	Dipl. Ing. Tomas Wilkendorf Captain Werner Hummel

This 'Group of Experts' presented their findings and the sequence-of-events supported by the metallurgical evaluations of Prof. Hoffmeister, all of which was discussed at the end.

- The JAIC admitted that the visor was already substantially damaged when the vessel departed from Tallinn.
- The JAIC admitted that the visor hinges were considerably weakened by fatigue.
- The JAIC admitted that the existing poor condition of the hinges and locking devices does not necessarily result from bad performance of the new-building yard if no repair work was found to be documented or otherwise recorded.
- It was agreed that Prof. Hoffmeister should make further detailed examinations of the hinges and Atlantic lock parts in close cooperation with KTH Stockholm and VTT Helsinki.

Finally, Dr. Holtappels indicated that the JAIC had to be considered biased due to the presence of the head of the Navigation Department of ESCO in the Commission, because ESCO having been 50% owner and crew manager of the ESTONIA was one of the subjects of the ongoing investigation. This was received by the audience in silence.

In summary it could be concluded that the JAIC got the message that their scenario was not necessarily the only one and that other circumstances had played a dominant role in the sinking of the ESTONIA and, further, that this 'Group of Experts' was not prepared to accept that the "scenario and main findings" of the Part-Report would remain "unchanged in substance". In those days this 'Group of Experts' still believed that the JAIC - being a governmental institution - wanted to find out the truth, maybe apart from the Estonians, however, the first shadows of doubt arose in particular created by the behaviour of Börje Stenström.

#### 38.5 Further Investigations and Meetings

At the beginning of September 6 Finnish statements of the key witnesses of the crew and the statement taken in Hangö from the nautical student Rain Oolmets were received from the Finnish JAIC. Almost one year after the casualty had passed before the first statements could be studied and evaluated by this 'Group of Experts'. In the meantime Stenström continued to give interviews in support of the JAIC scenario and cause consideration and, in particular, drew the attention of the media to the poor condition of part of the visor hinges and the locking devices for which, in his view, the building yard was to be blamed with the naïve argument that the JAIC was unable to find anybody who would admit to have done repairs as sloppy as described during the lifetime of the vessel, or that they could not find any recording on them.

Nevertheless the communication between Stenström and this 'Group of Experts' was continued.

At a further meeting in Stockholm on 2 October Stenström reported that the next JAIC meeting would be on 17/18 October in Tallinn. At the subsequent meeting in Stockholm on 5 December, the technical part written by him - see the Part-Report - would be finally agreed upon. The JAIC's scenario and cause considerations would not be changed. Nevertheless, he agreed to have a look at the facts considered by this 'Group of Experts' not to be in dispute and, further, to another meeting to be held in Stockholm during the first week in November. Stenström also reported that the tank tests with a model of the ESTONIA had shown that at a speed of 10 kn the same loads on the visor occurred as at a speed of 14.5 kn, however not as often.

Stenström furthermore admitted that up to 30 ts. water could have been in the visor.

Note: This was not surprising because this is the quantity indicated by the highest water mark visible inside the visor.

This means that the lower part of the bow ramp including the hinges had been under water. Stenström further stated that the heavy damage to the port outer ramp hinge - as visible on the videos - had existed already since some time before the casualty. As a result - in his opinion - the bow ramp could not be closed properly at

the port lower edge, thus was open to the visor up to about 20 mm. This - so he said - was also the reason why the port lower securing bolt of the ramp was unable to engage its mating pocket at the ramp side. He then stated that the Estonian crew had put this severe damage repeatedly on the repair list since some time already, however without N&T doing anything. He said that he had copies of these repair lists. Stenström argued further that because the bow ramp had been partly open for some time already, there must have always been water on the car deck if the theory of the German 'Group of Experts' would be correct. However, as there had obviously not always been water on the car deck the visor could not have been filled to the outside water level. Unfortunately the observations of previous passengers and, in particular, the statement of Pilot Bo Söderman - see [Enclosure 12.4.4.161](#) and [Subchapter 12.4.4](#) - were at that time not yet known to this 'Group of Experts'. They prove beyond reasonable doubt that there had indeed been water on the car deck already in 1993 and the worse the weather got the more water had been on the car deck.

In any event, Stenström had stated that the bow ramp could no more be properly closed for some time before the casualty, that the crew had demanded repairs which were rejected by N&T. It follows already from this fact that the ferry had been initially unseaworthy with the knowledge of the technical managers and owners since some time before the casualty already. No mention of this serious deficiency is made in the Final Report with the exception of the following remark on page 42 - [Subchapter 3.3.6](#) - "It was known that the play in the ramp hinges was approaching the point where corrective action would be needed".

By letter of 27 October the "the undisputed facts" were submitted by this 'Group of Experts' to the JAIC and a copy of the letter is attached as Enclosure 38.5.

Note: The letter was registered on 2 November 1995 under B125 in the logbook of the Swedish JAIC and was declared classified until 9 March 1998.

This 'Group of Experts' expressed once again its regret that it was not possible for the JAIC to travel to Hamburg and/or Papenburg:

*"Once again we have to express our regret that is has not been possible for you to visit us here in Hamburg and/or in Papenburg. Many things would have been much easier to transfer to you respectively prove to you, if you would have spoken to the individuals personally and asked your own questions, be that now the von Tell representative Todsen, the BV surveyor Lohmann or the welders, locksmiths, foreman, etc. of Meyer Werft having been engaged respectively responsible, e.g. for the welding of bushings into the lugs of the Atlantic lugs or the lugs to A-deck or the steel bushings into the bores of the visor arms etc., all of whom have been identified. Anyway this can still be arranged if you should wish so."*

As there was no response, it was decided to take one of the welders to Stockholm to the next meeting. This was welder Koenen who had welded, among other things, the locking devices in the forepeak area of ESTONIA during its construction.

The next meeting with the JAIC took place in Stockholm on 9/10 November and before the meeting this 'Group of Experts', together with the Meyer Werft welder Koenen, had about two hours time to look - undisturbed and in detail - at the recovered objects stored in the basement of the KTH. The comments of welder Koenen after this close inspection of the Atlantic lock lugs can be summarised as follows:

"(a) Starboard lug with bracket (Nr. 3)

- the welding seams at the outer side were made from the upper side to the lower side, when the lug was in erected condition, i.e. welded to A-Deck, by means of a very thin electrode;
- although if the lug was erected the welding seam should have commenced at the lower side and then gone upwards, which it did not;
- when the initial welding seam between the lug and the bushing was laid in the workshop the lug was lying flat which creates a totally different welding structure from the one visible at the lug remains; - the bracket is not original for many reasons,

- o i.e. it is longer than the bushing was because both welding seams end already ca. 15 mm before the end of the bracket;

- o the end is cut very roughly - as would never have been done by the yard

- o the welding seams were not made by the yard for the above-mentioned reasons. They are laid very unprofessionally and the ends of both welds are not connected at the top of the bracket, i.e. seawater could and obviously had penetrated the welds and seeped underneath the bushing with corrosion following therefrom."

This means that the Atlantic lock found was not the original and this was presented in detail to the JAIC at the meeting commencing at 11.00 hours with welder Koenen also in attendance.

The JAIC was represented by the following persons:

Börje Stenström : for Sweden

Mikael Huss :

Tuomo Karppinen : for Finland

Klaus Rahka :

Prof. Jaan Metsaveer : for Estonia

To begin with the findings and conclusion of the inspection of the Atlantic lock lugs were submitted in detail and in summary. It was concluded that the lugs of the Atlantic lock welded to the forepeak deck were no more original. Due to the red paint below the blue it had to be assumed, however, that the lugs had been exchanged already when the vessel was still "VIKING SALLY" which was noted by the JAIC in silence and without further comments.

Subsequently the participants of the JAIC were invited to ask questions to welder Koenen about the yard practice, welding standards or whatever else, but in particular about their view expressed as in the Part-Report conclusions, namely:

*"- The visor locking devices were constructed with less strength than required according to calculations. It is believed that this discrepancy developed due to lack of sufficiently detailed manufacturing and installation instructions for certain parts of the devices."* Not a single question was, however, put to welder Koenen who left with the impression that none of the experts of the JAIC was the least interested in his testimony. His impression was correct, because the JAIC reiterated in their Final Report what they had assumed to be the facts already in November 1994.

*"The attachments were constructed with less strength than the simplistic calculations required. It is believed that this discrepancy was due to lack of sufficiently detailed manufacturing and installation instructions for certain parts of the devices."*

The meeting went on and as this was the last meeting in Sweden and also the last one with Börje Stenström attending, the subjects of discussions shall be outlined in some detail:

JAIC: The vessel was assigned the highest B.V. class symbol, it could consequently operate in worldwide trade.

German 'Group of Experts': This is true, however, the trading area of a passenger vessel is defined in the PSSC, which is issued only after the class certificate has been submitted to F.B.N. The PSSC restricted the trade of the vessel to "kustfart mellan Finland och Sverige", i.e. coastal trade between Finland and Sweden.

JAIC: This restriction referred to the radio operator only. In case AB Sally would have put a radio operator onboard the ferry could have traded "Short international voyages", i.e. 600 nm between 2 ports and no more than 200 nm from the next port, i.e. the ferry could have sailed between Helsinki and Gothenburg.

German 'Group of Experts': It had been agreed in the building contract that the vessel had to be built for an "intended trade", i.e. for the Viking Line service Turku-Mariehamn-Stockholm.

JAIC: This referred only to the "partial collision door" while the contract is otherwise open.

German 'Group of Experts': The well known fact that the "partial collision door" was not installed is indeed proof that the vessel was built for a particular trade, for which according to the opinion of the responsible maritime administration - F.B.N. - such a "partial collision door" at the location required by SOLAS was not necessary.

JAIC: It was also in 1979/80 a well known fact that the Finnish and Swedish owners sold their ferries after 8-10 years in service to owners operating in entirely different areas of the world. Thus it would only be logical to build the ferries for worldwide trade.

German 'Group of Experts': This is the shipowners' concern. The yard builds the vessel according to the contractual agreements, class rules and requirements of the maritime administration.

Subsequently the development of the ferries built for AB Slite and AB Sally from 1969 to 1980 beginning with "APOLLO" and "DIANA" and ending with "VIKING SALLY" was explained, the discussion between Sjöfartsverket/Wahnes on basis of his logbook concerning "bow ramp = collision bulkhead" for "DIANA II" the attitude of the F.B.N. as to "VIKING SALLY", etc. were outlined. Further the "Copenhagen Convention" was handed over as well as this 'Group of Experts' report about "The description of the process of conversion from design to production of the locking devices" which can be found as part of Subchapter 2.4.6. This 'Group of Experts' explained also the background of the "partial collision door" clause in the "VIKING SALLY" specification ("EARL OF GRANVILLE" conversion) and the initial offer of the yard to install this partial collision door for DM 45.000,- which was rejected by the owners. It would, however, have been possible at any time to have these doors installed for less than DM 100.000,- in case the trading area would be changed to outside of "sheltered waters" as it occurred when the ferry's route was changed to Tallinn-Stockholm.

JAIC: Probably a yard has to argue differently than a Government commission, who will definitely and sharply draw attention to the faulty practice followed by the maritime administrations of the Nordic countries for decades by accepting the bow ramp as upper extension of the collision bulkhead on car/passenger ferries. The JAIC is of the considered opinion that according to SOLAS the maritime administrations may not grant exemptions in this respect, even not if the ferry trades regularly within 20 nm from the nearest land. Stenström said that it is a fact that in the Baltic about 70 ferries have been trading on which the bow ramp was the collision bulkhead. Of these 70 ferries 35 had the interlock between ramp and visor. The first vessel with such a construction was built in Finland. Meyer Werft is not responsible for it, Stenström said. It is considered a fact that the way "VIKING SALLY"s visor/bow ramp were built corresponded in those years absolutely to the state of the art and technique.

On 30 November Klaus Rahka from the Finnish JAIC phoned a member of this 'Group of Experts' and reported the following:

- They had carried out a break test with the mock-up of a side lock. It broke at 134 ts. load.

- They further carried out a bending test with the mock-up of the visor lug being part of the Atlantic lock. The load required to cause a deformation as found was found to be 200 ts., i.e. the Atlantik lock had held at least 200 ts according to Klaus Rahka.
- Börje Stenström was present during the tests and his comment at the end was: "We are not changing the report. Why should we be that friendly to the yard?"

This attitude was also reflected in the next telephone conversation on 12 December when Börje Stenström stated the following:

- The publication of the Final Report had been postponed.
- They had a full commission meeting last Monday/Tuesday (04./05.12) with Andi Meister, Enn Neidre, Uno Laur and two professors attending from Estonia.
- Purpose of the meeting was to establish what else had to be done.
- As far as the technical side was concerned (his job) they believed that the factual side was well covered by the Part-Report already, which would not be changed very much, although some analysis will still be carried out.
- On the operational side they would have a long distance to go because the Estonians practically had not delivered anything, although Andi Meister - being no more a Minister - was said to be writing every day. Enn Neidre and Uno Laur have neither commented in writing nor verbally, they are absolutely passive. T
- the Swedish and Finnish side developed the opinion they have to investigate the operational/educational side themselves, but do not know how, because the information is more or less exclusively in Estonia. They had hoped that something would come from their Minister, but so far in vain.
- Next meeting will only be mid February 1996.

This means that the date for the publication of the Final JAIC Report, announced with so much enthusiasm only a couple of months before had been postponed to some unknown time in the future.

In this connection a fax has to be mentioned which was sent by Kari Lethola already on 12 November to Olof Forssberg only, which reads - office translation - as follows: "Representatives of the F.B.N., Chief Director Mutttilainen (No. 2 in the organisation), Valkonen, the legal man Makkonen and the engineer Fabricius - met at the beginning of last week in Hamburg Holtappels, Hummel and possibly some other representatives of Jos. L. Meyer Werft. The yard had invited them to come to Hamburg. Simo Aarnio interviewed Makkonen subsequently. Makkonen reported that the yard's representatives had first asked whether the F.B.N. had anything "against the yard". The answer was no. Possibly the yard wanted to check whether there could be a conflict of interests between F.B.N. and the yard in case of possible legal proceedings in the future. Thereafter they presented the results of their investigation. I hope that we shall have the same information after the Friday meeting in Stockholm. In any event, they do further maintain their theory that the hinges broke first and not the Atlantic Sicherung. Fabricius took the same view during subsequent discussions. He had inspected the visor in Hangö before the trip to Hamburg. Tuomo and Klaus shall come and interview Fabricius pretty soon.

The Papenburgers have also pointed out that "Estonia" had traded with a water-filled visor for quite a long time already (almost all the time). There are clear indications for that inside the visor.

Holtappels did further indicate that in case of possible legal proceedings against the yard they would right from the beginning disregard the JAIC investigation results to the effect that no one could use it as evidence against the yard. This would be done on the grounds of bias (partiality) of all three Estonian members. Holtappels did not give any reason for this, but possibly he means that

- Andi (Meister) had at the time of the casualty the political responsibility for the appropriate safety rules and also because the government had been the owner of the company, which partly owned the vessel and/or had been the operator.
- Enn (Neidre) is working as safety chief for Estline, which partly owned the vessel.
- Uno (Laur) was Enn's predecessor in this job.

We shall possibly continue to discuss this matter.  
Regards, Kari"

The contents of this fax allows the following rather astonishing conclusions:

(a) Even after almost 14 months of "joint" investigations the Estonians - although being in the chair - were not informed and thus did not take part in crucial decisions concerning the reliability and credibility of JAIC.  
(b) The chairmen of the Finnish and Swedish JAICs were pretty much aware of the background of all three Estonian members and as Olof Forssberg reported to Inez Uzman, the Swedish Minister for Communication and Transport, and Kari Lethola reported to the Minister for Justice in Helsinki, it has to be assumed with certainty that the problems were well known at least inside these administrations as parts of the respective Governments. Nevertheless nothing was done from their side until Dr. Holtappels raised the point. It finally led to the resignation of Enn Neidre in April 1996 as member of the JAIC. He remained, however, an expert of the Estonian JAIC and as such participated undisturbed in the work, had access to the complete documentation, attended the meetings as before and even participated in the drafting of the Final Report. Whether this nominal change in the position of Enn Neidre did improve the reliability and credibility of the JAIC is a question for the reader to decide.

(c) Remarkable is finally how experts with differing opinions - like Mr. Fabricius - were being treated: Tuomo and Klaus had "to talk" to him.

Note: As a matter of fact engineer Fabricius never showed up again in this case.

(d) The meeting between the F.B.N. and this 'Group of Experts' was already the second one and confidentiality had been agreed. The validity of agreements with the management of F.B.N. seems to be rather short. In this case it was broken by F.B.N. immediately after their return to Helsinki.

At a subsequent meeting in Helsinki on 23 November between Kari Lethola/ Klaus Rahka and a member of this 'Group of Experts' the following information was received:  
- Andi Meister, the head of the International Commission (IHK), was no more the Estonian Minister of Transport but was sitting at his home writing the Estonian version of the report; they had so far however received nothing.

- Uno Laur as the personal representative of the President of Estonia in the "Estonia" matter came together with the President, Andi Meister, Enn Neidre and the then Prime Minister by military plane to Turku on 28 or 29.09.94 - probably 28.09.94. The Prime Minister was at first also a member of the Estonian intermediate commission but was subsequently fired, when it turned out that he was a weapons smuggler. Tuomo Karppinen was also in Turku on that day, the first one in the early morning hours had been Kari Lethola.

Note: According to the notes made by prosecutor Birgitta Cronier, then in charge of the ESTONIA case, on the morning of 28 September 1994 "Kari Lethola is already on site in Utö". See Enclosure 38.5.463.

- The co-operation between the part commissions could be better. Each national part of the JAIC was working internally on its subject, the exchange of information/documentation was basically restricted to the meetings. This refers in particular to the Estonians who have produced very little, so far, but also to the Swedes. Börje Stenström is an acknowledged expert in naval architecture, but it seems almost impossible to persuade him of other alternatives once he has made up his mind. He is not a good casualty investigator. They are expecting a lot of problems before the Final Report is agreed upon.

- They know nothing about the working lists where the twisted port hinge of the bow ramp was mentioned repeatedly for repairs.

- This 'Group of Experts' explained to them the connection water in visor / gap in ramp / water on car deck / clothing around the port hinge of the ramp. They were themselves puzzled about the many clothings hanging around that area which could only be explained as the crew plugging the gap in the ramp from time to time when the ramp and visor were closed.

- They will continue to investigate the above circumstances. The probability that the scuppers on the car deck were open was also discussed, that one or several non-return valves were blocked, that pipes leading from scuppers on car deck towards outboard through the 1st deck (deck below car deck) were corroded/leaking and in connection with open non-return valves water penetrated the starboard side of the 1st deck (vessel had a permanent starboard list of 4-5° around which she was rolling probably up to 10° to starboard).

- In the further discussion it became very obvious that they would like to do a much more technical investigation with the fantastic possibilities they have in VTT, however, however this was rejected by the Swedes respectively allowed to a rather limited scope only.

- They were also informed about the repeated invitations of this 'Group of Experts' to the JAIC to come to Hamburg and Papenburg, to talk to the von Tell representative and relevant yard workers, which they did not know at all. Obviously the channel of information between the JAIC and this 'Group of Experts' ended on the private desk of Börje Stenström. The invitation was repeated to them and they promised to consider.

- Kari Lethola promised to try to find the passenger of "SILJA FESTIVAL" who has told the newspaper HELSINGIN SANOMAT (published 29.09.94) that ESTONIA left Tallinn with open visor.

Note: At that time the statement of this passenger had been in the file of Lethola for sometime already. He denied during the following 2 years frequently to know the name, however, when some of his files were finally inspected by members of this 'Group of Experts' in December 1998 the statement was found and copied. See Enclosure 19.236.

- It was agreed to send them everything in copy which was sent to the Swedish Commission and further on to send them blind covers.

This was the first time for this 'Group of Experts' to get the chance to look at the other side of the coin and make the amazing experience that the relationship between the Finnish and the Swedish parts of the JAIC was not as good as demonstrated to the outside and, in particular, that this was basically due to the behaviour of Börje Stenström. Moreover, that Stenström basically dictated the scope of the technical investigations exclusively in accordance with the hypothetical casualty scenario and the cause considerations developed by him.

Already in December everything which had been submitted in writing to Stenström was sent in copy to the Finnish part of the JAIC and further on they received blind copies of all correspondence.

It was also considered to be remarkable that Stenström had not informed the Finns about the damaged port outer hinge of the bow ramp and the consequentially open part of the bow ramp to the water-filled visor, which, in fact, rendered the ferry initially unseaworthy with the privity of her owners/ technical managers. The Estonian part of the JAIC knowing these circumstances, of course, from their questioning of the relief crew remained silent. It is unknown what the Finns did after having been informed by this 'Group of Experts' about such grave deficiency as the partly open bow ramp being plugged with mattresses, blankets and similar material to avoid the worst - water in large quantities on the car deck - from the always at sea water-filled visor. No official reaction was noted until Karppinen made himself the laughing stock of the shipping

community when he invented the "floating mattresses" during the press conference in which the Final Report was presented.

The total disregard of Börje Stenström for orderly investigation is further demonstrated by the way in which he chose to file documentation he received in his capacity as JAIC member. Instead of having the documents registered in the logbook as provided for by law he kept them unregistered at home. Only after his death in February 1997 were these documents found in his house, and subsequently registered with the small notation "Inh. fr. BS 971006 or 970326" meaning "Arrived from Börje Stenström on 06.10.97 or 26.03.97". This should of course also have been done with the repair lists of ESTONIA on which the repair request for the damaged port outer hinge of the bow ramp was made, however these lists were never registered.

Note: The alleged "List of maintenance and repair works on M.V. 'Estonia': April 1993 - August 1994" - attached as Supplement 230 - just contains the engine and electrical part - deck is not mentioned. Moreover this "List" was received by the Swedish JAIC from N&T only on 31.10.97 - five weeks before the publication of the Final Report. - See Enclosure 38.5.465.

The year 1995 ended with a letter from Börje Stenström dated 22 December by which he asked in total 11 questions with regard to the contents of the memo this 'Group of Experts' had handed over at the November meeting - the letter is attached as Enclosure 38.5.464 and shall be commented on in connection with the reply dated 22 January 1996.

## CHAPTER 39

### THE YEAR 1996

This was the year of change when this 'Group of Experts' had to realize that the JAIC was not really trying to find the truth but was fighting for a particular truth as already stated before.

#### 39.1 Communication and Investigation up to March 1996

In January some time was spent drafting the reply to Börje Stenström's letter of 22.12.95 which - finally - was agreed and sent by fax of 22.01.96 to Sweden. As the contents is of some importance the questions with answers shall be quoted below:

1. On top of pages 4 and 6 you say that von Tell submitted and B.V. approved load calculations for the locking devices. The only document we know about is the short telex from von Tell to B.V. informing that they had used LR rules for defining the strength of the locking devices and were somewhat high on shear stress (must presumably refer to the locking bolt). Have you seen any calculations?"

as to 1:

We have seen part of the telex exchange between von Tell-Hamburg and Gothenburg and also have seen some of their memos. From both it is revealed that there have been discussions (probably by telephone) between BV-Hamburg and von Tell-Gothenburg, and it has to be concluded that von Tell-Gothenburg have made calculations. This is also confirmed by the telex you have quoted and which is in your possession. To answer your question, we have not seen any of the von Tell calculations as we do not know where the files from von Tell-Gothenburg are, if they should still exist. We do conclude, however, from what we have read and heard from von Tell-Hamburg that such calculations have been made."

2. On page 6 you further say that von Tell produced drawings sent to the yard for production. The von Tell drawings showed the von Tell deliveries and the complete assembly but not installation arrangements. Agree that the parts indicated by von Tell as "Werft Lieferung" are not clearly identified as information or as manufacturing guidance and we say in our text that this may have been misleading."

as to 2:

The parts marked "Werft Lieferung" in the von Tell drawings are generally according to scale respectively oversized in case they had to be made to fit for installation onboard. These parts are always drawn in such a way respectively the dimensions are stated in such detail that burning diagrams for the 1:10 shop could easily be made and/or the detail drawings were directly used for production. When questioning the yard workers having done the above-mentioned work in 1980 there was not the slightest indication that this "may have been misleading" - as you say in your report."

3. On bottom of page 6 you say that the yard compared the von Tell design requirements with own results. Again, where are von Tell design requirements given?" as to 3:

When we say von Tell design requirements then we mean dimensions and form of the von Tell parts as could be taken from the drawings respectively from the information on the drawings supplied by von Tell. In other words, the yard obtained the load requirements which von Tell had based their dimensioning of the locking devices on by drawing conclusion from these dimensions and comparing the results with own calculations. In addition, this matter was certainly also discussed on the telephone, possibly personally."

4. Page 7, item a), refers to welding tables instead of drawing information. The steel drawing for the visor does indeed contain very detailed welding information for welds which may be regarded as standard, such as butt joints between plates of different thickness. It is lacking, however, details of the non-standard welds, such as welding 60 mm thick plating. This seems to be contrary to your explanation."

as to 4:

The steel drawing does contain some welding information and we agree to your statement that butt joints between 2 plates of different thickness have to be regarded as standard. This, however, does not refer to shape of the respective steel plate edges. It is for this reason that at the lower right corner of drawing 1103 very detailed dimension sketches can be found. The same refers to other dimension sketches on other parts of this drawing. We assume that your missing welding information is for the 60 mm plate. This can be found in way of the visor arms (butt joints) as well as on the very detailed sketch of the welds of the cylinder lifting lugs. In both cases, however, the measurement information does not refer to the thickness of the welding seams but to the preparation for the welding seams. The thickness of the welds is only indicated by the thick-black coloured area. For comparison please look at the detail "visor arm/bushing", where you will not find any measurement. Consequently no welding preparation was required because a fillet weld was planned. The black-coloured area, however, indicates a rather thick weld and reference is made in this respect to page 8c, i.e. the thickness of the weld should be between 50% and 70% of the thickness of the structural member to be welded. Due to the very clearly and easily recognisable black-coloured area the welders could not understand why they should not have followed instructions."

5. Page 8, item (b). the lugs of the bottom lock show clearly that the holes for the bushings were made by machine flame cutting. The lugs for the hinges show at several places a machine flame cutting pattern. (The coarse flame cutting pattern still being a question-mark.)"

as to 5:

We have to assume that the lugs for the bottom locks including the holes in the lugs for the bushings had been made by the 1:10 shop by means of machine flame cutting. The lugs for the hinges, however, have been definitely drilled. This is confirmed by the evidence of those who have done it in 1980, the respective drawings, photos and, last but not least, the remains of the hinges at KTH. In particular, the outer port hinge - showing only very minor burning marks at one location - demonstrates the original condition of the hinges at time of delivery, whilst at the stb. hinges due to the severe burning marks 10-15 mm material is missing. This is contrary to your previous statement when you said that the initial thickness would be still there.

In summary we agree that the holes in the lugs for the bushings of the Atlantic lock have probably been machine flame cut, although we have not yet found the respective drawing for the 1:10 shop (probably due to the use of "Diana II" drawings). As far as the holes for the hinge bushings are concerned, however, we emphasize that these were drilled, which we are able to prove and have done so already. We strongly suggest that you re-measure the hinge remains at KTH again and you will find out that at the stb. hinges there is 10-15 mm material less than at the port hinges. That leads to the conclusion that at the stb. hinges at least 10 mm material was missing (taken away by the burning) which at port side is still there. What effect that had on the alignment of the visor you may conclude yourself."

6. Page 9, first para. We have not seen any von Tell drawings giving welding information to the yard."

as to 6:

The respective drawing will follow shortly."

7. Page 11, last para. We understand that Viking Sally was on the contrary a few hundred tons lighter than originally estimated."

as to 7:

"Viking Sally" was not a few hundred tons lighter than originally estimated, but during the building phase the steel weight was continuously controlled very carefully in order to avoid overweight which would reduce the deadweight figure. As a matter of fact, AB Sally commenced arbitration proceedings against Meyer Werft claiming that the vessel was too heavy and thus could not carry the contracted deadweight, which, however, was not found by the arbitrators.

All this has nothing to do with the welding seams which, in total, correspond only to max. 2% of the steel weight.

Your assumption is probably based on the well known fact that Meyer Werft vessels have proved to be heavier and stronger than ordered for decades."

8. Page 12, 4th para. We have no documentation showing that the bottom lock was installed to meet a design load of 132 tons. If available, please provide. Bottom of the same page, the safety factor is not so easily defined in a design where base material and welds carry the load simultaneously because the welds have some much

lower ductility once the yielding strength is exceeded."

as to 8:

The 132 ts figure is based on 7.5 mm welds and on a permissible tension of 150 N/mm<sup>2</sup>. (7.5 mm welds were initially applied.) The safety factor considered can be defined as the proportion between the nominal tension and the tension of the breaking tension of the basis material."

9. Page 13, bottom. Was the extract from the von Tell drawing with the length of the side lug S70 released by the yard for production? If so, based on which calculations? As far as we can calculate, the strength of the side lug installation was somewhere around 100 tons when subjected to the combined pulling and bending force. This matches the actual tests carried out in Helsinki."

as to 9:

The lugs of the side locks were made according to von Tell drawing. The yard has made sure that the length was sufficient. The relatively low LCC of the side locks is not due to the too short lugs but due to the wrongly placed stiffeners at the bulkheads behind the lugs."

10. Page 15, mid. The "Copenhagen Convention" you are referring to certainly does not put any obligations on classification societies but contains an agreement between the Nordic countries that classification societies may be authorised to perform certain functions under the jurisdiction of one country and agreement that such authorization will then be accepted also by the other administrations."

as to 10:

Name and application of this convention was given to us by the Finnish Board of Navigation as an explanation why they did not become active in SOLAS matters concerning vessel's structure."

11. Further observations. I have looked back on ROV videos and have seen views of the bottom lock sensor mounting plate where the smaller holes for the magnetic sensors are clearly visible. Still no signs of the sensors themselves."

as to 11:

- We have also had more closer looks at the mounting plate in question and still did not find any sign of sensors, which, according to a member of the relief crew had been removed already several months before (due to damage sustained during the ice-winter 1994). In our opinion it is also clear from the videos that the cables for the sensors have been cut.

- The condition of the rubber packings we have discussed so many times and we have nothing to add to this.

- The visor was not flooded during sea trials (there were 4 people present, among them the BV surveyor Lohmann and the von Tell representative Todsen). At 22 kn speed and vessel pitching in head sea near Helgoland some water was leaking through the packing. After return to Emden they carried out the chalk-test and found that the packing at one location was not fitting tightly enough; a flat bar was welded in way, the packing fitted again, a high pressure hose test was carried out, and the visor was accepted as being weathertight by owners, BV, Yard and von Tell. (Signed acceptance or delivery certificate has been sent to you.)"

"Have also seen plenty of rubber packing on the forepeak deck in various state of separation from the flat bars. Understand the visor was flooded already during the sea trials. Do you have any information about how this was corrected."

"General:

You will recall that the quantity of water at sea inside the visor respectively the height of the water level has always been in dispute between us. Although there are very clear water marks inside visor and outside the (closed) ramp you would not accept this, which we could never understand until you gave us the explanation for your attitude. Your explanation was the gap at the lower port side in way of the securing bolt (which did or could not engage the mating pocket at the ramp side), i.e. there was a small opening of the bow ramp through which water would have penetrated the cardeck much earlier already with serious consequences, which it obviously did not do and therefore the water could not have been as high in the visor as we say. Upon my question where do you know this from, your answer was that the gap was caused by the severely twisted port outer hinges of the bow ramp, which had been stated in the working list several times for repairs but had not been repaired because it is a major item. We have thereafter looked a bit deeper into this and can see on the videos that the hinge was under repair. We have also found the explanation for water in the visor up to the visible marks, i.e. above the gap, and still no water on cardeck (at least not in dangerous quantities, i.e. crew members have plugged the gap each time bow ramp/visor were closed when they had to go down anyway to hammer the bolt of the Atlantic lock closed and at the same time plugged clothing, sheets, rags and the like into the bow ramp gap. You can still see these rags, etc. hanging respectively being pressed in way of the initial gap." The complete letter is attached as Enclosure 39.1.466 and its contents have never been disputed by the JAIC.

On 8 January 58 pages of the index from the Swedish JAIC's register were received and carefully studied. The non-classified documents of interest, in particular the statements of the survivors, were ordered and subsequently copied and sent to Hamburg by members of the SEA relatives organisation. The statements and other documents arrived in bunches in the course of February and March and were very carefully studied, which took some time since they were in Swedish. Reference will be made to this further turning point in the investigation under the respective month. On the same day the Swedish JAIC plus the Sjöfartsverket observer Sten Andersson met again with S.C. Forsberg and Ulf Hobro from N&T who were accompanied by their lawyer. No details of the meeting are known.

February: In an internal meeting of this 'Group of Experts' it was decided to build a mock-up of the Atlantic lock with as-found welding seams, i.e. 3 mm, and have it pulled to destruction. The JAIC was informed accordingly and it was offered to have the break test performed by VTT or any other institute in the choice of the JAIC. After some time Klaus Rahka - the Finnish metallurgist expert - came back on behalf of the JAIC and declared that the JAIC was happy with the "Institute for Shipbuilding" (Institut für Schiffbau) of the University Hamburg to perform the break test, but that the JAIC would like to attend. The preparations for the tests, to which Klaus Rahka submitted own proposals, commenced and took several weeks. The JAIC Report was now scheduled to be published on 15.06.96. At the same time this 'Group of Experts' started the publication of a request to the Swedish people in the Swedish Text-TV for photos, slides, videos and other documentation/information about the condition and performance of the ESTONIA during her 20 months in service under this name. The request was repeated daily for 6 months and led to several slides, photos and videos, among them the so-called "passenger video" of 19.09.94 which shall be commented under "April" when it was received.

March: One of the highlights of the month was the publication of the book "Katastrofenkurs" (Catastrophe Course) by Anders Hellberg and Anders Jörle. Hellberg was working as journalist for DAGENS NYHETER and had proven on several occasions to have had confidential access to the classified files of the Swedish part of the JAIC while Anders Jörle was then working in the Stockholm office of "GÖTEBORG POSTEN".

The conclusion of the book written after more than one year of investigation was:  
The sinking of the 'Estonia' had been caused by the failure of the visor hinges which were considerably pre-damaged by faulty and unqualified performed repairs. The catastrophe was programmed and could have had occurred practically at any time. Contributing factors were the facts that the master had not been on the bridge during the decisive last 15-20 minutes and further that the vessel departed from Tallinn with full port ballast water tanks but still had a starboard list.

This was, more or less, a confirmation of the tentative casualty scenario and cause consideration of this 'Group of Experts' and in complete contradiction to the JAIC. Stenström said that he would not read the book, but his colleagues had done so.

### 39.2 The Break Tests and the FE Analysis of the Visor

The first break test of a mock-up of the Atlantic lock with 3-mm welds (as-found) between bushings and lugs was carried out by the Institute for Shipbuilding of the University Hamburg in the presence of Tuomo Karppinen and Klaus Rahka of the Finnish JAIC.

The result was the breaking of the big visor lug at a load of about 210 ts, a result which was in total contradiction to the calculations and findings of the JAIC and hectic phone calls between Karppinen/Rahka and Stenström followed. For details of this and the break tests performed subsequently reference is made to Subchapters 34.3 and 34.4. The result of this first break test meant that the break load of an intact Atlantic lock installation on the forepeak deck would have been in excess of 210 ts. As the lugs on the forepeak deck failed at the accident whilst the visor lug held, it follows that the lugs on the forepeak deck of ESTONIA must have had a holding power inferior even to a new lock with only 3 mm welding seams.

At this time the attention of the JAIC was also drawn to the results of an FE analysis of the visor and the loads on its locking devices which had been performed by the Technical University Hamburg-Harburg - see Subchapter 34.2. The result of this scientific analysis was that as long as the visor hinges were intact the load on the Atlantic lock was only in the range of 50-60 ts. - much less than on the side locks - and that the force direction was towards aft and upwards. Only after the visor hinges were broken the load on the Atlantic lock almost tripled and the force direction changed towards forward/upwards, i.e. the mode in which the lugs failed at the accident. All this was submitted in detail and in combination with the detailed break-test results to the JAIC, however without any obvious result. Upon request of the JAIC three further tests were prepared, i.e.

- with a strengthened visor lug to find out the break load of the 3 lugs with 3 mm welds;
- with tag welds between lugs and bushings;
- without welds between lugs and bushings;

Klaus Rahka attended at one further test and he even made written proposals - see [Enclosure 39.2.466.1](#) - the others were left to the "Institute for Shipbuilding". In any event, it had been established that an intact Atlantic lock installation with 3-mm welds only failed at a load of 210 ts, and that the visor lug made of mild steel was the weakest point. It was further established by the FE analysis of the visor performed by the TU-Harburg that the load on the Atlantic lock was comparatively small, less than 1/3 of the break load, and that the force direction was aft/upwards as long as the visor hinges were intact. Since the lugs on the forepeak deck, however, broke in a forward/upwards mode at a load below 210 ts, it has to be concluded  
 (a) that the visor hinges were already broken when the Atlantic lock failed and, further,  
 (b) that the Atlantic lock installation was no more intact, a fact that was confirmed by the investigation of Prof. Dr. Hoffmeister. See [Subchapter 34.8](#).

All this in combination with the side lock break-tests results by VTT, Helsinki, indicated very clearly that the intact, i.e. as built, locking devices of the visor had by far not been as weak as the JAIC had outlined in their Part-Report and this 'Group of Experts' could correctly demand from the JAIC to correct their load assumptions and conclusions. This, however, was not done in spite of all the contradictory evidence, which could not be better demonstrated than by the fax that the Swedish JAIC administrator Gunnar Göransson had sent to the 'STERN' representative in Stockholm in April 1996. It reads - office translated - as follows:

*"I hope you received the DN article, Anders Hellberg, who wrote the article did follow up the commission work already from the beginning and did also write a book which has recently been published.*

Here are the answers to your questions:

1. Why does the Commission disregard the rumours concerning sabotage, dumping of narcotics, the master involved with the Russian Mafia? The damage scenario is so clear. The Commission has examined the visor and knows that all the locking devices, Atlantic lock and side locks were properly closed when the visor broke off. Therefore the rumours that the visor shall have been opened early and that then the locking devices could not have been properly locked again, cannot be true. Furthermore, if they would have had indeed the intention to dump cargo overboard it would have been much more suitable to do it by the stern ramps.

2. Did 'Estonia' comply with requirements for so-called 'short voyages'? The answer is yes. The law requires that if the vessel proceeds more than 20 nm from the nearest land, there has to be a radio operator onboard and there has to be provision in the lifeboats (food and water). 'Estonia' had this after she flew the Estonian flag and it was valid until the accident. Earlier when 'Estonia' traded between Stockholm and Turku she had an exemption.

3. Cause of the casualty?

The commission maintains its opinion as stated in the technical Part-Report, see page 31, a.)

The locking devices of the visor were constructed with less strength than required according to calculations. Extraordinary heavy weather. The ramp enclosed by the visor construction, etc. The report shall be ready later summer or early autumn. Regards, Gunnar"

Subsequently Olof Forssberg was interviewed by "DER STERN" and the resulting article with the heading "Unqualified Rubbish Talks" published in STERN Nr. 18/96 shall be quoted in parts:

"STERN : Witnesses did reportedly hear already shortly after 20.00 hours starting noises on the car deck .... . What explanation does the commission have?

Forssberg : Of course all sorts of noises were heard. We have heard 135 witnesses (Note: actually they heard 5), however no one heard car noises or did see anything respectively. Furthermore the car deck was control-led by cameras and the pictures were transferred to monitors on the bridge and in the engine room .... . I do not understand that this is taken seriously in Germany.

STERN : Is it true that certain witnesses' statements have never been properly followed up and that they are now classified?

Forssberg : During the pending investigation not everything is public. However, when we present our Final Report all the statements will be put on the table.

STERN : How did the casualty develop according to the Commission?

Forssberg : ... The combination of weather, waves and speed explains why the visor was torn off. In addition, the construction of the vessel, the connection between visor and bow ramp was not very fortunate, and the locks were not strong enough to master the situation.

STERN : Is it true that divers were allowed to examine every-thing on the sunken ferry except for the car deck? Is there something hidden?

Forssberg : In order to be able to enter the car deck difficult burning work is necessary. There was no reason for this. It is irrelevant for our investigation whether there were drugs or cobalt onboard.

STERN : Isn't it wrong to bury the 'Estonia' under concrete in the light of these speculations before possible new evidence has been secured?

Forssberg : We have all the information we need. .... "

The fax from Gunnar Göransson and the STERN article are attached as [Enclosure 39.2.467](#).

The STERN questions were answered and the interview was made well after the results of the break tests in Hamburg and Helsinki were known to Forssberg.

It is also amazing to note that Forssberg states that the JAIC has all information they need while at the same time Stenström, Karppinen and Rahka are preparing a detailed ROV inspection of the vessel and Lethola even considered another wreck examination by Finnish divers. See [Subchapter 39.5](#).

### 39.3 The Passenger Video

On 30 April a 90-second video was received which showed the closing of the visor looking down from the open deck 8. After the visor was closed the operator zoomed on the starboard visor hinge for quite a while and the result was shocking. The video showed very clearly and without doubt that the hinge was in an inoperable condition: The outer bushing stuck out, with its lower half missing and the securing plate was gone as well, just to mention a few of the very serious deficiencies demonstrated by this video. The video was taken by a Swedish passenger only 10 days before the last departure of the ESTONIA, i.e. on 17 September 1994. In order to secure this valuable evidence properly and to obtain the most reliable information from it the reconnaissance expert Bryan Roberts was instructed to evaluate the video tape by means of his acknowledged methods and summarize his findings in a report. For details see [Subchapter 12.5](#) and [Enclosure 12.5.180](#). Various images were made and one was sent by courier on 4 June to Börje Stenström together with the explanation of what this 'Group of Experts' could see on the images/tape, i.e.:

- there is a clear gap between the outer hinge plates vessel-/visor-sides which was obviously created by the steel bushing not sticking far enough through the bore, i.e. the larger part of the bushing is at the outer side of the visor hinge plate. - the outer securing plate is missing although 3 bolts can be seen.

- the lower part at the outer part of the bushing is apparently missing because you can see the end of the visor arm respectively the deck where the bushing respectively the securing plate should be.

- From the original of this photo, which is slightly clearer than the attached copy, you can also see that the hinge plates at vessel's side are not parallel to those from the visor.

- Furthermore, at the inner side there is a rust spot where subsequently the upper fracture occurred.

Börje Stenström replied on 16 June as follows:

*"1. Starboard side hinge. Have double checked together with Mikael Huss and Hans Öberg that the free ends of the hinge beam side plates are parallel, not converging as the video picture shows. This may influence the virtual position of the hinge bushing. Will look forward to a computer enhanced picture when available."*

The Swedish JAIC showed the images sent to them to N&T for comments. The result is unknown.

In August, during a meeting in Hamburg with the representatives of the relatives' organisations DIS and SEA, Henning Witte and Lennart Berglund, the video tape was shown, without mentioning the date when it was made. After his return to Stockholm Witte informed the press which triggered off some interviews with JAIC members and N&T on which SVENSKA DAGBLADET reported on 31 August as follows:

*"The video film was made by a Swedish passenger when 'Estonia' was in Tallinn harbour. Meyer Werft refuses to say by whom and on which date the film was made, but stated that it was "shortly before the casualty".*

The film shows quite clearly, believes Meyer Werft, that the port hinges of the bow visor had been manipulated. The yard's conclusion is that carrying parts welded together in order that the hinges function better will lead to weakening of the load carrying capacity.

Shots from the video film are known to the International Commission for more than 1 month and they have received an offer to obtain a copy of the film. This shall be done shortly by the Finnish Commission members, said Olof Forssberg, Chairman of the Swedish part of the International Commission. He refused today to comment on the degree of importance of the picture material as evidence. This will, however, be determined before the substantially delayed Final Report will be published.

.....

On behalf of the owners N&T the technical manager, Sten-Christer Forssberg, rejected the last play-out of the German yard."

"This is nothing new or changed, not everything is as obvious as it seems. We have seen the shots from the video which the yard has sent to the Commission and we have replied that these pictures do not prove what the Germans are alleging", said S.C. Forssberg.

"The pictures are data enlargements and are of the same fantastic quality as the Germans are talking about their own behaviour. We base ourselves only on our own material which confirms that the vessel was 'in good condition' before the casualty", said S.C. Forssberg.

He also rejected the conclusion of Meyer Werft viz. that there should be no welding at load carrying parts in order to make the hinges of the visor function better.

"There have been no welding works at the visor hinges. This is furthermore another one in a line of allegations put forward by the Germans. Earlier they had already alleged that the bow visor was opened when the vessel was in Stockholm. But the visor is mainly not opened when the vessel is in Stockholm", said S.C. Forssberg.

who characterised the acting of the German yard as "unethical".

The remarks of the N&T manager shall not be commented, however, the attention of the reader is drawn to the picture on page 292 of this report which shows the ESTONIA at her berth in Stockholm with open visor and open bow ramp.

On 5 September a copy of the video tape together with the Bryan Roberts report was handed over to the Finnish part of the JAIC in Helsinki. It was viewed jointly with Kari Lethola, Tuomo Karppinen, Klaus Rahka and Kari Larjo and everybody realised and recognised the deficiencies as explained in the report of Bryan Roberts. Subsequently the tape was sent to the Criminal Police Laboratory for examination whether it had been falsified, which it was not. Thereafter a copy was sent to Olof Forssberg of the Swedish JAIC, who informed prosecutor Tomas Lindstrand about the video.

By letter of 13 September, however, Forssberg sent the tape to the Military Intelligence Service (MUST) - see Enclosure 39.3.467 - and asked for data processing and contour strengthenings of certain sequences.

The MUST reply came on 20 September and is attached as Enclosure 39.3.468.

The "comments on the picture sequence" by MUST reads as follows:

"Mikael Huss mentioned a 'white line' at the bottom of the visor arm and the right part of the hinge. Upon studying the sequences picture by picture it is visible that this line is connected and sometimes looks broken. We have made 2 examples from each part picture which show these variations.

Such effect might occur with pictures if the distance between 2 objects is just few frames. Sometimes the objects are melting together and sometimes there appears to be a gap between them. This is due to the digital sensor of the video camera, respectively, how this sensor meets the shadow in each single picture."

The result is not negative and it is nowhere mentioned that the video tape is not reliable and cannot be interpreted correctly.

Nevertheless Stenström wrote on 20 September to this 'Group of Experts':

*"Regarding the tourist video picture, we have of course studied the report of Dr. Robert with great interest. Unfortunately it does not come out from his report whether the analysis is based on a computer enhanced picture or purely from work with isolated pictures. Was a computer treated picture ever produced? We have looked at the video tape handed over to our Finnish colleagues two weeks ago and have done so on a screen where the pictures could be fed one by one with retained clarity. In this mode most of the details in the hinge area jump around quite a bit and the starboard hinge bushing is twisted clockwise almost as often as it is twisted anti-clockwise. We are attempting to get a computer processed picture from the copy we have and will study further the possibility of a pre-accident damage to the hinge arrangement."*

On 28 September DAGENS NYHETER published under the heading "The Hinges of the Visor Were Sound" the comment of Olof Forssberg: "The pictures which allegedly show that the visor hinges were maltreated show instead that the hinges were 'completely sound'."

The article is attached as Enclosure 39.3.469.

On 21 October Anders Hellberg wrote in DAGENS NYHETER under the heading "Video Film Causes Controversies" and quoted the following comments:

"Olof Forssberg: "We do not believe that the pictures show anything new, none of them reveal that there was such a damage as alleged by the relatives."

Hellberg went on to say: "Börje Stenström pointed out that the loads during the casualty night affected the port and not the starboard hinges as the yard is now alleging."

Finally he quoted Sten-Christer Forsberg, the technical manager of N&T, who could find nothing serious in the report of the English expert:

*"As far as I understand the judgements of the Swedish defence and the JAIC destroy the basis for the theory of the German yard."*

The article is attached as Enclosure 39.3.470.

Börje Stenström wrote on 3 November to this 'Group of Experts':

*"Have arranged for a copy of the data processed picture of the deck hinge to be sent to you. This picture is produced by superimposing in a computer program all the still pictures during a time period. In the 'average' picture so obtained the distortions, which are numerous in any one still picture from a video camera, will be eliminated.*

*I am still not certain whether Dr. Robert has used such technique or not in his work. In this cleaned up picture we cannot see any signs of the distortions that Dr. Roberts is reporting about.*

*Am trying to look into the listing of discrepancies you made in the fax but have very little evidence to by. Likewise we have no evidence of any contact accident with a berth of breakwater, certainly nothing that has been reported to the class."*

The picture received showed the same as all the other images and the tape itself. It was nevertheless sent to Bryan Roberts for comments, which read as follows: "Thank you for your letter of the 12 November and the enclosed print 0:05:17. This is within the bracket of frames I used in my Report. The complete range showing the starboard hinge assembly being 0:05:13 to 0:05:40. These were all used to arrive at the conclusions in my Report.

The frame 0:05:17 is one of this sequence and, with frame by frame re-examination I can see no reason to change the content of my Report in any way. The change of angle between the visor bolt (annotation 10) and the outer bushing (annotation 8) can be clearly seen on images in this sequence and equally well on frame 0:05:17, although the quality of the images I used were rather better than this print.

In assembling my Report I examined all frames on the video tape with any possible relevance to damage or distortion. These were viewed frame by frame on a Sony UP5200 printer/projector which allows visual examination of each frame and printout of selected frames at a chosen degree of enlargement. The ability to scan a sequence allows the comparison of one frame to another and any difference between components of an assembly to be seen."

Bryan Roberts' reply was sent to Stenström by fax of 15 November together with the following remarks:

*"Since you have given your photo together with the report of Bryan Roberts obviously to the press - where else should they have got it from - and bearing in mind your and Olof Forssberg's remarks to Dagens Nyheter published on 21.10.96 (copy attached), we will now also give the comments of Bryan Roberts to Anders Hellberg and others."*

Stenström's reply came two days later on 17 November:

*"To clarify matters, the picture of the starboard hinge first appeared on Swedish TV in an interview with the lawyer Witte, obviously after he had had a meeting with you. Media naturally demanded comments from the commission and only then did we make our opinion public.*

*As to the technicalities, we have also looked at the pictures one by one and, as I have said before, there is considerable jumping around of the contours of the details. The average picture obtained by superimposing all pictures via a computer program then shows the correct shape, better than any isolated picture. Taking the contour of the bottom of the hinge beam as an example, the "mean picture" shows that it stops short of the hinge bolt locking plate. Many of the individual frames show the same thing. To comment only from an individual frame showing the opposite obviously becomes dubious.*

*We are at the moment not exploring this matter further."*

In other words, the JAIC would completely disregard the evidence contained in this video and that's what they did. It was not mentioned at all in their Final Report. Hellberg, however, wrote again on 25 November, obviously after having spoken to Bryan Roberts:

*"Hinges of 'Estonia' Were Damaged.*

Dispute about video film, British photo expert rejects casualty investigation. By Anders Hellberg

The 'Estonia' Commission does not believe in the information that the starboard hinge was dangerously damaged when 'Estonia' left Tallinn on the evening of the 27th September 1994.

In case the Commission had taken another attitude a large part of the blame for the catastrophe would be with N&T, having been responsible for the operation of the vessel, and with the classification society Bureau Veritas, who performed the inspections.

The members and experts of the Commission, however, do not believe that it is possible to draw the same conclusions from the video, taken on board of 'Estonia' weeks before the catastrophe, as the English photo analysis expert did.

- *"This is pure nonsense", said one of the members to DN during the meeting the Commission had in Stockholm last week.*

- *"The total arm holding the visor is winding like a snake in the film due to unevenness of the video - it is not possible to draw conclusions from such material", said one of the experts.*

- *"We do not trust the interpretation of the British photo expert who has been instructed by the German yard", said another member.*

According to the Yard and the British photo interpretation expert Bryan Roberts the bolt, which holds the starboard hinge, is not there and the bushing through which the bolt should go is partly missing. Thereby the whole hinge should have been so dangerously weakened that it collapsed in the heavy weather and was also the cause for the visor to fall off. The Swedish experts of the intelligence Service, MUST, state in their short report that there are variations between different pictures of the film and that this should explain, among other things, why the bushing towards the bolt appears to be broken.

Bryan Roberts said he was astonished by such an attitude:

*"It is obvious that on a number of picture details of the deck can be seen which should not be possible to be seen" - this is a fact which is difficult to get around. There can be no doubt that the bolt of the hinge is missing.*

Roberts, who has long years of experience as a photo interpreter inside the British Military Intelligence Service, said he had used a number of pictures in video sequences and that his expert opinion therefore was not just based on one frame.

Although the angle to the bushing was changed, it could be seen on a large number of frames on the video. "I cannot understand", said Roberts, *"how other experts can come to a conclusion other than mine. I would be pleased to meet them to discuss the matter."*

But the Commission consequently cannot trust Roberts without changing their initial opinion stated in the Part-Report from 1st April 1995, viz. that at first the locking devices failed before the hinges broke. According to the opinion of the yard, at first the hinges collapsed due to having been weakened before the locking devices at the bottom of the visor broke."

Thereafter the video film was not mentioned again in the Swedish media but was brought back to the attention of the public by the Exhibitions held by this 'Group of Experts' in Stockholm in June and December 1997. See Subchapters 40.2 / 40.3.

## 39.4

## The Survivors' Statements

As stated before, the non-classified statements were copied from the files of the Swedish JAIC in January/February and sent in bundles to Hamburg. All statements were in the Swedish language, i.e. the original Finnish and Estonian statements were already translated into Swedish. See also Subchapter 36.5.  
It took almost 3 months to analyse and evaluate the statements. The result was astonishing as the hypothetical sequence-of-events of the JAIC did not at all match with the statements of the survivors. It follows that the JAIC had disregarded the passengers' statements and just relied on the testimonies of the crew members, in particular, of Silver Linde and Margus Treu.

Note: Chapter 21.2 demonstrates the "reliability" of these statements.

The summary and evaluation of all statements, the changed sequence-of-events and cause consideration as well as the conclusions resulting therefrom were submitted - together with a summary of the technical findings in a 87-page letter dated 22 July 1996 to Börje Stenström with copy to the Finnish part of the JAIC. Stenström wrote a few comments by the letter of 30 September, however, the Finnish part of JAIC never did reply to this letter. The letter is attached as Enclosure 39.4.471. It was classified by the Swedish part of the JAIC on 02.08.96 and declassified again on 06.03.98 - 14 months after the publication of the Final JAIC Report.

## 39.5

## Communication and Investigation as from April 1996

April: Since the beginning of 1996 the Finnish Environment Agency was preparing the removal of the fuel oil from the bunker tanks of the ESTONIA. This should be carried out by sophisticated ROVs, able to cut holes into the vessel's side. The heavy fuel should then be heated and sucked out by means of equipment which could, however, only be used up to wind force 3-4 Bft. As this meant that there would be quite some idle time at sea for the vessel "HALLI" from board of which the ROV was operated, Tuomo Karppinen and Klaus Rahka of the Finnish part of the JAIC took the chance to stay onboard at those idle times and used the ROV for examinations of interesting parts of the wreck. See Chapter 28. This 'Group of Experts' was kept closely informed and even asked what they wanted to have examined. Thus a fax with various points of interest was sent to Tuomo Karppinen on 18 April - see Enclosure 39.5.472. Tuomo Karppinen also wrote down in a memo which items the Finnish part of the JAIC would like to have examined and as it is revealed from the memo that their requirements went much farther than those of this 'Group of Experts'. Also Börje Stenström wanted more and better pictures from the wreck when he wrote by fax of 15 April to Tuomo Karppinen:

"re: Pictures from 'Estonia'.

After some consideration I can still see the necessity for us to try to get better pictures from the damage to the deck and the front bulkheads, inclusive of pictures through the holes in the vessel. Furthermore, close-ups of the electric cables to the sensors of the bottom lock, in particular the free ends and the backside of the plate to which the sensors had been mounted.""

See Enclosure 39.5.474.

He should have remembered that the sensor plate and the free ends of the cables had been cut off in his presence by the divers in December 1994 - see Chapter 27 - and thrown away.

Since it was one of the really urgent requirements of this 'Group of Experts' to have an own look at the wreck the Finnish part of the JAIC was requested to permit a member of this 'Group of Experts' to attend one of the planned ROV surveys. This was however at once and categorically rejected. Nevertheless Karppinen and Rahka kept reporting on these ROV inspections, for example Karppinen on 29 April:

"The water was so dirty that the ROV operators refused to put their equipment into the water in order not to endanger it. All the time the Norwegian M.V. "TERTNES" was dropping sand and rocks into the water only 100 m away from the wreck, therefore the visibility was zero. "TERTNES" left on Sunday and will return only in June. They will make another attempt by ROV next weekend. So far they have searched the whole wreck except for the extreme aft and found nothing - no hole cut into the side."

May: Börje Stenström, whose health was continuously deteriorating, complained bitterly about the Estonians who still had not delivered anything, thus the Swedes had practically taken over everything from them. Enn Neidre was replaced by Pritt Mänik. He stated, that they had accepted our letter of 22.01.96, also the plugging of the bow ramp by the crew and it will be included into their report. He was aware of the fact that the Estonian witnesses were lying to them and did not tell the full story, however, "What can we do?"

Note: They should have listened to the surviving passengers.

He did not read the Hellberg book, but others in the Commission have and feel that the yard is "treated quite well". When the gap in the bow ramp was further discussed, it turned out that the gap was now apparently an admitted fact. Stenström also spoke about the interlock between visor and bow ramp and it turned out that he believed that the visor could only be closed if the bow ramp was properly closed and locked. He was informed that the visor could be almost closed (for painting purposes) if the bow ramp was fully open. Also the water in the visor and on car deck was discussed and the passenger video. Stenström was informed in detail about the missing material at the starboard hinge compared to the port hinge. Stenström further informed that their report was still not ready and that they would send the draft to N&T, ESCO, B.V. and the yard before it would be finalized so that all parties involved would have a last chance to comment on their respective parts. Stenström further advised that they believed to have enough evidence to evaluate their case, but if any diving on the wreck would be done they would certainly want to examine certain things. Compared to the Part-Report they had "softened" the Final Report not to put more or too much blame on the yard. They did not get the information about the officers from the Estonians which they need. They cannot even blame them for the speed. He will send the draft report next week. Margus Treu has said that the watertight doors were open.

June: During a telephone conversation on the 5th Klaus Rahka advised that he would go out by tug to M.V. "HALLI" tonight, to attend another ROV inspection of the wreck. They had a meeting of the technical group, i.e. B. Stenström, T. Karppinen, Metsaveer and Ingerma, M. Huss and himself. The atmosphere was quite relaxed and it seems that they do accept a break load of 175 ts for the side locks now.

Subsequently Rahka wrote as follows:

"With respect to doing a test including weaker than actual weldments we seem to share an interest toward a test, because that would be the only practical way to find the magnitude of an extreme minimum strength of a lock of this general configuration. As it is now - estimates of minimum strength have only been made analytically, and we see a strong chance that these estimates inevitably produce low values for the strength estimates. The forepeak structure is high quality FE 37-type steel, which thanks to its high ductility could work to even out loads between the three lugs, thus raising the result above that obtainable by calculation only. Technically it would thus be valuable to determine the behaviour of such a structure, because the assumptions underlying the analytical calculations most likely underestimate load sharing between the three lugs. An experiment would be the only reliable way to find how much this technical minimum is larger than the analytical estimate."

Such a test was subsequently also carried out and for details see Subchapters 34.3 and 39.2. The complete fax is attached as Enclosure 39.5.475.

On 8 June SVENSKA DAGBLADET published an interview with Olof Forssberg of which some parts are quoted below:

"There is no guarantee that the Commission's report will be completed by the 2nd anniversary of the casualty. This was said by Olof Forssberg, chairman of the Swedish part of the International Commission.

The delay of the report is a disappointment for many relatives. On the 2nd anniversary the liability of the owners for the casualty becomes time barred and the relatives had stated that they need the report of the Commission to sue the owners.

It cannot wait

F: As there is a time-bar period of 2 years the relatives cannot sit and wait for our report. They have to commence legal proceedings on basis of own material, said Olof Forssberg.

SvD: Why is the report so much delayed? From the beginning it has been said that it should come out 1 year after the catastrophe. Now it is uncertain whether it will be ready on the 2nd anniversary.

F: It has to be borne in mind that we here in Sweden cannot do everything in the commission. This is actually an International Commission with an Estonian chairmanship.

F: There are always difficulties if one is working in a commission with leaders from 3 different nations and if one is an own national commission. There is hardly a subject which due to the language does not lead to delays and complications.

Discussions about selection of words

F: The text is read and everybody has to agree, and that takes time. Always discussions remain about the selection of particular words, in particular in the judgement of people and people's behaviour, i.e. that the words have to be chosen very carefully.

SvD: It has been said that the delay is due to disagreement within the commission?

F: This I deny categorically.

SvD: Is there agreement between the delegates of Estonia, Sweden and Finland?

F: In case we do not agree, we are writing our different opinions. Because majority decisions are not allowed, we have to reserve our rights.

SvD: About a year ago the commission submitted a part-report concerning the technical aspects of the casualty only. The behaviour of the crew shall be dealt with only in the final report.

Olof Forssberg is today neither confirming nor denying information concerning missing initiative of the Estonian crew.

SvD: What is your opinion about the picture of the master as outlined by the journalists Anders Hellberg and Anders Jörle in their book about the catastrophe? The master is said to have been authoritarian and incompetent.

F: Talks with pilots show a different picture. There is much different information about the master.

SvD: When 'Estonia' got the list, however, the master choose to turn to port which increased the list?

F: Theoretically, it would have been better to turn to the other side. It is, however, not so easy just to say that the master turned to the wrong side. It is often so that in case of a list this side is turned into the sea, exactly as the master did.

Bad Repairs

SvD: The yard which built the 'Estonia' is alleging that N&T neglected the condition of the vessel and postponed necessary repairs. Can you reject this allegations?

F: We shall comment on this in our final report, said O. Forssberg and added that the German yard has "a number of theories at the present time". He pointed out that the yard e.g. was interested in a Russian report which alleges that the casualty was a result of the ferry having been used as a smuggle ship.

SvD: Do you mean that the yard is looking for any straw to find an explanation which would release her from liability?

F: We get the impression that they are trying to do that.

SvD: How was it to investigate the largest civil casualty in Europe in modern times?

F: - Many times people are of the opinion that because so many have lost their lives there must be a rather complicated cause for the casualty. There can, however, be a rather banal accident even if the consequences are disastrous.

- It is easy to conclude that a lot of people must also have made a lot of mistakes. Sometimes however life is quite simple such as that an accident occurs.

SvD: Will the theories and speculations come to an end once your final report is submitted?

F: No, because we have no access to the wreck the rumours will continue to live. This was the same with the disappearance of Raoul Wallenberg, Dag Hammarskjöld's air plane casualty and the murder of Olof Palme - theories are coming and emerging in uniform distances."

The complete article is attached as Enclosure [39.5.476](#).

On 13 June Klaus Rahka informed that the ROV inspection of the wreck had brought nothing. It might be repeated but Kari Lethola wants a diving investigation. Finnish divers had made an offer already and one diver can work on site for about 20 minutes. One job will be to closely film the sensor plate and the free ends of the cables of the Atlantic lock sensors, however the wish list of this 'Group of Experts' would also be favourably considered. Rahka was informed that his proposal to make a further break test with tack-welds had been accepted and the test was already being prepared.

July: In early July the evaluation of the many statements of the survivors was completed and based on the noise and time scenarios revealed from these statements, a new casualty scenario was developed which differed considerably from that of the JAIC. The present stage of the technical investigation by this 'Group of Experts' including the interpretation of the passenger video, the summaries and evaluations of all survivor statements and the consequently newly developed casualty scenario and cause consideration were - as stated before - submitted to Stenström with copies to the Finnish JAIC. - See [Enclosure 39.4.471](#).

While in the Swedish and Estonian media a squabble was carried out between Andi Meister/Uno Laur and Olof Forssberg and other Swedish JAIC members and experts, the rumours that Andi Meister would resign from the JAIC were growing and, indeed, on 30 July he resigned.

Börje Stenström commented this as follows:

- Andi Meister was already very tired at the last meeting and had indicated that he was considering to retire. They believe that the Estonian complaints about the Swedes withholding evidence was just an excuse to create a break in the commission which, however, would not be permitted by the politicians on both sides. The Estonians were apparently under growing internal pressure to avoid what becomes more and more obvious viz. that the main blame lies with the management and crew and that the evidence given by the Estonian crew members is wrong. Stenström further said, that he had a lot of material at home which was not even registered. See also [Subchapter 35.7](#). He declared not to have the repair list for the bow ramp damage. He was told by chief engineer H. Moosaar (of the 2nd crew), Hobro and Rasmussen that the copy remained onboard. That was clear, however, where was the original? No reply.

August: The diver videos and three amateur videos were received, viewed and evaluated which took time and the further development and discussion of the new casualty scenario took even more time. Sweden and Finland were on vacation.

September: On 5 September a member of this 'Group of Experts' met with the Finnish part of the JAIC in Helsinki when a copy of the passenger video was handed over - see [Subchapter 39.3](#). and all subjects were discussed. It turned out that the JAIC trusted the model test results of SSPA more than the reports of the survivors and, further, maintained their initial findings and casualty scenario in spite of all the contradictory evidence submitted to them by this 'Group of Experts' and others. The results of the meeting are summarized in a memo and because this was the last meeting with the JAIC the conclusions shall be quoted as follows:

*"Tuomo Karppinen, who is obviously in overall charge of the evaluation of statements, is very uncertain and unsure. He was apparently following instructions when submitting the scenario explained under 1.8. without creating the impression of being entirely convinced himself. In addition, he obviously has not yet carried out a detailed evaluation of the statements, which is really necessary to understand the full background. The obvious fact that his nautical experience is limited to some yachting does not make it easier. Consequently, it again has to be concluded that the Commission is still not doing the required work as it has to be and can be expected with a case of this dimension. It is not enough to explain all indications of an early starboard list with "but the seas continued to strike from port side until the visor fell off."*

It has to be decided now whether we shall spend some more time in explaining to them in more detail why the starboard list must have occurred much earlier, etc. The next Commission meeting is at the end of September. They will under all circumstances complete their report before Christmas, even if it should not contain the latest stage of the investigation. The pressure from government side is said to be very severe."

By letter of 30 September Börje Stenström commented on some of the issues raised in the letter of this 'Group of Experts' but no word about the survivors' statements and the resulting new casualty scenario.

Since 24 September Uno Laur was the chairman of the JAIC.

October: The exchange of information by fax and telephone between the JAIC and this 'Group of Experts' continued and some time was spent with the discussion of the statements of ex-boatswain Luttunen, who testified that the three lugs of the Atlantic lock on the forepeak deck had been renewed in 1982/83, most probably by von Tell AB, Gothenburg. The JAIC did not accept the statement of Luttunen, because it was not confirmed by other crew members having been onboard with him. It led, however, to an analysis of the paint layers of the starboard lug and the visor lug which revealed that the basic primer of the starboard lug was grey and of the visor lug was yellow. As the basic primer of the foreship at the newbuilding stage had been yellow, this analysis result confirms the Luttunen statement, but even despite such improved knowledge the statement was still disregarded by the JAIC.

November: The JAIC had a commission meeting for three days in Stockholm from 19-21 November at which 24 persons attended, among them Enn Neidre - who as the reader will recall - had officially resigned from the JAIC. See [Enclosure 39.5.477](#) - List of Attendants.

December: Following the above-mentioned meeting various JAIC members and experts made different statements to the media, and the yard was again attacked. Soon thereafter Börje Stenström wrote an apologetic fax to Dr. Holtappels, which is quoted as follows:

"You will no doubt learn through your press monitoring about what was going on in Stockholm during the past days. A radio channel reporter had talked to an outside expert, getting the impression that there were additional facts about the locking mechanisms beyond what is mentioned in the Part-Report. This led to activities in several other media including two TV channels by which I have been interviewed. I stated repeatedly in the interviews that we do not point out who installed the lock attachments of their current dimensions. Unfortunately this was now picked up in only one of the broadcasts, but rather an impression that it was now more clear than before that the yard had installed undersized lockings.

Lawyer Witte was also interviewed and claimed quickly that chances to sue the yard will now increase. I will call Witte Tuesday morning to explain to him that his conclusions are not based on facts of our report, on the contrary we will remain silent on the issue of who may have installed the weak parts."

The complete fax is attached as [Enclosure 39.5.478](#).

Note: Marine investigators and/or naval architects are not known to be professional in public relations.

### 39.6 Changes in the JAIC

The Estonian chairman Andi Meister resigned on 30.07.96. The chairmanship had been offered to Kari Lethola and to Olof Forssberg, however, was rejected by both of them as the Prime Ministers of Estonia, Finland and Sweden had decided on 28 September 1994 that the chairman should be Estonian. Only in the course of September did Uno Laur accept the appointment and took over the chair on 24 September. Already on 30.07.96, the day of Andi Meister's resignation, Heino Jaakula - from the Estonian National Maritime Board (E.N.M.B.) - was appointed as member.

In April Enn Neidre had already resigned from the JAIC upon pressure from Sweden and Finland caused by the remarks of Dr. Holtappels (see Chapter 38.4). As stated above Neidre was replaced by Pritt Männik, but remained an expert to the Estonian JAIC and participated in this capacity full scale in the JAIC work including the drafting of the Final Report. The initial judgement that the JAIC was biased due to its Estonian members remains upheld.

The Finnish expert Simo Aarnio passed away on 22.01.96 and was replaced by Kari Larjo on 27.02.96.

There were considerably more changes to come which will be explained in the following chapter 40.

**CHAPTER 40****THE YEAR 1997**

The JAIC finally managed to complete their Report and publish the English version together with 2 Supplements on 3 December while the Swedish version took another year. Before the publication, however, many things happened which shall be explained in the following Subchapters.

#### 40.1 The Development until May 1997

**January:** Due to the illness of Börje Stenström the position of the technical head of the JAIC was apparently taken over by Tuomo Karppinen assisted by Mikael Huss and Klaus Rahka. Karppinen phoned on 17 January and reported the following:

- They are still making small changes to the report. They had the lugs of the Atlantic lock at VTT and have analysed the paint layers. They found some 7-8, grey, white, red, blue paint and are certain now that the lugs were on board for quite some time.
- They have also spoken to the Turku yard, who stated, never to have painted the forepeak deck area, thus it must have been the crew.
- Have told him about the change of shape and he said the lugs from board have the same shape as the von Tell drawing and as the mock-up during the break tests, which is correct except that the aft part is vertically cut off.
- He is unable to give an estimate when their report might be completed, a lot depends on the meeting next week.

The JAIC met in Helsinki on 24/25 January and continued to discuss the final version of the Report. The protocol of the previous meeting on 16/17 December in Pärnu was distributed. It reveals that Kari Lethola had spoken to Edelmann/F.B.N. who had told him that there were two persons in the administration, who knew that there was a "problem" with accepting the bow ramp as upper extension of the collision bulkhead, but that it was common practice to do so.

This protocol further reveals that Tuomo Karppinen had contact to a Mr. Mäkeläinen, who had stated that locking devices had been changed and that Uno Laur had demanded a written statement from this man. The person is unknown to this 'Group of Experts' and nothing about him is mentioned in the JAIC Report. This and other protocols finally reveal, that the Sjöfartsverket 'observer' Sten Andersson actively participated in the drafting of the Final Report. He was obviously treated as a commission member and apparently did behave like that. Enn Neidre participated also.

From one of the relative organisations the information was received that the handling of the ESTONIA case by the Swedish Government had been moved away from the Ministry for Communication and Transport (Minister Inez Uzman) to the Ministry of Defence - "Department for Psychological Defence".

**February:** The JAIC met again in Helsinki on 19/20 February. The discussion of the chapters of the final Report was continued and Enn Neidre attended again. On 21 February Tuomo Karppinen phoned again and reported about the results of the meeting:

- In principle they do agree on the contents of all the chapters - they however have to be proof-read.
- But they did not agree on the conclusions and recommendations. Therefore they will meet again on 12 March and remain together until everything is agreed.
- The conclusion will be that one wave impact broke the visor at 01.00 hours.
- All attachments including the hinges broke a few minutes after 01.00 hours.
- The first water on the car deck was at 01.10.12.
- Then it took about 10 minutes for the visor to cut through the deck beams and then the ramp was pulled open.
- 01.20/22 the main engines stopped, vessel started to drift, starboard side to the wind.
- Only two passengers have reported water in the 1st deck.

Note: Actually 9 survivors reported water on the 1st deck, of which two already before the big heel.

- At 01.30 hours ESTONIA was on the side.

On 25 February Klaus Rahka reported the following:

- He wanted the report from the Institute for all the break tests performed (was sent to him).
- He promised to send a copy of the final findings (which he never did).
- They ignored the passenger video - see Subchapter 39.3 - because the pictures are jumping too much. It was explained to him that the pictures did not jump on the copy which was jointly viewed in Helsinki, but he was not interested. His attention was drawn to the fact that the starboard hinge bolt was standing without bushing on the rail, which confirmed that the bushing cannot have been complete as otherwise it couldn't have fallen off the bolt and would have remained attached to the bolt as evidently the point bushing did. He was not interested, the decision had already been made jointly.
- They had come to the conclusion that the load on the visor was about 60 ts which was sufficient to break all the locks.
- He believes that the welding seams of the 1st mock-up had been 5 mm instead of 3 mm.
- Börje Stenström had now officially resigned from the case. Note: Börje Stenström passed away on 25 February.

**March:** On 5 March Tuomo Karppinen faxed page 13 of the Draft Report and requested details about the communication between the yard/BV/von Tell, etc. which was compiled by sending the respective chapter of the Report of this 'Group of Experts'. From 12-16 March the JAIC met again to finalize the Report which failed, although - as stated above - it had been the intention to stay together until the last disputes were solved. On 17 March "DAGENS NYHETER" as well as "SVENSKA DAGBLADET" published articles about the internal disputes in the JAIC between Estonia on the one side and Sweden/Finland on the other concerning the behaviour of the crew, respectively how much blame was to be put on the crew. Furthermore, the attention of the public was drawn to the letter Stenström wrote at the beginning of December 1996 to Dr. Holtappels indicating that the JAIC would not point to Meyer Werft having installed the faulty locks by not excluding that the installations could have been changed after the vessel had left the yard.

**April:** At the beginning of this month the stowage plan showing the reconstruction of the condition on the car deck according to the cargo manifest was sent from Hamburg to Helsinki. In exchange, a copy of the KTH-Report about the examination of the hinge material was received.

During the second half of this month a contact to the Turku Repair Yard was established which resulted after some time in the receipt of very valuable documentation, i.e. the repair-specifications, -quotations and invoices concerning the time before, during and after the take-over of the ferry by N&T - see Subchapter 3.4.

Tuomo Karppinen phoned on 23 April and requested help with regard to

- the memo on magnetic limit switches (made up by the Estonian JAIC - see Enclosure 12.5.172);
  - type of these switches, names/telephone numbers of the electricians having installed them;
- all of which was sent to him.

In exchange he sent the Leif Bogren and the Hangö statements, which were received the following day.

He reported further that proof-reading and lay-out of the Report would not be completed before the end of May, i.e. the Report might be printed before midsummer, thus could be published just before the vacation season begins, which the JAIC would prefer.

At a meeting on 18 April with the Stockholm public relations company H&H the idea was developed to present the findings of this 'Group of Experts' to the Swedish public at an exhibition in Stockholm at the same time when the Report of the JAIC was presented and the media and the public could come to the exhibition and check, compare and discuss the results. This was decided during the following days and the time was set for the week before midsummer, which left two months for preparations.

**May:** Tuomo Karppinen phoned on 6 May and stated that

- they were still proof-reading;
- they had planned some sort of seminar under the chairmanship of Prof. Rutgersson from KTH in Stockholm where they wanted to present their technical findings to raise the profile of the JAIC, however this can, of course, only be done after the publication of their final report, which will probably be during the week before midsummer.

On 16 May Karppinen phoned again and told that they were making good progress, about half of the Report was already in the printing house in Helsinki. The day before they had gone through part of the Report with their English language expert. It is most unlikely that they will attend the seminar. It is still under consideration between Kari Lethola, Uno Laur and Olof Forssberg whether this 'Group of Experts' will get the part of their Report dealing with Meyer Werft matters.

On 20 May journalist Anders Hellberg from DAGENS NYHETER reported that the seminar had been postponed.

#### 40.1.1 The Dismissal of Olof Forssberg

On 26 May the interview quote below by radio journalist Erik Ridderstolpe with Olof Forssberg was broadcasted in Swedish Radio:

Journalist (J), Olof Forssberg (OF)

"Speaker: The Swedish chairman of the JAIC has lied about a letter concerning important facts about why Estonia and other vessels were built in an incorrect way. Despite the fact that Olof Forssberg has been assigned by the government to lead the commission's work in trying to establish the truth behind the sinking of Estonia, he has repeatedly lied.

J: So you have never seen this letter?

OF: No.

J: Never at all?

OF: No. It must have been delivered faulty. I will receive a new copy on Monday ... It wasn't today's mail.

J: Isn't that strange since the letter was sent to you a long time ago.

OF: These things happen. The post is not always reliable.

J: So you haven't seen what this letter contains at all?

OF: No.

Speaker Olof Forssberg is chairman of the JAIC. He is the one responsible for establishing the truth behind the catastrophe. He has already been heavily criticised for his way of handling the investigation. This time the issue is sensitive information about the Sjöfartsverket. It is information that shows that Sjöfartsverket for many years didn't control the placement of the very important collision bulkhead that shall prevent water from entering the car deck in an emergency situation. If Estonia's collision bulkhead had been placed in the right position, the vessel would never have sunk. Olof Forssberg has received and read the letter, but had not registered it. He has deliberately or non-deliberately misplaced the letter. At least one other occasion he has denied that he has received the letter, and he has asked the sender to send the letter again just so that it would seem as if he had never received it.

J: But I just can't understand why you are lying?

OF: I can't understand it either and I must say that I am ashamed over having lied. I have no explanation. I regret that I have been handling the truth carelessly. The reason I have asked you to come here today is partly that I want to explain that I have been lying and also apologise to you.

J: Is this common behaviour for the chairman of the JAIC?

OF: Absolutely not. It goes without saying that the answer to that question is no.

J: Is this the way you normally handle documents?

OF: Absolutely not. I always register documents very carefully. Actually I think that the reason for this omission, or rather consequence of, was the fact that the person who handles the Estonia file was on vacation.

J: How do you think this affects the credibility of the JAIC?

OF: This is what concerns me most. There have been a few occasions where I not even today can understand why I have acted with such a lack of judgement in certain situations.

J: The motive behind this is still not quite clear. Why did you lie about the letter?

OF: ...the...hm...I don't think that the motive is unclear. Quite simply this document was received or I read it through and I put it somewhere and then I didn't think anymore about it.

J: But it is one thing to do that, and quite another to deny the existence of the document. And also you don't have the document here in your office.

OF: ....ne.....I don't know where it is right now, the letter has now been miscarried but that is not a problem since I have asked the sender to send the same letter once more.

J: That you did in order to look good and so that you could say that you had now received the letter.

OF: I have now explained the whole situation to you and I think that, well, that things are as they are."

The subject of the discussion which subsequently turned out to be the reason for the dismissal of Olof Forssberg by Minister Inez Uzman is attached as Enclosure 2.2.3. It is a letter concerning a directors' meeting at Sjöfartsverket dated 07.04.59.

On 28 May Tuomo Karppinen phoned and reported the following:

- Ridderstolpe from Swedish Radio had phoned Forssberg and asked whether he had received a paper from 1959, of which he, Karppinen, also has a copy. Forssberg's answer was no, although he knew that he had the copy but could not find it. He asked Sjöfartsverket to send the letter again which was, however, delayed. So he told Ridderstolpe that he did not have it and never saw it and was subsequently proven to have lied. The first letter was not registered because it was considered unimportant. Ridderstolpe got a tip from somebody inside Sjöfartsverket.

- General Director of "Statens Havarie Kommission" (SHK) is a full time job. In case the Government should decide to put an outsider in this position, it will take several months and will cause further delay to the publication of the Report. Therefore it has to be assumed that it will be somebody from the Government administration.

- He has sent two more Chapters to the printing house.

- They are still of the opinion that it all started with the failure of the visor locking devices on course 287° and full speed, but some within the JAIC believe that it started with the hinges.

Olof Forssberg was dismissed from his position as Chairman of the JAIC on 27 May and replaced by Ann-Louise Eksborg on 16 June. The lady had been working in the legal department of the Ministry of Defence before. Also on the same day Captain Olle Noord, nautical expert up to that time, was appointed member in replacement of Börje Stenström, i.e. now two master mariners were members (Rosengren and Noord). Naval architects were no more present in the JAIC, which, however, did not mean that more emphasis was put on the up to then widely neglected nautical aspects of the case. Olof Forssberg attended for the last time at a working meeting of the Swedish part of the JAIC on 4 June.

Note: Olof Forssberg was very soon appointed an appeal court judge. One wonders.

#### 40.2 The First Exhibition in Stockholm

##### 40.2.1 Preparations

The investigation events were summarized in a brochure in English and Swedish languages - the English version is attached as Enclosure 40.2 - which were distributed to the visitors. In further preparation, two exhibition guides were acquainted with the investigation results, these were

- from Sweden, Captain Erland von Hofsten, 68 years old, retired Stena Line captain and Chairman of the Swedish Sailors Foundation, and
- from Finland, Captain Peter Jansson, 53 years old, maritime consultant and owner of Oy Mariners Assistance, Porvoo.

Both spent one week in Hamburg, read through the material, viewed the videos and discussed open questions with this 'Group of Experts'.

For the exhibition the history of the vessel from newbuilding to sinking was illustrated on big paper sheets. In addition, the topics of the investigation, e.g. the passenger video, the condition of the visor hinges, etc. were illustrated on separate sheets. Furthermore, one of the mock-ups of the Atlantic locks, broken at the break test, a model of the "VIKING SALLY", models of intact and damaged visor hinges, the hinge mock-up with the burning test, numerous drawings and other documentation of interest were shown at the exhibition which took place in the "Gamla Spårvägshallarna" on Birger Jarlsgatan in the centre of Stockholm.

While the preparations were in progress the chairman of the Swedish JAIC, Olof Forssberg, was dismissed, which triggered off a wave of speculations and, last but not least, caused a new delay of the publication of the JAIC Report. After careful consideration of all circumstances it was decided to continue with the preparations and to open the exhibition - as planned - on Thursday, 12 June, because it was possible by this exhibition to fill the gap which had doubtlessly been created by the new postponement of the publication of the JAIC Report.

##### 40.2.2 The Exhibition

The Exhibition was opened on 12 June at 10.00 hours with a presentation for invited guests. Invitations had been sent to the JAIC chairman, members of the Government and of Parliament. About 30 persons of the invited persons appeared, among others:

- Lennart Berglund/Odd Lundqvist - SEA Relative Organisation
- Gunnar Benndreus/Henning Witte/Alve Wendt - DIS Relative Organisation
- Prosecutor Tomas Lindstrand
- Sjöfartsverket Director Johann Fransson
- Jörgen Almelöv - Lawyer of N&T
- Carl Romare - Skuld / Stockholm
- Lawyers from Skuld / Estline / ESCO
- one representative of Trygg Hansa - the leading Hull Underwriters of "ESTONIA"
- Pierre Frey of Bureau Veritas/Paris
- Bureau Veritas Stockholm - Lawyer Bengt-Ake Johnsson.

No one from the JAIC, the Government or the Parliament appeared.

About 50 journalists attended the following press conference. They came mainly from Sweden, but also from Estonia, Finland, Denmark, Norway and Germany. Various TV and radio programs were present with own teams and a considerable number of interviews were made. On the next morning, however, there were only small articles in SVENSKA DAGBLADET and TT NEWS, while TV 1 and TV 4 mentioned the exhibition briefly in their evening news. The question arose why the Swedish media were suddenly so disinterested. Nevertheless the Swedish public, informed about the exhibition by various advertisements, had a different opinion and visited the exhibition in daily growing numbers while the media remained silent. Only in DAGENS NYHETER on the "Debate" page did one letter from the N&T lawyer, Jörgen Almelöv, appear, which was written in response to the letter of Dr. Holtappels having been published on the same page the day before the exhibition was opened. Among the daily increasing number of visitors were retired captains, pilots, professors from the Royal Technical High Schools in Stockholm and Gothenburg, but also relatives, survivors and previous passengers. Even the master, the chief mate and the chief engineer from "REGINA BALICA", the ferry having replaced the ESTONIA, visited the exhibition twice and took information material with them.

The Finnish JAIC chairman Kari Lethola came with two assistants and stayed for 11/2 hours, the investigating public prosecutor Tomas Lindstrand came twice with criminal inspector Bo Wide. Both stayed for several hours. Also several employees of Sjöfartsverket appeared and very interesting discussions took place. Most important were the many statements taken from previous passengers, in particular truck drivers, which provided new and more detailed evidence about the disastrous condition of visor and bow ramp including hinges and locking devices, all of which were incorporated into the report of this 'Group of Experts'. See Subchapters 12.4.3 / 12.5.

On the last day the relatives organisation DIS held their press conference inside the exhibition to demonstrate their appreciation for the work of this 'Group of Experts' and its preparedness to show the results in Stockholm.

At the exit of the exhibition a black book had been waiting for entries by visitors about their impressions and feelings after having seen the exhibition and the result was overwhelming as demonstrated by the Swedish original and the English translation attached as Enclosures 40.2.480 / 40.2.480.1.

On Thursday, 19 June, the day before the Midsummer celebrations would commence, the exhibition was closed after having been open for 7 full days, during which approximately 1200 visitors saw the exhibition.

In summary it has to be concluded that the exhibition had been a great success, in spite of the silence of the media. The visitors appreciated the opportunity to study the history of the vessel from design/construction to the sinking, the many photos, drawings, the models and mock-up, all of which was explained to them, if they wished so. Many regretted what they thought was a too early closing, however, accepted the reasons, viz. that it would make little sense to keep the exhibition open through Midsummer. Many visitors urged the exhibition guides to request Mr. Bernard Meyer urgently to make sure that the exhibition would be made available again to the Swedish public once the JAIC would finally publish their report. Many visitors demanded a new diving investigation to establish the real truth of the catastrophe.

It became obvious that the Swedish public and in particular the relatives did realize that this 'Group of Experts' - contrary to all publications and assumptions - really had done their utmost to uncover the real facts and circumstances having led to the catastrophe, and still continues to do so as demonstrated at the exhibition. The message from many relatives and survivors, that it is of utmost importance to them to know, what really happened, was understood and, also, that they felt to be left absolutely alone by their authorities.

Furthermore, it was realised and accepted that there was serious and convincing evidence available indicating a much better and more logical casualty scenario than that published so far by the JAIC.

The visitors also understood that a substantial part of the responsibility for the catastrophe was resting with their own Sjöfartsverket and many did express their deep concern about it. The recent resignation of the Swedish JAIC chairman Olof Forssberg in this connection did increase the ill feelings of many visitors.

Basically it became clear to most visitors that the main blame was resting with the technical managers and part owners N&T, the crew managers and part owners ESCO and the classification society Bureau Veritas. Many visitors were shocked that the ferry in such condition could depart every 2nd day from a Swedish port with 1000 or more Swedes onboard, without any Swedish authority doing anything to prevent it.

The Swedish Government, when faced with the facts shown at the exhibition, reacted as follows:

- The responsible Minister of Communication, Inez Uzman, remained silent and did not attend.
- The same refers to the members of the Swedish JAIC (only the expert Mikael Huss visited the exhibition in his own time).
- The only "officials" were Johan Fransson from Sjöfartsverket and prosecutor Tomas Lindstrand.

#### 40.3

##### The Development from July to December

July: In the meantime the "WASA KING" specification dated 25.09.92 which had been received at the exhibition from the Turku Repair Yard - see Enclosure 3.4.96 - had been translated and evaluated. See Subchapter 3.4 - when Tuomo Karppinen phoned on 1 July and reported the following:

- He would finish the Report in two weeks, then everything would be in the printing house and the printing would start.
- The result would be the 1st draft which would then be sent to all members and experts for comments to be delivered by mid August. The enclosures would be in a separate supplement of about 500 pages.

- After printing of the final version the Report would be published circa mid to end September.

- A new Swedish Commission would be formed to investigate everything the Swedish Government did or did not in connection with the ESTONIA;
- Karppinen was then asked whether he knew about the repair specification dated 25.09.92 - Enclosure 3.4.96 - which he confirmed and further advised that he had spoken with Tuomo Mäkki about it, who had made an offer for the bow ramp hinges but not for the visor locking devices.

Note: This is true. Behind the respective item is a handwritten note: "Price to be quoted after visual inspection." Apparently Mäkki never inspected the locking devices visually because in the meantime it had been decided to sell the vessel and only those items were repaired by the sellers which had to be rectified according to the sales contract.

Karppinen further explained that he had also spoken to the last Finnish inspector, Charles Richardson from Wasa Line, who had told him that at the time the specification was made up by the crew they did not know that the vessel would be sold.

- Next the possibility that the Atlantic lock had been changed after newbuilding was discussed and Karppinen said that there was a small chance because the basic primer of the visor lug was found to be yellow but on the starboard lug grey.

Note: Actually the basic primer of all lugs had been yellow at newbuilding - see Subchapter 2.4.6 and Enclosure 2.4.6.63.

- Finally Karppinen advised that it had been decided that this 'Group of Experts' would receive no parts whatsoever from the JAIC Report before the publication.

August: On 13 August Tuomo Karppinen advised on the following:

- The draft version of their Report had now been distributed to the members and experts except for three chapters which are still missing.
- He expects amendments, because after all delegations have read through the draft he is certain that not everybody will agree. - Amendments are sent to him and he incorporates them into the existing text.

- They still hope to publish around the 3rd anniversary.

On 15 August the Swedish JAIC had a working meeting in Stockholm.

September: From 3 to 5 September the Swedish JAIC went again through the text of the Report and apparently concluded the matter. During this meeting it came to a clash of different opinions which led to the resignation of the psychological expert Bengt Schager three days later on 8 September. In a subsequent interview by Jutta Rabe, Bengt Schager did explain the situation as follows:

*"BS: It was a meeting where we should look at the text. I was prepared for that meeting because as I figured out, it was the last chance to alter some of the details in a favourable way as I regard it is the truth. I was very well prepared and got the message that this meeting would only deal with the language problems and such things and that the report should be printed even though not all the chapters were ready, I didn't think that this was a proper way of working with it and then I told them that I would resign and, also I might mention, before that, when Olof Forssberg was the Swedish chairman, he was in favour for the opportunity for me of having a special opinion also printed into the report and then, later on, I understood that Mr. Laur would never allow a special opinion from me printed in the report. This, together with the rush in timing was the basis for my decision, and the long frustration also."*

*Q: But you emphasize just at this moment that their truth and your truth, so there is a difference between your truth and their truth?*

*A: There is a discrepancy and, of course, I believe that I am right, but I don't know and that's why I would like to be revealed my thinking when the report is there, so that everyone who is reading the report and listening to me, or, perhaps is reading what I am writing at that time and can see for themselves and judge, because when you are one against 20 you have some difficulties with, you have consequences with your relations, with the rest of them, and arguing for something, when you have 20 against you, of which 10 are silent but hostile and 10 are arguing against you, you have a friend at your side frequently saying: "Bengt, stop, for heaven's sake, stop," then you may come to a point, where you are really questioning yourself. Then, after a while, you have to continue because you are believing in a certain thing and the rest of them could not really give me good arguments. So, then you have to continue, in a way. Even though, of course, it makes you sometimes a little bit uncertain whether you really have right or not."*

On 18 September Tuomo Karppinen started during a telephone conversation:

- He received the comments/corrections from members and experts on Monday, 8 September, and has given the corrections to the printing house this Monday, 15 September.

- He will receive three printed copies in about two weeks which will then be read through again by the English language expert and himself at least twice.
- Then the final version goes to the printing house and then it takes 4-5 weeks, i.e. publication mid to end November.

On 22 September during a further telephone conversation Tuomo Karppinen said that they will have another full commission meeting in Tallinn due to unexpected difficulties with the text and only thereafter the final corrections can be made and printing started, i.e. publication early December.

On the same day "SVENSKA DAGBLADET" published an article which contained the first interview with Bengt Schager after his resignation and which reads - office translated - as follows:

*"Estonia' Report is Protecting the Crew.*

*The 'Estonia' Report is incomplete. The Estonian chairman tries to avoid criticizing the crew and this has disturbed the work of the commission, alleges an expert, who resigned from the investigation.*

*Turbulent Investigation.*

*The investigation of the International Commission was accompanied by numerous delays, censorship, accusations, criticism by the Judicial Ombudsman and change of chairman.*

*July 1996: The Estonian Chairman Andi Meister resigned after having severely criticized the Swedish part of the Commission.*

*May 1997: Olof Forssberg, chairman of the Swedish part of the Commission, was forced to resign after having lied to a radio reporter.*

*"I don't trust the Commission any longer", said Bengt Schager, psychological expert of the 'Estonia' Commission, who resigned from the investigation under protest.*

*Now the 'Estonia' Report, which will be submitted to the printing house shortly, risks losing much of its credibility.*

*Bengt Schager is of the opinion that the commission did not properly investigate the safety culture onboard of 'Estonia'. The question was much too sensitive.*

*"There has been a preparedness to talk matters and circumstances unfavourable for the crew to their advantage."*

*Bad Quality.*

The 'Estonia' Commission is a three-nation commission with experts and members from Estonia, Finland and Sweden. B. Schager means that the work was very much disturbed by the obligation to reach agreement. The Swedes and Finns had frequently considered giving up.

*"It has been so important to keep the Commission together to avoid that somebody acts on his own initiative", he said.*

*"I do not believe that the quality of the report is good. You find more lessons to learn from this casualty than is mentioned in the report, there had actually been lots of defects onboard", said Bengt Schager after almost 3 years work.*

*Ferry Sentenced to Death.*

Bengt Schager stressed that there is no disagreement inside the Commission about the main cause of the casualty: These were technical defects which sank 'Estonia' down into the depth. The large ferry was sentenced to death. This conclusion has never been in dispute.

The question about the acting of the Estonian crew in the very situation has, however, been in dispute the more, Bengt Schager is of the opinion that there are lots of question marks.

*"There are lots of things which belong into the report but which you cannot find there", he said. B. Schager is critical about the way the report deals with the acting of the crew: "Safety culture was with certainty not at the standard which could be expected".*

But he means that also other parts are defect. *"Certain analysis work was more or less just average work. We should have gone much more into detail and investigated much deeper"*, he said pointing at the fact that they were practically investigating Europe's largest ferry casualty in modern times.

*Stressed Commission.*

B. Schager sees two reasons why the investigation, according to him, shall remain faulty (imperfect): Certain questions have been sensitive whilst the commission has simultaneously been permanently under stress.

The investigation requirements could not withstand the requirements of the media for a quick completion and, therefore, an incomplete report shall be submitted.

B. Schager means that the Estonia Commission should have permitted herself to investigate the matter properly.

The article is attached as Enclosure 40.3.481.

The interview is self-explanatory. It confirms the bad atmosphere inside the JAIC which existed practically from the very beginning, at first due to the dominant behaviour of Börje Stenström, followed by the discrepancies which led to the resignation of Andi Meister and finally due to the attempt of Uno Laur to protect Estonian interests.

On the 3rd anniversary of the catastrophe "SVENSKA DAGBLADET" published a small article under the heading "Investigation of the 'Estonia' Catastrophe" which reads - office translated - as follows:

*"Criminal Violation of the Maritime Law and/or Causing Other Persons' Death" is the heading under which the Criminal Police is investigating the 'Estonia' catastrophe going on parallel with the investigation of the International Commission. In addition to survivors' statements the police and the chief prosecutor have among other things interrogated representatives of N&T, who had the technical responsibility for the vessel and of the classification society B.V. who approved vessel's construction and condition. "Some further interrogations are pending", said chief prosecutor Tomas Lindstrand, who is leading the inquiry. The purpose of the inquiry is to find out if somebody will have to be prosecuted for the 'Estonia' catastrophe."*

October: On 17 October Tuomo Karppinen reported as follows:

- The report was changed at the recent meeting and, as a matter of fact, they are still discussing details.
- Next week the English language expert will come again for two days and check the report whereafter it will go to the printing house.
- He estimates that it will take several weeks before the final version is printed and they would be happy if the publication could take place before the end of the year because this is what the politicians are demanding from them.
- He said further that they were aware that "REGINA BALICA" is either "VIKING SAGA" or "VIKING SONG", but they did not look into the "NORD ESTONIA" matter and they also had not realised that Ulf Hobro had been employed with Sjöfartsverket as safety inspector before he joined N&T.

On 20 October Tuomo Karppinen reported more details:

- They have had a meeting in Helsinki with Ann-Louise Eksborg and Uno Laur attending when the report and some minor changes were finally discussed. Casualty scenario and cause considerations remained unchanged. The report is now finalised.
  - Commencing tomorrow he will go through the changes together with their English language expert Bing Crossfield from London, which might take two or three days.
  - Thereafter the changes will be worked into the existing manuscript by the printers and a further manuscript will be printed, which he hopes to receive around 26/27 October.
  - He will then go through the complete manuscript once again and hopes to be able to submit the final version by the beginning of November, i.e. week 45, to the printers who will then commence printing 5000 copies, which will hopefully be completed in week 49.
  - This means that the report will be published either in week 49 or 50. The exact date will be fixed as soon as printing has started.
  - Since the summer, i.e. after the exhibition of this 'Group of Experts', they have included a new chapter into their report which concerns the "upper extension of the collision bulkhead above bulkhead deck = car deck" and have tried to find an explanation for the attitudes of Sjöfartsverket and Finska Sjöfartstyrelsen.
- Thereafter it was decided to have an up-date exhibition in Stockholm during the time of publication of the JAIC Report and the preparations commenced straight away.

November: In the early days the Swedish TV 2 program "STRIPTEASE" showed the second part of their "Estonia" investigation. It was apparent that the "STRIPTEASE" journalists had a copy of the Final JAIC Report or one of the drafts of it, which they had submitted to Prof. Vassalous of the West Clyde University, Glasgow, one of the leading naval architects in the UK. Vassalous was asked to give an opinion on the technical part and the conclusions, which he did.

The JAIC had concluded:

"The casualty sequence may have started around 00.55 hours when an A.B. seaman heard a metallic bang behind bow ramp. Locks and hinges broke completely through one or two heavy waves just after 01.00 hours. Consequence: The locks were too weak. 'Estonia' had met similar wave conditions only once or twice earlier between Tallinn and Stockholm. The accident occurred under conditions that were probably the worst she had ever encountered. The casualty has no pre-history, everything happened in one sequence and very quickly."

"Vassalous commented:

*"To reach ultimate loads at sea so that the components could fail in one or two loads is highly unlikely. Most components that fail at sea do so because of fatigue, there must have been a pre-history. Therefore the cause for the failures has to be found in the condition of the ship, and especially of the visor."*

*"The professor did not accept that the visor was really completely o.k. on the casualty night nor did he accept that the conditions were unique. He stated that cyclic loading is the nature of any structure, failure caused by fatigue loading is a fact of marine life".*

Failure to use common sense by the JAIC was his conclusion.

More uncertainty came up when the General Director of the E.N.M.B. and Estonian observer in the JAIC, Kalle Pedak, and the head of the Maritime Division (Department) of the E.N.M.B., Arne Valgma, went public by giving an interview to the Baltic News Service about the circumstances surrounding the diving investigation of the ESTONIA in December 1994 when only Arne Valgma had represented the Estonian side.

The following is quoted from BNS message:

"The divers' mission, which lasted for 64 hours, was filmed and the video picture was continuously forwarded to the support vessel. The Swedish Maritime Administration, which had commissioned the mission, supervised it from aboard the same ship, and also the Swedish criminal police observed the course of the mission there."

Valgma said that during the 64-hour mission there were moments when there was no video picture on his monitor.

"All I can presume is that the diving work was not filmed during those breaks." Valgma told BNS on Thursday. Maritime Department general director Kalle Pedak said it was not very likely there were breaks in the video recording during the divers' mission.

"Valgma had admitted that at intervals he saw no video picture in his monitor room and had no access to the ship's main monitor", Pedak told BNS. "I believe there was a video picture on the main monitor all the time, because the divers were constantly watched".

Pedak and Valgma didn't want to comment on why the video picture was interrupted on the Estonian observer's monitor."

The complete wording of the message is attached as Enclosure 40.3.482.

On 17 November the following message was received from the JAIC:

"Re: Press conference concerning the presentation of the Final Report of MV 'Estonia'

The Joint Estonian, Finnish and Swedish Commission to investigate the 'Estonia' catastrophe presents its Final Report on 3rd December. The Commission meets in Tallinn to present the Report jointly at 12.00 hours. Simultaneously the Report is submitted to the Swedish and Finnish Governments. A press conference shall be held in Estonia as follows:

Date : Wednesday, 3rd December 1997

Time : 13.00 hours

Place : Sakala Centre, 12 Rävala Avenue, Tallinn

The Report, which is in English, can be simultaneously picked up, i.e. at the BoA/Stockholm at 11.00 hours and at the BoA/Helsinki at 12.00 hours." This was the end of the communication between the JAIC and this 'Group of Experts' because the JAIC ceased to exist after the publication of their Final Report.

40.4

The Second Exhibition in Stockholm 1 to 14 December 1997

#### The Motivation

The decision to have another Exhibition in Stockholm before, during and after the publication of the Final Report of the International Commission was based on

(a) the growing certainty that the International Commission would conclude in their final report that the casualty was mainly caused by the too weak locking devices of the visor due to faulty design, etc.;

(b) the fact that such an Exhibition was the only possibility of proving quickly and convincingly to the national and international media as well as to the Swedish public that the above-mentioned conclusions were wrong;

(c) the frequently stated wish of many visitors to the 1st Exhibition to come back and give them the chance of comparing the findings of the JAIC with the findings of the German 'Group of Experts' after the Final Report had been published.

#### Preparations

Based on the experience with the 1st Exhibition it was decided to organise everything in close cooperation with the two relative organisations SEA and DIS and moreover to invite them to perform the exhibition jointly with this 'Group of Experts' and participate actively in the day-to-day preparations. This was welcomed by both organisations. Whilst SEA offered the assistance of their vice chairman Odd Lundkvist, who had been a conference/exhibition manager before his retirement, DIS offered the services of their technical expert Alve Wendt as exhibition guide in order to help this 'Group of Experts' with the many visitors to be expected. In addition, SEA would show their own little exhibition simultaneously. The SEA exhibition would draw attention to the crucial mistakes made by the Swedish government in the handling of the ESTONIA affair. DIS wanted to put up some screens whereupon they would outline what they thought were the real causes for the disaster and who had done what wrong.

When it was definite that the Final Report would be published on 3 December, 1997 in Tallinn and copies could be picked up simultaneously in the JAIC offices in Helsinki and Stockholm the following arrangements were made:

- advertisements should appear on 29/30 November, on 1 and 2 December, and again on 8 December
- o in DAGENS NYHETER, SVENSKA DAGBLADET, AFTONBLADET, METRO - all in Stockholm and countrywide;
- o in GÖTEBORG POSTEN appearing in Gothenburg and along the Swedish West Coast with the following text:

#### *Varför sjönk Estonia?*

Den Tyska Expertgruppens utredning föreligger nu.

Den visar en helt annan bild av M/S Estonias förlisning än Den Internationella havarikommissionens omstridda rapport.

Välkommen till

#### ESTONIAUTSTÄLLNINGEN

Gamla Spårvägshallarna

Birger Jarlsgatan 87 A

1 - 14 december 1997

Öppettider: 1-4,12-16,11-18 \* 5-12,14-17,11-18

8,12-16,11-18 \* 9,12-14,11-15 \* 10-14,12-14,11-19.

- the media were invited for 4 December;
- the opening times of the Exhibition were announced to all members of Parliament, the navigation schools and public schools in Stockholm and surroundings, all members of DIS and SEA, the Swedish survivors and many others.

#### The Exhibition

After arrival on 30 November 1997 a first review of the Sunday papers revealed the following:

- DAGENS NYHETER: two complete pages with the headlines:

(1) "The Final Report About Estonia : Nobody Will Be Blamed."

"Interview With The Survivor Carl Övberg."

(2) "The Swedish Maritime Administration Acknowledges Mistakes."

"Estonia and Diana II Received Exemptions. In Spite Of Many Warnings About Dangerous Visors The Safety Was Not Improved."

- AFTENBLADET: one full page:

"Estonia Had A Crack In Her Hull."

- GÖTEBORG POSTEN: Front page:

"Doubts Why Did Estonia Sink."

One further complete page: "It is impossible to dispel the doubts."

Interview with Olof Forsberg, the previous chairman of the Swedish Commission.

"Disputes about the visor."

"Mine explosions and Mafia Sabotage: Such explanations for Estonia's foundering require fantasy. There are, however, also well founded alternatives to the conclusions of the Commission."

This 'Group of Experts' was only mentioned in connection with other investigation results and alternative conclusions to those of the Commission.

This time no one was invited to the opening nor was there a press conference on the occasion of the opening, nevertheless visitors started streaming in right from the beginning and it can be said that the average number per day was in the range of 200, however, there were days with twice this figure.

The visitors spent a lot of time with reading, had less questions and thus the stress for the Exhibition guides was much less than previously.

Also the atmosphere this time was different right from the beginning, it was much more relaxed and free of tension, which was certainly to a considerable extent due to the presence of the representatives of the relative organisations, mainly the SEA Exhibition represented by Odd Lundkvist.

#### 1st day - 1 December 1997

Visitors started to stream in even before the Exhibition was opened at 11.00 hours. The day was full of pre-arranged interviews with German Finnish, Swedish and English TV and radio teams. Nobody from the writing press was spotted.

#### 2nd day - 2 December 1997

Whilst the chair lady of the Swedish Commission together with the administrator Gunnar Göransson were in Tallinn to attend the ceremony on the next day Lennart Berglund and Odd Lundkvist managed to obtain substantial parts of manuscript of the Final Report and members of this 'Group of Experts' started immediately to analyse the contents.

The chairman of the Association of Swedish Marine Underwriters, Sten Gathenborg, paid a visit to the Exhibition and everything was explained to him. He asked thereafter whether it would be possible to have a private show for the Swedish Marine Underwriters without the public and this was agreed for 9 December, from 08.30 to 11.00 hours.

In the afternoon the Hamburg office phoned and informed that two complete sets of the Final Report of the Commission including supplements had just arrived by courier from Kari Lethola, the chairman of the Finnish JAIC, which meant that almost 24 hours before the official publication the JAIC Report was available to this 'Group of Experts'. The main parts were sent by fax and the analysis commenced at once in order to have some comments already on the following day.

During the evening and parts of the night the Report was analysed as well as possible and already then it became quite obvious that

- the JAIC's scenario was based on the possibility that the vessel could have encountered 1 or 2 heavy waves which could have been able to break to locks of the visor, etc. and
- the JAIC had completely ignored the passengers' statements as to time of heel, water on 1st deck and on car deck and
- the JAIC had completely ignored the disastrous maintenance condition of visor and bow ramp; but had, to the contrary, found that the vessel had left Tallinn in a completely seaworthy condition, well maintained, manned and loaded.

The conclusions were - as already in the Part-Report from April 1995 - that "the visor attachments were not designed according to realistic design assumptions ..." and "the attachments were constructed with less strength than the simplistic calculations required", etc.

So not very much had changed during the past 3 years, almost nothing of what this 'Group of Experts' had submitted to the JAIC had been taken into account, it was thus still the Yard and only the Yard on which blame was put.

The defence was prepared straight away by so-called "First Remarks on the Report of the International Commission" of which 400 copies were distributed to visitors until the closing of the Exhibition. One copy is attached as Enclosures 40.4.483.

#### 3rd day - 3 December 1997

As of 11.00 hours the Report plus Supplements could be picked up by anybody at the office of the Swedish JAIC.

An article appeared in "DAGENS NYHETER" wherein the previous psychology expert Bengt Schager, who had resigned from the JAIC in September, stated that ESTONIA had left Tallinn in an unseaworthy condition referring to the evidence of the Sjöfartsverket inspector Åke Sjöblom, who had left the vessel only shortly before her departure. This led to additional questions from many visitors.

Next, Gerhard Klahn phoned from Ystad in Southern Sweden and stated to have seen a TV interview with the above-mentioned Åke Sjöblom shortly after the casualty during which he had said that they had found the bow ramp in a totally unsatisfactory condition and had strongly recommended to their Estonian colleagues not to permit the ferry to sail in this condition, which, however, was ignored. He was then asked by the journalist what he would have done if he had checked the ESTONIA in a Swedish port? He replied that under absolutely no circumstance would the ferry have left port.

#### 4th day - 4 December 1997

This was the day of the press conference of this 'Group of Experts' right in the middle of the Exhibition. It began at 11.00 hours with approximately 40 journalists and four camera teams attending, many of whom had been in Tallinn the day before. (Reportedly some 200 persons attended the press conference of the JAIC.) Dr. Holtappels submitted the first analysis of the JAIC's Report, drew attention to the obvious mistakes and wrong conclusions, answered numerous questions from partly very insistent journalists who were much better prepared than they had been in June. Simultaneously the survivor from the 1st deck, Carl Övberg, was introduced to the media and told his story and answered questions.

Thereafter it was explained by means of the models that the scenario of the JAIC was not possible to have happened and, as a comparison, this 'Group of Experts' scenario was presented, as supported by the statements of the survivors and other facts.

The two main newspapers in Stockholm reacted as follows:

##### 1) DAGENS NYHETER:

- Front page: Top story the Jeltsin visit covering most of the page. A small column on the left side: "Estonia: The yard bears the main responsibility."
- Page 2: "Estonia Without Finale. The work of the three nation commission is clearly meeting opposition."
- Page 5: Full page: "The Locks Of The Visor Were Too Weak."

The Yard is criticised by the Commission. The locks had insufficient dimensions. A drawing illustrates the weak points including the damaged visor and ramp hinges, the gap in the bow ramp, the missing and damaged rubber packings, etc. with detailed explanations.

Also the scenarios of the Commission and of this 'Group of Experts' were illustrated and compared with each other.

Comments from Uno Laur, Dr. Holtappels, Inez Uzman, a speaker for the Ship Owners' Association and Lennart Berglund were quoted.

Mini portraits of Arvo Andresson, Andi Meister, Kent Härstedt, Jan-Tore Thörnroos, Silver Linde and Margus Treu were shown, who were considered to be the main persons of the drama.

- Page 6: The names of the 852 persons having lost their lives (full page).

- Page 7: Full page: "Difficult Decision Not To Recover (The Bodies)." "Distress Call Came Too Late." "Nobody Will Be Prosecuted."

##### 2) SVENSKA DAGBLADET:

- Front page: Top story "The 'Estonia' Report". Heavy waves and weak construction of the visor sank ESTONIA. These are the conclusions of the International Commission's Report. The catastrophe could however have been avoided if the Classification Society Bureau Veritas had been more alert.
- Headline: "Bureau Veritas Is Accused." "The Catastrophe Step By Step." Only at the bottom is there a small note on the Jeltsin Visit.
- Page 2: Two-column comment: "After Three Years."
- Page 4: Full page: "Weak Visor Picked Out As Casualty Cause". New information in the Final Report of the Commission puts the blame for the weak visor which caused the casualty on the Yard and Bureau Veritas.

"The Yard Criticises Many Items." "More And Better Locks On Russian Vessels." Drawings illustrate the last hour of ESTONIA and the scenario of the Commission. Interview with Wanda Wanninger (Wachtmeister).

##### 3) GÖTEBORG POSTEN:

- Page 1: Three-quarters of page: "Weak Locks And Late Alarm. ESTONIA's Sinking Explained On 228 Pages. Now The Legal Follow-up Begins."

#### 5th day - 5 December 1997

The reactions to the press conference were:

- in DAGENS NYHETER : Nothing.
- in SVENSKA DAGBLADET : On page 6 a quarter-page article: "The German Yard Criticizes The Report."
- in TT PRESSEN (nationwide): "The Yard does not accept any blame."
- in GÖTEBORG POSTEN: "German Criticism Against The Estonia Report."

"The Yard Is Supported By Sweden." Christer Lindvall, managing director of the Swedish Masters' and Ship Officers' Association, agrees to a certain extent that 'ESTONIA' sank due to poor maintenance and not faulty design or construction by Meyer Werft.

In the morning Lennart Berglund and Anders Lindström, managing director of Sjöfartsverket, were interviewed on Breakfast TV and Lennart Berglund stated to have reliable information that Åke Sjöblom had discovered the damaged bow ramp and tried to stop the ferry. Lindström reacted with obvious shock and said he knew nothing about this, but would certainly investigate it.

This triggered off some press activities which were, however, overshadowed by the new developments in the Palme murder case, which were told to the media in a separate press conference at 10.00 hours. Probably for this reason the press conferences of DIS and SEA at the same time were just attended by one or two journalists.

#### 6th day - 6 December 1997

The Exhibition was reopened at 11.00 hours and the visitors streamed in more than before and the questions were sharper and more precise because all of them had read

the comments in the papers, followed the TV and radio comments and sometimes had even studied the JAIC's Report respectively were in the process of doing so and wanted to fill gaps by looking at the Exhibition and asking questions. This was exactly what this 'Group of Experts' had expected.

A number of retired masters, pilots, engineers, divers and even safety inspectors from Sjöfartsverket came and stayed on an average of two hours. Many came again on one of the next days. In addition, people calling from all over the country and also from Finland, offered their knowledge, photos, videos.

The repair manager of Turku Repair Yard, Arvi Puroya, also visited the exhibition and upon being questioned he stated that

- N&T had not booked any drydocking space for January 1995 for ESTONIA,

- nor had he received any repair specifications.

He also confirmed that the only JAIC member or expert who had ever visited the yard was Tuomo Karppinen.

One of the visiting retired pilots stated that the traffic controller of Sandhamn had told him that he had frequently seen ESTONIA passing on her way out with the visor slightly open. This was mainly during the last weeks before the casualty.

Another visitor said that the weather statements in the JAIC's Report were wrong and "selected". The naval architect Per Fagerlund stated that he had immediately called his friends at SSPA when he heard the nonsense of Karppinen that the speed had had no relevance for the catastrophe and they had strictly rejected to have found anything during their tank tests which would support that and also had made it quite clear that they did not want to be quoted in this connection.

A visitor, who refused to tell his name, stated that he had been working for Stolt and had been on the Stolt diving support vessel "STOLT COMEX", which had been on the ESTONIA position already a few days after the casualty and which Stolt immediately offered to Sjöfartsverket for a diving survey. He said that they had made some tests in the early stages and measured radio activity near the vessel.

In the evening the Swedish JAIC explained their findings and conclusions to the survivors and relatives. Reportedly Mikael Huss said that the Yard had not only miscalculated the loads, but had also used the wrong low quality steel. Ann-Louise Eksborg said that the manual locks were only to be used if the others were out of order. The expert of DIS, Alve Wendt, put the question to Mikael Huss, whether they had considered what would happen to the ramp hinges if the vessel would proceed with fully open ramp and 15 kn speed against head seas? With certainty the hinges would break. M. Huss replied that this had been neither considered nor calculated, although it was part of their scenario. Note: See Subchapter 34.10 - The hinges would break and the ramp fall off.

7th day - 9 December 1997:

About 300 visitors were counted.

8th day - 10 December 1997:

On Breakfast TV 2 Sten-Christer Forsberg - the Technical Director of Nord-ström & Thulin - was interviewed in connection with the conclusion of the JAIC. He admitted the general responsibility of N&T for the conditions of the vessel upon departure from Tallinn with exception of the too weak locks. They had no knowledge about this hidden defect and said that had they known, they would have rectified it.

Forsberg, however, was not confronted with the repair specification of the last Finnish crew from September 1992.

9th day - 11 December 1997

Among the visitors were Ann-Louise Eksborg and Gunnar Göransson from the Swedish JAIC, who did not contact the guides.

10th day - 12 December 1997

On this day from the Finnish JAIC chairman Kari Lethola with his administration director and the two managing directors of the Swedish Masters' and Ship Owners' Association, Chister Lindvall and Per Ringhagen, visited the exhibition.

Also the truck driver Torbjörn Cederkvist appeared and confirmed:

- the burning off of the lug of the starboard side lock;
- the burning off of mating boxes for securing bolts;
- the dismantled flaps between bow ramp and car deck at the port side and crew members pulling them into position after the ramp had been opened;
- frequent water on car deck at sea, car deck doors open not locked at sea;
- water still streaming out of the closed visor, when he drove from the vessel in Stockholm;
- the port ramp hinge was broken and the crew was unable to close the ramp for some hours;
- the vessel returned to Tallinn for repairs on one occasion;
- vessel moored stern first in Tallinn at least 2-3 times.

His statement was taken and he was available whenever required and also prepared to testify before the public prosecutor.

Note: But was never heard.

11th day - 13 December 1997

Apart from visitors, the survivors Sarah Hedrenius and Pierre Thiger came and had a close look. Their statements were taken in June already, thus just some new information was discussed. Both rejected the conclusions of the JAIC entirely on the basis of their personal experience.

12th day - 14 December 1997

This was the last day and although it was a Sunday some 150 visitors came until 19.00 hours when the Exhibition was closed.

It has to be assumed that about 2.500 visitors saw the Exhibition this time.

The "Black Book" already offered to the visitors of the first exhibition for writing down their feelings and impression was put again on the table near the entrance and was put again on the table near the entrance and many visitors made again use of it. The entries - translated into English - are attached as Enclosure 40.4.484.

40.5

"Why did Estonia sink?"

The Engineer Knows the Answer.

Seminar Organised by the Royal Technical University (KTH) Stockholm on 01.12.97

This seminar, planned already to take place in June, had to be postponed due to the delayed publication of the JAIC Report because it was practically a presentation of work and results of the JAIC. Since Swedish was the main language the Finnish lawyer of Messrs. Meyer Werft did attend and his report reads as follows:

"The purpose of the seminar was apparently an attempt to explain for shipbuilders and engineers the conclusions drawn by the JAIC in its recently published report.

Among the audience one can find a number of representatives for the shipbuilding and shipping industry in general, but also some insurers and lawyers.

First speaker was Ms. Ann-Louise Eksborg, recently appointed chairman of the Swedish national commission.

She discussed the aims and purposes of commission work mainly from an internal Swedish point of view, emphasizing the importance of the JAIC integrity especially towards those authorities, who supervise the activities subject to an investigation, i.e. The Board of Navigation, the Board of Aviation etc.

She took it for granted, that parties subject to an investigation would not participate in the work.

On my question whether she thinks these high principles were followed by the JAIC she immediately grasped the purpose of the question and admitted, that the Estonian members were not impartial if measured by this standard, but she explained their presence in the JAIC with the allegation that apparently all Estonian navigators are or have been employed by the ESCO. There should, however, not remain any doubt among the audience after this answer, about the fact that the JAIC was clearly prejudiced.

Tuomo Karppinen then ventured to explain the sequence of events as per the JAIC's apprehension, first stating that times given have the exactness of ± 2 minutes.

Karppinen then stated that some of the points of time given are more reliable than others, as these can be explained by means of outside sources; such are: the time of departure, the time for passing the waypoint, the time for the first MayDay message and the consequent radio traffic, as well as the time or the Estonia disappearing from the radar screen of the Mariella.

Karppinen, however, started the summing up of the events with the "bang" heard by the AB, and after that, in my opinion, all points of time are in fact based on the indications given by crew members, not by the passengers. Accordingly the JAIC is, albeit the point of time cannot be verified, of the opinion that the events started at 00.55, that the visor locking devices were broken between 1.05 and 1.10, and that the visor fell off at 1.15 with immediate list as a consequence.

From the evidence recorded it is apparent, that the JAIC is not, as said, attaching any greater significance to statements by passengers.

Karppinen also described the maneuvering of the vessel at this period of time, i.e. the total lack of maneuvers with the exception of the fact that the speed was turned down when the vessel already had a severe list.

A member of the audience very in detail expressed his opinions how a vessel in a situation like this should be maneuvered, by reducing speed, turning the stem/stern against the sea etc., to which Karppinen responded that obviously, if the vessel had been turned such that the angle to the sea would have been abt. 90 degrees, the water could not have entered through the ramp at all and the vessel would have been saved. Karppinen had obvious difficulties with explaining to the audience why the JAIC did not clearly say this in its report.

After this discussion, there could not be any uncertainty in respect of the fact that grave errors by the crew significantly contributed to, if not even caused the accident."

In respect of Rahka's paper, as far as I could understand, the difference in opinions between the yard/the JAIC viz. the strength calculations regarding the visor locks is now being explained with reference to a turning moment caused by the impact of the seas coming from abt 30 degrees to port from the vessel's line of heading.

Rahka emphasized a number of times that irrespective of how the calculations are made, the locks were too weak anyhow.

Rahka denied, that the JAIC would have said that the speed was of no significance at all; he (and Karppinen) stated, that a speed below 10 kn, would have nullified the risk of visor failure, but the point is that speed impact is linear while wave impact is proportional.

As to Huss's two papers, there was nothing extraordinary to be mentioned.

Fransson discussed the Solas requirements as to the placing of the collision bulkhead extension, and concluded that the solution onboard Estonia was in conflict with the applicable rules.

Much was discussed about the original approval by the FBN and subsequent approvals by the BV on behalf of the Estonian BN. I did ask Fransson what his opinion was about the alleged seaworthiness of the vessel at departure from Tallinn, if the vessel de facto was in breach of the Solas requirements, and he transferred the question to the JAIC representatives, of which Karppinen ventured to answer. He said, that the seaworthiness statement in the report is to be understood as a legal and formal one only! This answer no doubt is the more peculiar, as the breach of the Solas requirements clearly is a "formal and legal" failure, as the vessel no doubt had valid certificates. In the end I asked Karppinen about the repair list from the Turku repaiyard, and the answer was that in fact this was not a quote, but a summary of the items the deck officers had forwarded as a "wish", and Karppinen's rather unfounded conclusion was that actually there were nothing at that time to remark about the locks/hinges/packings!

He had no proper answer to the question that the list no doubt also comprised items which the JAIC has chosen to mention as unrepaired, that is the packings. How the JAIC has arrived at the conclusion that the remaining items were not of importance or, as he is saying, did not exist, is unclear.

He did after the seminar take great pain in explaining to me that the list is not an usual "to do" list, but something else, which I refused to understand.

As such the seminar was interesting, but too comprehensive with too little space for adequate questions; too much was packed in the program. Another problem was the heterogeneous composition of the audience, a number of participants with knowledge based on media information only took up the time with self-evident questions.

I met afterwards Karppinen and Rahka on the airport, and we had a pleasant discussion waiting for the much delayed plane.

I told them that my opinion is, that they have an uphill task in convincing the interested parties in respect of the correctness of their conclusions, as the JAIC in the eyes of any outsider is prejudiced, and as some conclusions, such as the role of the crew, are obviously quite wrong. The two gentlemen admitted the difficulties with the Estonians once more, but emphasized of course the value of their own contributions. They welcomed me or my prospective principals to study the background material now available at the VTT."

Nothing more remains to be done but to compare the investigation results of the JAIC with those of this 'Group of Experts', which is done in Chapter 41.

## CHAPTER 41

### EVALUATION OF THE JAIC REPORT AND COMPARISON WITH THE REPORT OF THE GERMAN 'GROUP OF EXPERTS'

The two reports differ substantially. Subchapter 41.1 will describe the difference in structure and in findings, which are the basis for the conclusions drawn. Subchapter 41.2 will deal with the differences in methodologies applied by the two investigating bodies.

#### 41.1 Differences in Structure and Findings

The following comparison shows the difference in the structure of both reports:

THE REPORT OF THE JOINT ACCIDENT INVESTIGATION COMMISSION	THE REPORT OF THE GERMAN 'GROUP OF EXPERTS'
<b>PART A FACTUAL INFORMATION</b>	<b>PART A FACTUAL INFORMATION</b>
Chapter 1 The Accident	Chapter 1 The Casualty
Chapter 2 Ownership and Operating History	SECTION I UNDER FINNISH FLAG
Chapter 3 The Vessel including Surveys, Maintenance, Damage & Repairs	Chapter 2 The Vessel "VIKING SALLY"
Chapter 5 The Circumstances of the Voyage	Chapter 3 Ownership and Operating History, including Surveys, Maintenance, Damage & Repairs
Chapter 6 Summary of Testimonies by Survivors	<b>SECTION II NORDSTRÖM &amp; THULIN AND THE STOCKHOLM-TALLINN SERVICE</b>
Chapter 7 The Rescue Operation	Chapter 5 The Historical Development
Chapter 8 Observations after the Accident	SECTION III UNDER ESTONIAN FLAG
	Chapter 6 The New Owners/Managers and the Take Over
	Chapter 7 Operations on Board
	Chapter 8 Emergency and Lifesaving Arrangements and Equipment
	Chapter 9 Classification - Statutory and Port State Control Inspections
	Chapter 10 Operational and Characteristics of the Vessel
	Chapter 11 Cargo Handling Systems
	Chapter 12 Operating History including Maintenance, Damage and Repairs
	<b>SECTION IV THE LAST VOYAGE</b>
	Chapter 13 The Crew and the Advisers
	Chapter 14 The Day in Tallinn
	Chapter 15 The Sjöfartsverket Inspectors and Their Trainees
	Chapter 16 The Condition of the "Estonia" and the Status of Her Main Class and Safety Certificates before Commencement of the Last Voyage
	Chapter 17 The Loading and Securing of the Cargo
	Chapter 18 Weather Forecasts/Storm Warnings
	Chapter 19 The Departure
	Chapter 20 The Route - Wind and Sea Conditions Actually Encountered - The Speed

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	Chapter 21
	Summary of Testimonies by Survivors
	Chapter 22
	The Rescue Operation
	<b>SECTION V INVESTIGATIONS AFTER THE SINKING</b>
	Chapter 23
	Search for Drifting Objects
	Chapter 24
	Locating the Wreck and the Visor
	Chapter 25
	The ROV Inspections of the Wreck Area
	Chapter 26
	Recovering the Visor
	Chapter 27
	The Diving Investigation 1-4.12.94
	Chapter 28
	The ROV Inspections in 1996
	Chapter 29
	The Wreck
	Chapter 30
	The Condition of the Visor
	Chapter 31
	The Casualty Scenario
	Chapter 32
	Unexplained Damage/ Unexplained Evidence
<b>PART 2 ASSOCIATED FACTS</b>	<b>PART B ASSOCIATED FACTS AND SEPARATE INVESTIGATIONS</b>
Chapter 9	Chapter 33
International Conventions, Legislation, Regulations and Cooperation	Bow Door Failures and Other Incidents of Ro-Ro Vessels
Chapter 10	Chapter 34
History of Ro-Ro Ferry Traffic in the Baltic Sea	Separate Investigations
Chapter 11	Chapter 34.1
Bow Door Failures and Incidents	"Forgery of Documents to hide the initial Unseaworthiness"
Chapter 12	Chapter 34.2
Overview of Separate Investigations	"Structural Analysis of Bow Visor and Locking Devices by means of the Finite Elements Analysis"
Chapter 13	Chapter 34.3
Development of the Accident	"Systematical Fracture tests with Atlantic Lock Mock-Ups"
Chapter 14	Chapter 34.4
Ownership and Operating Arrangements	"Determination of the Steel Quality of the Atlantic Lock Mock-Ups"
Chapter 15	Chapter 34.5
Strength Evaluation of the Visor and the Ramp Attachments	"Bow Impact of Ro-Ro Vessels" Chapter 34.6
Chapter 16	"Investigation Report of Video Tapes Featuring the Car/Passenger Ferry Estonia"
Analysis of the Evacuation	Chapter 34.7
Chapter 17	"Investigation Report on Possible Explosion Damage"
The Rescue Operation	Chapter 34.7.1
Chapter 18	"Supplementary Investigation Report"
Compliance with Collision Bulkhead Requirements	Chapter 34.8
Chapter 19	"Defect and Failure Analysis of the Bow Visor Structure"
Development of Regulations after the Accident	Chapter 34.9
	"Evaluation of the Video Film made on 17.09.94"
	Chapter 34.10
	"Structure Analysis of the Bow Ramp Hinges"
	Chapter 34.11
	"Calculations of the Floatability of the Bow Visor"
	Chapter 34.12
	"Breakload Calculations of the Deckbeam at Frame 159"
	Chapter 34.13
	"Comments on JAIC Report"
<b>PART C THE JOINT ACCIDENT INVESTIGATION COMMISSION (JAIC) AN INDEPENDENT BODY ?</b>	<b>PART C THE JOINT ACCIDENT INVESTIGATION COMMISSION (JAIC) AN INDEPENDENT BODY ?</b>
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	The Year 1997
	Chapter 41
	Evaluation of the JAIC Report and Comparison to the Report of the German 'Group of Experts'
<b>PART 4 CONCLUSIONS</b>	<b>PART D FINDINGS AND CONCLUSIONS</b>
<b>Chapter 20 Findings</b>	Chapter 42
<b>Chapter 21 Conclusions</b>	Findings
<b>Chapter 22 Recommendations</b>	Chapter 43
	Conclusions

Hereafter the JAIC Report is commented, wherever this 'Group of Experts' is of the opinion, that the factual assumptions of JAIC are wrong or stand correction:

#### 1. JAIC Chapter 2.1 :

*"The JAIC does not mention the statement of ex boatswain Juhani Luttunen that the lugs of the Atlantic lock on the forepeak were renewed already in 1982/83, which could be confirmed by the fact the basic primer of the starboard lugs as found on the wreck was grey while the original basic primer was yellow as found on the visor lug." (See Chapters 3.3 / 2.9 sub 8).*

#### 2. JAIC Chapter 2.2 :The following is noteworthy in this chapter:

*"Operation of the ESTONIA was under the supervision of the Navigational Department of ESCO. The crew was provided by the Personnel Department of ESCO. Two full crews were employed, manning the ship in two-week shifts each. The qualifications and training of the crew are described in Chapter 4. The master taking over a shift was required to visit the ESCO Navigational, Technical and Personnel departments for briefing. The master being relieved likewise had to report personally to the navigational department of ESCO on the situation on board. A captain's meeting was held at the ESCO office once a week attended by all masters in Tallinn on that day, including those on vacation. Regular meetings were also held on board the ESTONIA, attended by the masters, chief officers and chief engineers of both shifts and by representatives from ESCO and from Nordström & Thulin AB." That means that the Navigational Department of ESCO was responsible for the "operation of the ESTONIA" and that the master of the ESTONIA, before taking over the command of a new shift, was briefed by this department. Head of the Navigational Department was Captain Enn Neidre, who participated in all meetings at first as member and subsequently as Expert to the Estonian JAIC. Enn Neidre thus participated in the investigation of his own department's activities in the operation of ESTONIA. See also Subchapter 39.6.*

#### 3. JAIC Chapters 2.2, 2.3

- especially if compared with Chapter 12 of this Report - reveal a remarkable reluctance of the JAIC to concern themselves with the actual operating history of the vessel and the surrounding conditions, whilst it was traded under Estonian flag.

#### 4. JAIC Chapter 3.1.1 reveals

- if compared with Subchapter 2.4 of this Report - that the JAIC did not find it necessary to describe the design and construction procedures of the vessel. This is indeed remarkable as the information contained in the above-mentioned Subchapter was given to the JAIC and confirmed to them during their visits to the building yard.

#### 5. JAIC Chapter 3.2.6 :

The JAIC states here that the doors from the car deck into the centre casing were locked at sea. This is in controversy with the statements of many previous passengers who had been on the car deck at sea at their leisure (see Subchapters 12.4.4 and 12.4.5).

#### 6. JAIC Chapter 3.2.7 :

Here the following remark is found:

*"Because of the retracted position of the navigation bridge, the bow of the vessel was not visible from the conning station, as Figure 3.4 indicates."*

This statement is too superficial given the importance of the issue. The correct description can be found in Subchapter 2.5.7 above and is reiterated here for the convenience of the reader:

*"Because of the retracted position of the navigation bridge, only the flag pole on the bow of the vessel was visible from the conning station - see drawing below - whilst the most forward part of the visor could be seen through the two windows on deck level at both sides of the extended central part of the bridge, as can be seen on the drawing below." See drawing on page 110.*

#### 7. JAIC Chapter 3.2.10 :

Here the JAIC describes in detail which inspections were carried out by Port State Control and the surveyor of the Classification Society "in line with common practice and requirements". The JAIC has always known positively that neither the visor nor the forward ramp of the vessel were weather-respectively watertight. (See Subchapter 38.2.) The JAIC was at all times furthermore aware, that the vessel - on the route Tallinn-Stockholm - did not comply with stringent SOLAS requirements with regard to the position of the upper extension of the collision bulkhead above main deck. (See Subchapter 6.5.2.) Such deficiencies render any such vessel unseaworthy without any further debate. If the inspectors appointed by the Swedish government to execute Port State Control or the surveyor of the Classification Society overlook such deficiencies then such behaviour is not considered to be "in line with common practice and requirements" amongst reputable members of the shipping community. It is furthermore noteworthy that the JAIC in this Chapter describes the delivery drydocking in Turku "in 1993" without any mention of the Repair List issued by the former owners and known to the representatives of the new Owners. (See Subchapters 6.5. and 12.5. and Supplement 231 to the JAIC Report). This list - as described in detail in Subchapter 12.5 - contains the root of all the deficiencies, the further worsening of which later led to the catastrophe. Given this fact, hardly any interested reader will consider the following casual remark, which can be found in Chapter 3.3.6., to be a satisfactory description of the problem:  
*"Just before transfer to Estonian flag by the end of 1992 attention had been given to the strength of the ramp and visor locking devices and a quotation for reinforcing them had been requested by Wasa Line. However, nothing was made to the locking devices."*

#### 8. JAIC Chapter 3.3.5 :

The JAIC states here (page 42, middle column):

*"It has been stated that the lower locking bolt on the port side of the ramp sometimes failed to go to fully extended position. The standard procedure was then to retract the bolt and again command it to locked position, whereby it would normally go to fully extended position and the green indicator lamp would come on."*

Evidently the lower port locking bolt of the bow ramp could not engage the mating pocket at the ramp side and consequently also not contact the sensor because the port side of the ramp was misaligned by ca. 21/2 inches = 10 cm (diver's statement 2.12.94 - see Subchapters 27 and 29.2) which had the consequence that neither the upper port bolt nor the port ramp (pull-in) hook of the bow ramp were able to engage their respective mating pocket/mating lug. The cause for this severe misalignment was the collapse of the port outer ramp hinge - see Subchapters 12.4.3, 12.5 - by which the lugs connecting the ramp with the vessel slid off the pin respectively broke. This had been known to the technical managers and the crew since several weeks before the casualty and the crew had - according to Börje Stenström - Enclosure 12.5.166 - frequently asked for repairs by putting this item on the repair list. Although these circumstances - as stated above - rendered the ESTONIA unseaworthy they are not mentioned in the Final Report.

#### 9. JAIC Chapter 3.3.6:

Here we read:

*"After transfer to Estonian flag no more service work was carried out by the MacGregor service base in Turku as the regular maintenance was carried out by the ship's crew and, according to the new owners, no need for external service had developed. New rubber seals had, however been ordered. It was known that the play in the ramp hinges was approaching the point where corrective action would be needed."*

In this respect reference is made to Subchapters 12.4 and 12.5 where the observations of the many previous passengers are reported. Contrary to the statement of the new Owners, upon which the JAIC apparently relied, many repairs were carried out both to visor and bow ramp parts, partly with heavy burning and welding. There were frequent problems with opening of the locking devices of the visor and/or the bow ramp after arrival in Tallinn which sometimes made it necessary to tow the ferry away from the berth, turn her around and berth her again stern first. This subsequently created very substantial difficulties for the trucks to turn around and leave the car deck.

As stated by witnesses the lugs of the side locks were frequently burnt off and subsequently rewelded. In this text reference is also made to the divers' report - see Chapters 29.2 and 30 - who stated when inspecting the lugs of the side locks still in the wreck that only a very small piece of (white) visor bulkhead was attached to the lug, otherwise there were only very thick welding seams. Nevertheless there were rectangular holes of the size of the lugs in the visor plating which means that the lugs were since some time before the casualty not welded anymore to the visor plating but only stuck through the existing rectangular holes and then spot-welded from outside and/or inside which explains the extraordinary thick welding seams on the lugs. Thereby it was possible for the crew to adjust the lugs to the changing distance between visor-platings and vessel-platings which increased due to the growing misalignment of the visor. These very obvious deficiencies have apparently not been investigated by the JAIC at all and consequently also not taken into consideration when calculating the remaining load carrying capacity of these lugs. Instead the JAIC based their calculations on newbuilding standard. The JAIC continues further on page 43:

*"Minor routine welding repairs had been carried out on the mating boxes for the ramp locking bolts whilst the ship was in service in the Gulf of Bothnia."*

Actually when the vessel was in service between Stockholm and Tallinn the top plates of these mating boxes were frequently burnt off by crew members when they were unable to disengage the bolt after arrival at Tallinn. Subsequently the plates were re-welded. Reportedly this was also done after the last arrival on the morning of 27 September 1994 when the starboard upper mating box had been burnt open but the plate had obviously not been re-welded because the box is still open with no sign of the top plate. See Chapter 29.2.

*"Local welding of a crack in a stiffener underneath the mounting platform for the port side visor actuator has been noted."*

Actually the two lugs by the port visor actuator were found to have been in the following condition:

- The outer stiffener had been very poorly repair-welded some considerable time before the casualty.
- The inner stiffener was no more the original one since it did not show any protective coating and it was only spot welded to the deck - if at all. All stiffeners however were fully welded to the deck by the shipyard during newbuilding, as it can still be seen on the starboard actuator foundation.

For details see Chapter 30 - pages 990-1002. The JAIC continues further on the same page:

*"One of the visor hinge pins had, according to verbal information, a tendency to move out of position, breaking away the locking plate. This was repaired once at the Finnbody yard by pushing the hinge pin back in place and drilling for new locking bolts.*

*No other repair was, according to available information and extensive search, carried out during the lifetime of the vessel on or in the areas of the various operating and locking devices for the ramp and the visor."*

This is wrong for the following reasons:

- According to the statement of the long-term chief officer Stig Lindström ((January 1996) one of the visor locking devices had to be strengthened some time before the sale - see Enclosure 3.4.101 and in the Swedish JAIC register D11.
  - The JAIC was made aware of several statements of truck drivers that the lugs of the side locks were frequently burnt off and that the ESTONIA berthed sometimes stern first in Tallinn in July, August, September 1994 because visor and/or bow ramp could not be opened upon arrival, but subsequently, after certain repairs could be operated again.
  - Truck drivers have also directly reported to the JAIC that the port side of the bow ramp was severely misaligned, was actually hanging down and could not be properly closed since some time before the casualty.
  - Truck drivers have also reported to the JAIC that securing bolts could not be opened and therefore the top plates of the mating boxes at the ramp were burnt off.
  - Passengers/truck drivers have furthermore directly reported that the ferry after having berthed bow first in Tallinn, was subsequently towed back and turned by tugs and subsequently berthed stern first whereafter the trucks could leave the car deck only with difficulties which reports have made available to the JAIC.
  - The JAIC has in its possession a video film made by a passenger upon departure from Tallinn on 17.09.94 which clearly shows that the starboard visor hinge had been repaired very badly with disastrous effect on the load carrying capacity.
  - The as-found condition of the bushings and hinge plate parts of the starboard visor hinge arrangement confirms the above.
- The JAIC also neglected the old damages in the visor, apparently caused when the ESTONIA was used as an "ice breaker" and was forcing ice barriers several meters high at full speed according to passenger information, which are known to the JAIC. See Chapters 12.4.2 and 30.
- Also the very fresh footprints on the 3rd and 2nd stringers of the visor were not explained in the JAIC Report although the last JAIC chairman, Uno Laur, has stated that they were created by crew members when they went down to hammer open or close the bolt of the Atlantic lock before arrival and after departure from Tallinn. The reason was the impossibility to open/close the bolt hydraulically because the visor was that much misaligned and the lugs of the Atlantic lock were that much deformed. See Enclosure 12.5.175.

#### 10. JAIC Chapter 3.6.2 and 3.6.3 :

The Interim Passenger Ship Safety Certificate (PSSC) was false. It confirms that the vessel fulfills the SOLAS requirements, which however it did not in respect of the location of the upper extension of the collision bulkhead. On the ESTONIA this was the bow ramp, which was positioned too much forward. Since the Tallinn-Stockholm route - contrary to the Turku-Mariehamn-Stockholm route - leads more than 20 nm away from the nearest land, no exemption was permissible. The "partial collision door" initially offered by Meyer Werft but rejected by AB Sally against a credit of DM 45.000,00 should have been installed prior to taking up the Stockholm-Tallinn service. This was not done and thus the ferry did not comply with the SOLAS requirements and consequently the PSSC confirming this was false. The JAIC finds it appropriate to explain the failure of Bureau Veritas in the issuance of the false PSSC with words, that stem from Bureau Veritas, namely:

*"When Bureau Veritas surveyed the vessel for change of flag this was done in accordance with the requirements to the extent of a periodic survey, which did not include examination of construction drawings. The location of the extension of the collision bulkhead was thus not considered during this survey."*

It is doubtful, whether a periodic survey did suffice (see Subchapter 6.5.2.) and it may also be debated whether inspection of the structure of a passenger ship does not also include a check of the design drawings. The essential point in this case is that Bureau Veritas had accompanied this vessel since its birth and hence perfectly well knew her design. Their own form for the Survey Report as a prerequisite for the issuance of a PSSC demanded the inspector to check the structure of the vessel! (See Subchapter 6.5.2). The same is true for the Load Line Certificate, allegedly issued on 9 September 1994, which confirmed that the vessel complied with the requirements of the International Load Line Convention. This the vessel did not for the simple reason, that its hull was not closed watertight against the seas at its bow. Both parts of the double security to ensure this state, namely the visor and the ramp, were not watertight. See Chapters 12.4.3 and 12.5.

#### 11. JAIC Chapter 3.7.3 :

Here the following comments seem to be appropriate: At the time of the casualty a new Trim and Stability Booklet was not yet available, but was still in progress, therefore the PSSC and Load Line Certificates were issued only interim and B.V. had to carry out Load Line Surveys every 3 months. In relation to the Trim and Stability Booklet valid at the time of flag change which had been approved by the F.B.N. on 20.01.91 the JAIC states among other things:

*"The Commission has noted that at the inclination test, the ship's centre of gravity was positioned to starboard to such an extent that the port side heeling tank was filled with about 115 t more water than the starboard tank in upright condition. The load cases in the trim and stability manual, however, include the heeling tanks as being either both empty or both full."*

Such a condition did not exist during the initial inclination test performed in the presence of Gunnar Edelman of the F.B.N. on 21.06.80 in Papenburg and it was unknown what had caused such unfavourable weight distribution 10 1/2 years after delivery.

Had the JAIC investigated this matter and not left it as mystery, they would probably have found the same answer as this "Group of Experts", namely a hole in the underwater hull which opened a tank or void space to the outside and thereby permitted the creation of unknown weights in the vessel. (See Subchapter 17.1)

#### 12. JAIC Chapter 5.2 :

Here the JAIC states:

*"On departure from Tallinn on 27 September the ESTONIA was seaworthy and properly manned. There were no outstanding items either from the authorities or from the classification society's surveys. The maintenance standard of the vessel was good as witnessed by various instances."*

It has been stated before, that this statement is not only untrue, but that it has also been made with full knowledge of it not containing the truth. This Group of Experts is not the only one to say so.

Last - but not least - the chairman of the Swedish Masters' and Ship Officers' Association, Captain Christer Lindvall, has frequently condemned the findings of the JAIC. With good reason.

The JAIC further comments on the "Port State Control" carried out until shortly before the last departure:

*"During the last day in Tallinn the vessel was used in a training programme for Estonian Maritime Administration surveyors in the conducting of a Port State Control in compliance with the Paris Memorandum of Understanding on Port State Control (see about Paris MOU in 9.1). The trainees made a thorough Port State Control inspection of the ESTONIA and were supervised and instructed by two senior inspectors from the Swedish Maritime Administration. The exercise was documented in protocol, set up in a form according to the Paris MOU. A copy of this protocol is included in the Supplement."*

With regard to the inspection and the protocol reference is made to SUBCHAPTERS 34.1 and 36.1. Evidently several different versions of this protocol do exist with the knowledge of Sjöfartsverket and the JAIC.

*"The Swedish inspectors leading the exercise have been interrogated by the Commission and have stated that the vessel was in good condition and very well maintained. They found no deficiencies that would have caused detention or other serious remark, if the inspection had been a regular Port State Control." Contrary to the statement the Swedes have actually tried to prevent the departure of the ferry after having detected the many serious deficiencies which are noted in the protocol registered in the files of the Swedish JAIC under A 46 b - see Enclosures 15.200 - see Chapters 15 and 36.1. The JAIC continues:*

*"However, some deficiencies were noted, such as that the rubber seals for the bow visor were worn, had tear marks in some places, and were in need of replacement, and watertight hatch covers on the car deck were open and in a condition indicating that at least one was not normally closed. It was also stated during the interrogation that the Swedish inspectors had experienced "lack of respect for issues related to load line matters" in their contact with officers met during the exercise."*

Whichever protocol is the correct one, they all contained deficiencies rated 17, which means that they should have been mandatorily remedied before departure. The protocol contained in the Supplement to the JAIC Report (Enclosure 15.200) contains no less than 7 of such deficiencies, none of which was remedied before departure.

In a telephone conversation after the hearing of Åke Sjöblom and Gunnar Zahlée by the Swedish JAIC between Bengt Schager and Åke Sjöblom, the latter did state, that the ESTONIA and her crew were the worst that he had ever experienced.

#### 13. JAIC Chapter 5.3 :

The JAIC does not mention the filled void spaces at starboard side due to corroded bottom plates which are most likely the cause for the starboard list. This is hardly a condition that would be described by experts as a "*loading condition that was normal for the route*". The contrary is true. A passenger ship with unknown weights of abt. 200 mts leading to an undefined list of abt 10 degrees, which cannot be compensated by filling of the opposite heeling tank is - on this count only - unseaworthy and should under no circumstance be put to sea.

The JAIC also does not mention that according to eye witnesses from the "SILJA FESTIVAL" the ESTONIA passed the breakwater with half open visor towards the open sea. The respective statement was found in the files of the Finnish JAIC. See Enclosure 19.236 - Chapter 19.

#### 14. JAIC Chapter 6.1 :

The JAIC create the impression that they have actively participated in the interrogation of survivors, which was not the case. JAIC members and experts have only questioned one passenger - Pierre Thiger - and some of the crew members, whom they considered to be key witnesses. However, the questioning of a witness simultaneously by six or seven persons can hardly be called an "interrogation". The psychological expert to the Swedish JAIC, who wanted to interrogate all the important witnesses separately, including the passengers, was precluded from doing so by Olof Forssberg, with the exception of the purser Andres Vihmar, whom he questioned alone. The statement is not available. This means that the JAIC questioned the following crew members only:

3rd engineer Margus Treu  
 Motorman Hannes Kadak  
 Watch A.B. Silver Linde  
 System engineer Henrik Sillaste  
 Trainee officer Einar Kukk  
 Purser Andres Vihmar (only by Bengt Schager)

and decided already at a very early stage to rely almost exclusively on the statements of 3rd engineer Margus Treu and A.B. Silver Linde as far as the casualty scenario is concerned. As demonstrated in Subchapter 21.2. the numerous statements of these gentlemen are better evaluated with utmost care and when doing so another consideration should be taken into account. It is a fact well known in the shipping community, that crew members generally tend to be very loyal to their owners and, as a matter of fact, it has been confirmed by Börje Stenström to a member of this 'Group of Experts' that the Swedish and Finnish JAIC members and experts were very much aware, that the Estonian crew members were lying when it came to the most crucial parts of their evidence. Nevertheless the frequently changing statements of Margus Treu and Silver Linde became the essential evidence for the casualty scenario developed by Börje Stenström one week after the casualty.

The JAIC goes on to state:

*"Police interrogations in languages other than Swedish have been translated into Swedish and this Summary is based on the Swedish text."*  
 It has been described in Subchapter 36.5 that the statements of Estonian survivors taken in Tallinn in the Estonian or Russian languages had for example not been completely translated into Swedish and that therefore important details were missing. Therefore the summaries of the survivors' statements contained in the JAIC Report are to a certain part based on incomplete translations. It also has to be mentioned that most of the Swedish and Finnish survivors were questioned by policemen not trained to interrogate witnesses of marine casualties. Therefore most important details did not come up in the course of the questionings, because the relevant questions were never asked and thus did not become part of the JAIC investigation and cause consideration at all. Chapter 21 and the numerous statements by survivors as attached to this Report demonstrate the scarcity of the database of the JAIC Report.

There are indications that the Estonian Commission members as well as the Estonian security police and other government bodies had frequently spoken to the crew members, in particular to Margus Treu and Silver Linde. It is unknown whether these questionings were recorded, but at least, recordings are not available.

#### 15. JAIC Chapter 6.2.2 :

As demonstrated in detail in Subchapter 21.2.2 the statements of this crew member are constantly changing to the extent, that this witness must be regarded as excluded from any further consideration of this accident. It can be said with certainty, that

- Silver Linde had not been on the car deck on his last round;
- Silver Linde had never seen whether all the control lights for visor/bow ramp were still green, because the control panel was locked and the boatswain had the key;
- Silver Linde had not been back to the bridge at around 01.00 hours, because he was then already in the crew accommodation;
- Silver Linde had never been at the Reception to ask for the car deck doors to be opened, because these doors were not locked;
- Silver Linde had never been on his way down to deck 1 after the starboard heel, because he was then in the crew accommodation area (probably to fetch his relevant personal belongings such as passport, money and the like). All this is revealed from either his own testimony or the testimony of passenger survivors, who were not properly questioned by the police respectively not interrogated by the JAIC at all.

#### 16. JAIC Chapter 6.2.3 :

Treu is the main witness for the JAIC scenario, although his evidence is as conflicting as that of Silver Linde and, in addition, is in conflict with Silver Linde's testimonies when it comes to Treu observing Linde on the car deck. It is obvious that Treu's timing is about 15 minutes late when he states that the heel was about 45° at 01.30 hours, whilst the vessel was actually already on the side according to a number of other witnesses. Nevertheless the JAIC scenario is based almost entirely on Treu's wrong evidence.

#### 17. JAIC Chapter 6.2.4 :

Much more information can be found in Subchapter 21.2.4 since a member of this 'Group of Experts' was able to question Sillaste at an early stage and he was subsequently interviewed twice by journalists who gave the protocols of the interviews to this 'Group of Experts'. Two aspects remain open however, viz.:

(a) Sillaste has testified that the pumps were running to drain the water, without stating from where. Actually it can only be from compartments of the 1st deck and 0-deck.

(b) Sillaste has indicated on the drawing he made on 13 January 1996 for the Estonian Police, as he did on the drawing he made for a member of this 'Group of Experts' already in March 1995, that there was a roll at the upper part of the bow ramp. In March 1995 he said it was a tarpaulin rolled together. It definitely did not belong there and on the available videos and photos showing the closed bow ramp from the inside such a roll is not visible and also not on the videos/photos showing the car deck opening from the outside with open bow ramp. Since the bow ramp was also known to be partly open at the upper side while in closed condition - see the statement of Carl Övberg - Enclosure 12.4.2.151 - it has to be assumed that this tarpaulin roll was also some sort of sealing material, same as the mattresses, bedding, blankets, etc. at the lower side of the ramp.

#### 18. JAIC Chapter 6.2.5 :

Kadak saw at 00.46 hours a jet of water coming into the car deck at the upper starboard side of the bow ramp, but was persuaded finally by his Estonian principals (Neidre) that he had not even said so when being interrogated for the first time. Kadak stated that the heel was about 50 degrees when he and Sillaste left the engine control room and that the light went out and came back when they were at the Emergency Exit between decks 5/6 (Sillaste said the same) and further, that the heel was 90 degrees when they reached deck 8. Actually the heel was about 40 degrees when the auxiliary diesels/generators stopped and power disappeared for a short while until the emergency generator started to generate power to a limited number of consumers including all the emergency lights. Furthermore, Kadak was seen by 2nd engineer Peeter Tüür in front of his cabin window when he was climbing out of it shortly after the "Mr. Skylight No. 1 and 2" message. Actually both Sillaste and Kadak but also Treu left the engine control room much earlier as they had initially stated and that was admitted by them (Treu, Sillaste) in their last statements, which, however, are not included in the summary of the JAIC.

#### 19. JAIC Chapter 6.3.1 :

The JAIC just quotes the statements of the two sailors having been engaged with lashing and securing of the trucks and trailers and disregards the many statements of passenger/truck drivers, e.g. Per-Arne Persson, who had seen that their trucks and trailers were not secured at all.

The JAIC even adds that both sailors have testified that the bow visor was properly closed before sailing, although according to the evidence in the Finnish JAIC's files the visor was just provisionally closed and half opened again after the ferry had pulled back from her berth and the vessel finally proceeded through the breakwater with half open visor. Not a word can be found in the whole of the JAIC Report about this incident contained in their own files.

#### 20. JAIC Chapter 6.3.2 :

According to the JAIC only 22 persons survived from Deck 1, of which three were crew members, viz. Treu, Sillaste and Kadak from the engine control room, however, actually the following passengers survived (forward to aft cabins):

1. Jaan Stern - cabin 1120

- left cabin after the big heel

- water penetrated the door above the sill of his cabin

2. Neemi Künno Kalk - cabin 1122

- left cabin after big heel

- saw water on car deck level (must have run through water on 1st deck, because he had to pass the cabin of Jaan Stern)

3. Ulla Marianne Tenman - cabin 1098

- left cabin before the big heel (no detailed statement available)

4. Carl-Erik Reintamm - cabin 1094

- left cabin after the big heel and noted a lot of water in the alleyway which came from somewhere under great pressure

5. Carl Övberg - cabin 1049

- left cabin before heel

- saw water escaping under pressure from two gooseneck-type pipes into the alley-way and also penetrating the door of another room

6. Holger Wachtmeister - cabin 1047

- left cabin at the big heel and noted water in the alleyway and on car deck level

7. Antti Arak - cabin 1056

- both left cabin after the big heel and noted water in the alleyway

8. Ain-Alar Juhanson -

9. Taavi Raba - cabin 1070

- left cabin after heel and had to jump through a water curtain, saw also water on car deck level

10. Martin Nilsson - cabin 1028

- left cabin after heel, saw water on the car deck level

11. Daniel Svensson - cabin 1027

- left cabin after heel and saw water on car deck level (must have seen water on 1st deck alleyway because he was in the same cabin as Jasmina Waidinger)

12. Jasmina Waidinger - cabin 1027

- left cabin after the heel and saw water penetrating the floor in front of her cabin

13. Bengt Nilsson - cabin 1026

- left cabin after heel

- saw water penetrating car deck doors

14. Ants Nadar - cabin 1025

- left cabin left cabin before the heel and does not mention water at all

15. Andrus Maidre - cabin 1022

- left cabin left cabin after heel, saw a lot of water on the car deck through a partly open door

16. Tambet Herbert Lausma - cabin 1023

- left cabin after heel, saw water on car deck level

17. Ints Klavins - cabin 1024

- left cabin not properly questioned or incomplete statement available

18. Gennadi M. Pärson - cabin 1013

- left cabin after the heel

- no water mentioned

19. Dainis Steiners - cabin 1015

- left cabin left cabin after heel and noted water on car deck level

20. Nikolajs Andrejev - cabin 1016

- left cabin after heel, noted water on car deck level

21. Mats Finnanger - cabin 1002

- left cabin after heel

- did not mention water

This means that 21 plus 3 = 24 crew members and passengers survived from the 1st deck and not 22 as stated in the JAIC Report. From the 21 passengers, of which 9 have reported water in cabin and/or alleyways of the 1st deck, 8 were in forward cabins. The JAIC mentions that one passenger saw a "thin trickle of water" in the corridor. This was meant to be Carl-Erik Reintamm, who actually saw a lot of water under pressure rushing through the corridor. As the JAIC spoke to none of the 1st deck passenger survivors they cannot know better. No doubt, they should have gone deeper into the matter, because water on the 1st deck penetrating from the 0-deck below under pressure indicates one or more flooded compartments of the 0-deck.

#### 21. JAIC Chapter 6.3.4 :

The JAIC mentioned only statements from passengers putting the time for the heel at well after 01.00 hours, although there are in total only 13 (01.10-01.30 hours) out of 45 survivors having made time statements. On the other hand, the JAIC has quoted from some of the statements correctly that there had been impacts to the vessel before or after the big heel which made the survivors believe that there had been a collision. This refers in particular to Pierre Thiger in the Pub Admiral, the only survivor interrogated by Olof Forssberg because he, Pierre Thiger, had insisted on being questioned. However, none of this very detailed and valuable evidence - see Enclosure 21.3.3.19.1 - is contained in the JAIC Report.

#### 22. JAIC Chapter 6.3.5 :

Again only such statements are quoted which put the time for the heel well after 01.00 hours.

#### 23. JAIC Chapter 6.3.6 :

The statements quoted in the Summary include those of deck passenger Valters Kikuts, who stayed together with his friend in the port stairway behind the windows facing the forecastle deck visor. Reportedly he had told the JAIC that he had seen the visor moving up and down, which he later denied, and that the visor was moving forward/aft and that a transverse gap opened/closed between visor and forecastle deck - a clear indication that the hinges were broken. He further testified that water was gushing out of the gap when the vessel was diving into a wave and that water was surging into the gap when the bow was rising, which makes sense as a moving up and down of the visor is not possible as long as the actuators are connected to B-deck, because the actuators follow the opening movement, however, resist the closing.

#### 24. JAIC Chapter 7 - The Rescue Operation

- has been investigated by the JAIC in great detail, but has not been part of the investigation of this 'Group of Experts' except for the "Distress Communication" which is explained in detail in Subchapter 22.1. The JAIC does not mention the possibility that there had been an earlier "Mayday". As no one on board will ever admit to have heard an earlier "Mayday" without having reacted, it is very well possible that there had been an earlier "Mayday". This was at least reported by the watch A.B. of a big Swedish ferry in the area - see Chapter 22.1. The notes taken during the telephone conversation with an anonymous caller are attached as Enclosure 42.485. The JAIC also does not mention the Estonian car/passenger ferry "BALANGA QUEEN" (bareboat chartered), which was on way from Travemünde to Tallinn in the vicinity of Cape Ristna when the casualty occurred, however, was instructed by the Estonian Coast Guard to proceed on to Tallinn. The vessel is only mentioned in the JAIC Report to have participated in the search during the afternoon of 28 September, when she was already on her way back to Travemünde. It is also strange that the distress communication picked up by the "BALANGA QUEEN" and her offer to help is nowhere mentioned.

#### 25. JAIC Chapter 8.1 :

It has to be mentioned that the survey vessel "SUUNTA" stayed in Hangö during the 28th when the weather was relatively bad and the wind speed was 16/18 m/s. On the 29th and the 30th the wind speed was just 12 m/s, however, "SUUNTA" departed only on 30th at 08.40 hours from her berth to the casualty position, which was, of course, known by the Utö and the "MARIELLA" radar observations. She commenced the search at 16.27 hours and found the wreck at 17.32 hours on 59°22,92'N; 21°41,06'E, which is the actual wreck position. She dropped a buoy and returned at 18.45 hours to Hangö. Consequently the real position of the wreck was known to the Finnish authorities from the very beginning, and with certainty also to Kari Lethola. Nevertheless, he reported 59°23,0'N; 41°43'E by fax to Olof Forssberg on the same evening and, furthermore, Sjöfartsverket took up in their tender specification for the diving investigation sent out to various contractors in Northern Europe a wreck position which is 2100 m to the NNE of the actual one.

As for the further mysteries surrounding the fairly simple task of finding a wreck the size of ESTONIA at just 80 m of depth, the reader is referred to Chapter 24.

#### 26. JAIC Chapter 8.2 :

It is noteworthy that the videos produced on 5/6 October and in 1996 are not mentioned by the JAIC - see Chapters 25.1-25.3 and 28. The JAIC here seems to create the impression that the vessels used, viz. the "HALLI" at first and "TURSAS" subsequently, were engaged exclusively by the JAIC which according to the logbook entries of both vessels however is doubtful. These entries indicate that the vessels, manned with navy personnel and operating under the command of the Western Fleet (Finland), primarily performed military activities.

#### 27. JAIC Chapter 8.4 :

The Report does not state that the diving survey described here was not the first ordered by the Swedish Government. The JAIC furthermore just spends a few lines on this major operation carried out by very professional contractors on behalf of Sjöfartsverket. The evaluation of the video tapes presented to this Group of Experts show that this operation was conducted simultaneously with another diving investigation by other divers. Since it has to be excluded that this second operation could be carried out without the divers and the operators and supervisors on board of the diving support vessel "SEMI I" noting it, it has to be concluded that this other diving operation was also performed with the approval of or by Swedish governmental authorities. It is noteworthy, that no tapes or written documentation of this second operation have ever been released by the Swedish authorities to the public. They are however available. It has further to be mentioned that the Finns obviously tried to hide the presence of Tuomo Karppinen onboard - see Chapter 27 - the reason probably being the attempt to leave the responsibility for the many obvious mistakes made with Börje Stenström being the only "official" participant on behalf of the JAIC.

These mistakes were:

- the failure to instruct the divers to search the bridge properly for bodies and identify the bodies by means of their uniforms (or not wearing uniforms at all);
  - the failure to have the front bulkheads, the longitudinal bulkheads and the recesses on both sides of the bow ramp, the locking devices of the bow ramp and the ramp hooks examined properly by the divers;
  - the failure to have recovered at least the port visor hinge bolt with bushing, the lugs of the visor side locks and the whole bow ramp with hinges, just to mention the most important items;
  - the failure to have examined by the divers why the starboard stern ramp was open;
  - the failure to have the starboard side of the wreck above the mudline including the starboard stabiliser video filmed and properly recorded;
- In summary it has to be concluded that the wreck examination by the JAIC was carried out very poorly and insufficiently which is also reflected in the description of the damage to the wreck in the following chapters.

#### 28. JAIC Chapter 8.5.1

- General Condition of the Wreck - where it is stated:

*"No external damage other than that in the visor and forward ramp area was observed on the wreck."*

This is wrong because other substantial damage exists such as:

- Bridge: The steel plates of the underside of the port bridge from the superstructure to the outside were completely torn off, with the support stanchion smashed forward and broken off;
- Aft accommodation: The port aft accommodation area of decks 7 and 8 was distorted and pressed in.
- Foreship:

- o the starboard front bulkhead was cracked off the forepeak deck, hull plates and the inner bulkhead;
- o the port longitudinal bulkhead was cracked open from forward into the car deck, including the area below the control panel over several meters.

- Aft ship: The starboard stern ramp is evidently open.

- Bottom and bilge strake area: The starboard side above the mudline was noted to be holed several times. These are just the most obvious damages noted on the publicly available videos, however, it has to be assumed with certainty that there is much more damage at the starboard side above the mudline, which was cut away from the publicly available videos - see Chapter 34.6.

#### 29. JAIC Chapter 8.5.2 :

The damage in the bow area is allegedly summarised in the drawing 8.1 on page 120. This is misleading.

The drawing does not show

- the damages mentioned above, i.e. the cracked off starboard front bulkhead and the large holes in the longitudinal bulkheads;
- the missing and damaged rubber packing of visor and bow ramp;
- the cracked off outer starboard girder of the bow ramp, just to mention a few examples, instead
- pounding damage is indicated where is no such damage;
- the port outer and inner hinges of the bow ramp are indicated to have failed, which they did but some time before the casualty;
- "deep indentations" are just indicated at the lower part of the bow ramp, i.e. in way of the contact area with the forepeak deck, in case the ramp should have been fully open, although all transverse girders up to the flaps are very heavily distorted in way of the centre line.

In summary the JAIC again indicates existing or non-existing damage the way it fits their casualty scenario. Missing rubber packings, cracked open bulkheads and distorted, cracked off girders, which obviously cannot have been caused during the hypothetical casualty scenario of the JAIC are either not mentioned or misinterpreted.

Some details:

- The JAIC states that the visor parking devices (harbour securing) were undamaged, but do not state that they were open (this means that there had to be "one red light" on the control panel when it was allegedly checked be Silver Linde - see Chapter 21.2.2.).
- The JAIC states that "the opening in the front bulkhead on the port side had rather clean cut contours", which is true, however the JAIC does not state

that the starboard front bulkhead was completely ripped open from the inside to the outside, that a green painted deck piece is sticking in the opening and that the starboard side corresponding to the photo at Fig. 8.2 is just a big black hole of the size that the diver could crawl into it.

- The mounting bracket for the locking-bolt position sensors, in short the sensor plate of the Atlantic lock, was found to be empty with corroded screw holes indicating that the sensors had been dis-connected some time before the casualty;

- The sensor cables were clearly cut - not torn - all of which is not mentioned in the JAIC Report. Moreover the sensor plate as well as the cables had been cut off by the divers in December 1994 and thrown away to the sea bottom, thus disappeared forever, under the eyes of Stenström. There was indeed substantial damage to the rubber seals and flatbar housings in the "corner of the mouth", however not or rather limited to the forepeak deck.

- Pounding damage was noted in way of the stempost area, but only to a very limited extent to the edges of the forepeak deck.

- The bulbous bow does not only show scratch marks, but 3 partly deep indentations indicating very heavy contact because the bulbous bow is a very strong structure.

### 30. JAIC Chapter 8.5.3 - Visor Damage :

At first the JAIC describes the big indentation in the starboard shell plating of the visor in a misleading way creating the impression that it was only one indentation, although there are actually two, i.e. the upper part is of older and different characteristics and the lower larger part is extending into the older upper part as can be seen in Figure 8.5. The JAIC uses repeatedly the term "pounding" when describing the damage to the visor bottom and alleged damage to the edges of the forepeak deck, although the visor bottom is severely distorted and pressed in which occurred obviously when the visor had moved that wide forward that the stempost area was extending the forepeak deck and thus had lost its carrying function. As a result the forepeak deck was pressed into the visor bottom with the visible result. The only "pounding" which actually occurred was within the play of the locking devices. This had created the low banging noises heard by many passengers before the casualty on this voyage and also already on previous voyages. On pages 122/123 of the JAIC Report the visor and parts of it are shown on 7 photos (Figure 8.4 - 8.10) in a very particular way.

Fig. 8.4 shows the visor looking from aft to forward and starboard to port. The picture shows the damage to the port inner longitudinal bulkhead and the deep indentation on the port side of the upper cross beam. Both damages can be seen in more detail on Figure 8.7. What is not shown is the opposite port side: There is absolutely no damage, i.e. the starboard inner longitudinal bulkhead does not even show scratches in the paint and the port side of the upper crossbeam just shows paint scratches. The explanation for this damage being restricted to the port inside of the visor is the apparent fact that the vessel was considerably heeled to starboard when the lugs underneath the visor arms (visor lugs) broke through the front bulkheads of the vessel and did not support the visor any longer against moving to starboard. The visor fell for about 100 mm to starboard until the port inner bulkhead of the visor was resting on the bow ramp then lying inside the visor already on the vertical and crossbeams. This impact caused the up to 360 mm deep indentation on the port inner bulkhead of the visor. There is corresponding damage in way of the port upper side of the bow ramp - see Chapters 29, 30, 31 (Casualty Scenario).

Figure 8.7 also shows the port inside of the ramp house with the last two of nine frames of the aft part of the ramp house bent. That is to say that actually only the last frame (P4) at port side was pressed together while the next one (P3) is only slightly indented, the next one (P2) even less and P1 just shows a slight contact mark and the remaining frames towards the starboard side are unaffected. See pages 955 ff. in Chapter 30.

Figure 8.9 does not show the starboard side (outside) of the port, but of the starboard actuator attachment lug (visor lug) with deep scorings and green (deck) paint marks indicating frequent forward/aft movements of the visor when the visor was tilted down by different angles. The JAIC does not show pictures of the inside (port side) of this starboard lug and also not from inside and outside of the port visor lug, thereby depriving the reader of the possibility to draw conclusions from the conditions of these lug plates as to movements and tilting angles of the visor. The respective pictures are shown in Chapter 30 on pages 973 and 996. It reveals that both the outsides and insides are deeply scored at starboard side, though differently, i.e. much more and deeper at the outside and at the inside only one main scoring line almost parallel to the forecastle deck.

At port the outside of the visor lug plates is totally unaffected, i.e. not even paint scorings, while the inside is very deeply scored, almost engraved indicating forward/aft movement of the visor at varying tilting angles.

The obvious fact that the starboard outside and the port inside of the lug plates were most severely scored leads to the conclusion that the vessel was already heavily heeled to starboard when the hinges broke, first at starboard and subsequently at port, because the obvious fact that the port outer lug plate is not scored at all indicates that the vessel must have been heeled to starboard already quite considerably when the port hinges broke because there was no contact between the lug plate and the deck/deck beam.

Figure 8.8 shows damage below the recess for the port locating horn which was obviously caused by the port locating horn at a time when the port hinges were broken already, because the visor was in raised condition as otherwise the locating horn would be resting deeper and higher in the recess as confirmed by the contact marks at both sides of the recess.

Figure 8.10 shows the big visor lug being part of the Atlantic lock installation. It shows the bore to be elongated, but it cannot be seen that the hole lug is bent to starboard, it almost cracked off the visor bottom, obviously when the visor moved the above explained ca. 100 mm to starboard, a very strong indication that the Atlantic lock was at that time still intact. The JAIC picture also does not show the flame cut-off part of the lug with two deeply penetrating cracks having started in one of the burning marks. For details see page 1028.

Figure 8.11 shows a rather foggy picture of the port outer bow ramp hinge (the JAIC has crystal clear pictures in particular from this area) which is again described in a misleading way. The lines allegedly point to "rags" are actually pointing at a thick blue mattress at the upper side and the bed-cloth at the right which were put there by the crew as "sealing" material because there was a gap of some centimetres between bow ramp and bulkhead in this area since the hinge had failed several months before the casualty. The bolt is visible in a declined condition much too far to starboard. The brown lug visible at the upside slipped off the bolt several months before the casualty where after the other one broke. The JAIC is wrong when stating that the aft deck plating of the visor had heavy pounding marks. Just in the recesses at the port and starboard side there are some contact marks, otherwise there are no indications of pounding in way of the deck plating.

### 31. JAIC Chapter 8.5.4 - Ramp Damage corresponds to Chapter 29.2, item 6.

The JAIC writes:

*"The condition of the ramp was inspected primarily from its lower side due to the limited access to the upper side."*

This is wrong. The ramp was accessible at the upper side as well as the lower side, from the inside and from the outside. The divers went everywhere - even inside, i.e. the car deck side - and everything is on video.

The JAIC writes: *"The 2 port side hinges at the bottom the ramp were torn apart"*, thereby creating the impression that this occurred during the casualty. This is wrong. The heavy port hinge should have been renewed already in January 1993 according to the specification of the last Finnish crew of the vessel. See Subchapters 3.4/6.5.1. This was ignored by the new technical managers N&T and nothing was done. As time went by the bolt of the port outer hinge worked itself more and more to starboard, broke the securing plate and, finally, the outer lug connecting the ramp to the vessel via this hinge bolt, slipped off the bolt which caused the failure of the inner lug as well. The ramp was no more connected to the vessel at the port outside, a gap of some 20-30 mm occurred which increased. See memo about the discussion with Stenström in October 1995 - Enclosure 12.5.166. The car deck was open to the at sea always water-filled visor. According to Stenström the damage was frequently put on the repair list, however, repairs were rejected by N&T. It is unknown when the port inner hinge of the bow ramp broke, however according to the damage picture it might well have been sometime before the casualty. The two starboard hinges of the bow ramp are just elongated.

The JAIC writes: *"Both hydraulic actuators for the ramp had failed in their piston rod end eyes, i.e. at the ramp attachments points."* That is correct, however, the starboard piston rod broke twice, once in the eye and another time between eye and piston.

The JAIC continues: *"The actuators were in partly extended position as when the ramp is partly open."* This is wrong. The starboard actuator is not visible at all. Its opening in way of the recess of the starboard front bulkhead is almost covered by the bow ramp resting on the recess and what is visible is torn and deformed. The JAIC fails to mention that the starboard landing of the bow ramp to which the attachment points were fitted was completely torn open (inside to outside) and severely distorted. The port actuator is visible inside its housing in slightly open condition. On one video it is completely inside the housing, on another one it is slightly extending to the outside - see pages 836, 837. Apparently the divers did change the condition of this actuator. Also inside this housing an angle iron is visible which obviously had been pressed into the bulkhead plating in way of the lower side of the opening. See Chapter 29.2 - item 6 - pages 832, ff.

The JAIC writes that the *"wires preventing the ramp from falling down to the forepeak deck had detached from the lugs on both sides of the ramp"*. That is true, both ramp lugs are intact and without wires, which are however both still connected to the attachment points at the upper car deck opening. The starboard wire is full length visible to the intact lug with shackle and bolt attached. The bolt is apparently intact and screwed into the shackle which raises the question who did unshackle the wire from the ramp lug and screwed the bolt again into the shackle? Needless to say that all this is, of course, not mentioned in the JAIC Report.

The JAIC: *"The ramp port side beam was damaged in several places, mostly towards the top end"*. Meant is probably the port outer vertical girder, which is only slightly damaged at its bottom part between the lower and the next upper transverse girders. It is also possible that the JAIC means the damage at the port upside, outside of the ramp which was caused when the visor was resting on this part of the ramp.

The JAIC: *"The lugs for the pull-in hooks were twisted."* Actually both lugs are intact, i.e. not broken, but heavily bent away from the location of the pull-in hook and on the ROV video from 09.10.94 there are two wooden pallets visible which jammed in between the bulkhead recess and the bow ramp in way of the landing of the lug for the pull-in hook. On the diver videos from December 1994 these pallets were no more at this location, which means that the bow ramp must have been opened and closed.

The JAIC continues: *"The hooks themselves could not be inspected closely."* This is wrong. The port hook arrangement including actuator is fully visible on the available videos and was also checked by the diver Dave Mawston: *"There is a latching mechanism."* The port hook is in its initial position and intact which means that it cannot have been engaged before the casualty respectively if it was engaged upon departure Tallinn it must have been

opened at sea before or during the casualty. The starboard hook is not in its initial position, where it should be is a big black hole.

The JAIC continues: "The boxes on the ramp side bars, mating the bolts of the ramp side cleats were twisted to open position except for the lower port side one." This is wrong: None of these mating boxes were twisted to open position, i.e. the port upper one was completely intact but just slightly bent upwards, the port lower one was completely intact with a rope wound around it, the starboard upper one was intact with the upside missing (had been burnt off upon arrival in the morning of 27 September 1994 by flame cutting when the crew was again unable to disengage this securing bolt). Obviously there had been no time to re-weld the cut off part to the box before the last departure. See also chapter 12.5. Finally the starboard lower box was completely smashed together in a way that the bolt was unable to enter the box. This damage was apparently caused earlier when the ramp had been closed when the bolt was already extended.

In addition attention has to be drawn to the reports of diver Dave Mawston when checking the ramp. He found that the extended bolts at the port side of the ramp were about 21/2 inches = ca. 100 mm below the respective mating boxes, i.e. none of the port side bolts could anyway have engaged their mating boxes and this is apparently also the reason why the port pull-in hook had not engaged its mating lug. All this was obviously due to the very severe misalignment of the whole ramp and its disastrous consequence - nothing of it is mentioned by the JAIC.

### 32. JAIC Chapter 8.6 - Damage to Visor and Ramp Attachment Devices :

8.6.1 The Visor Bottom Lock (The Atlantic Lock) : JAIC: "The remains of the attachment lugs and the locking bolt were removed from the wreck during the diving operation for close investigation." The locking bolt was brought up by the divers but thrown back into the sea by Stenström, thus it could never be "closely investigated". Nevertheless the JAIC writes: "Only a slight variation in diameter was measured at the contact area between the bolt and the visor lug. No other damage to the bolt was noted."

This is wrong. Although the bolt is not available for close examination the following can be concluded from the quite good video footage:

- there were two contact areas indicating that the bolt was sometimes fully closed, sometimes only partly;
- the vertical steel bracket fitted to the bolt was bent to port and showed heavy hammering marks at its edges;
- the two lugs, between which the piston rod was connected to the bolt by pin, were bent outwards, i.e. away from each other, and also showed heavy hammering marks.

The reason for these damages were the problems the crew had with closing and opening the bolt which did not function any more hydraulically since some months before the casualty because the lugs were severely deformed. See Chapter 12.4.3 and 12.5.

The mating lug of the visor was already discussed further above.

### 33. JAIC Chapter 8.6.2 - The Visor Side Locks :

The JAIC writes: "The port side lug had rotated as far as it could in the recess in a direction indicating an upward movement." Taylor made for the JAIC scenario, but it is wrong. On the ROV videos from 02.10.94 and 09.10.94 the port lug was not extending the bulkhead, the lug condition visible on the picture, Figure 8.17, has been created by the diver. The starboard lug, however, was indeed pointing out of the bulkhead.

The hole above the side lock in the front bulkhead stated to be punched in by the manual hooks was actually not punched in but torn out, i.e. the plating was bent inside to outside - see Chapter 32. The condition of the lugs and its welding seams in relation to the visor plating shall be discussed in Chapter 12 - Overview of Separate Investigations.

### 34. JAIC Chapter 8.6.3 - The Visor Hinge Arrangements :

It is already visible from the pictures - Figure 8.21-8.24 - that the starboard hinges were in a much worse condition than the port one with deep burning marks and deeply penetrated cracking, however, the comments shall be made under Chapter 12 - Overview of Separate Investigations - in order to avoid repetitions. It was another unforgivable mistake from Stenström not to arrange for the two hinge bolts - one with the bushing still attached - to be recovered.

### 35. JAIC Chapter 8.6.4 - The Visor Actuating Arrangements :

The explanations of the JAIC concerning the failure of the port actuator foundation, called bottom mounting platform, is confusing and partly wrong. The initial construction and the damage picture of the foundation is explained in detail and illustrated by several photos on pages 990 ff. of this Report. The summary reads as follows:

"(1) The outer stiffener of the port actuator foundation shows an old temporary repair with very poor welding seams in its forward part. Due to the corrosion visible on the previous photos it has to be assumed that this improper repair was carried out already some considerable time before the casualty.

(1) The stiffeners show relatively straight cracks directly below the forward and the aft ends of the lug plates. Therefore it can be reasonably assumed that the stiffeners were affected by fatigue cracks and thus pre-damaged. The cracks had developed during some considerable time before the casualty due to load changes during the opening and closing of the visor.

(2) The B-deck was also affected by fatigue as already explained for the stiffeners. This fact is indicated by the condition of the ripped off deck remains.

(3) The port inner stiffener was no more the original one since firstly it did not show any protecting coating and secondly was only spot welded to the deck - if at all. All stiffeners were however fully welded to the deck by the shipyard during new-building, as it can still be seen on the starboard actuator foundation.

(4) The load carrying capacity of the port visor actuator was considerably reduced."

The JAIC explanations about the failure of the starboard actuator is accepted, however except for the following remarks by the JAIC:

"The lugs for connecting the actuators to the visor deck beams showed indentations and scoring on the forward and starboard side faces (Figure 8.9). The sealing arrangement around the deck openings for the actuators, consisting of rubber seals supported by steel flat bars, was compressed over most of the surface and some paint marks showed that the hinge arms had been in limited contact with the deck plating."

The "lugs for connecting the actuators to the visor deck beams" were called "actuator attachment lugs" in the previous Chapter 8.5.3 and were actually the pair of lugs underneath the port and starboard visor arms (called visor deck beams by the JAIC) by means of which the actuators were connected to the visor. The condition of the lug plates, i.e. starboard outside: deeply scored, starboard inside: slightly scored: port outside: no contact marks at all: port inside: very deep scorings; has been explained and commented under Chapter 8.5.3 above and needs not be repeated.

The JAIC is also wrong when stating that "the rubber seals supported by steel flat bars (around the deck openings for the actuators) were compressed over most of the surface" because this is the case only at port side where the rubber seals were indeed distorted apparently by rubbing. See pages 996 ff. The starboard side rubber seals are, however, unaffected. See pages 973 ff. The forward parts of the port and starboard lug plates show contact marks without paint at their upper parts, which were apparently caused when the lug plates were cutting through the forecastle deck plating. Below these areas there is more or less unaffected or just slightly affected white/red paint at starboard side all the way down, but at port side there are further contact areas without paint.

Bearing in mind the strong deck beam at frame 159 which the lugs at both sides reached after only 120 mm of 8 mm forecastle deck plating were easily cut through and which was evidently cut through at both sides, it is difficult to believe that this was performed by the above explained foreparts of the two starboard and two port lugs. Calculations revealed - see Chapter 34.12 - that weight and forward momentum of the water-filled visor were theoretically able to cut the deck beam, however the damage picture of the cutting tools - the lug plates, and in particular, the starboard ones, do not confirm this.

This problem has been closely examined by The Independent Fact Group, Stockholm, who more or less proved that the lugs could not have cut the deck beam, however, do not offer a reasonable solution but leave that to a new investigation.

As to the starboard side the possible explanation is outlined in Chapter 32 - Unexplained Evidence - because there are several indications that a powerful explosion occurred also inside the void space above B-deck, which blew open the front bulkhead and possibly also destroyed the deck beam in question before the hinges broke.

At the port side, however, there are no such indications. Here the answer might be that the deck beam was cut by the piston rod of the partly extended actuator. The piston rod is made of high tensile steel. See Figure 8.25 in the JAIC Report.

Finally the remark of the JAIC that "some paint marks showed that the hinge arms (now the visor deck beams) are called hinge arms to confuse the reader even more) had been in limited contact with the deck plating" has to be totally rejected because not even the primer is affected.

Note: This "contact" between the undersides of the visor arms and the forepeak deck in front of the deck openings for the actuators has been one of the strongest arguments in favour of the JAIC casualty scenario presented in the Part-Report published already early April 1995. The argumentation of Stenström then was that "as soon as the visor bottom was compressed deeply enough due to repeated up/down pounding of the visor the underside of the visor arms did rest on the forepeak deck and due to the leverage created the hinges broke". This was proven to be wrong and the above is the rest of this line of argumentation and even that is wrong.

#### 41.2 Differences in Methodologies

When this 'Group of Experts' set out on its assigned task there was considerable experience in writing and structuring of similar reports especially with Capt. Hummel. But then there was the Report of the Court compiled under the direction and written by the Hon. Mr. Justice Sheen on the capsizing of MV HERALD OF FREE ENTERPRISE. A similar accident, brilliant in its clarity and style and - so we still think - an ideal example to use. Justice Sheen in the descriptive part of his Report used the "historical" method in compliance with general practice in writing such reports. The facts are presented in timely order. This 'Group of Experts' hence applied this method as well but adjusted it as far as possible to the different methodology applied by the JAIC in the compilation of their Report in order to ensure comparability of the texts of both reports as best as possible. (See Subchapter 41.1.)

The Report of Justice Sheen sets a further example: It compiles all facts relevant to the casualty without regard to source and consequences. No facts are disregarded. Facts deemed relevant which however could not be clarified were clearly marked as such. This 'Group of Experts' has accepted this standard and attempted to adhere to it to the fullest extent possible. There were however additional problems in this investigation. Those who had information and knowledge pertaining to the sinking of ESTONIA were often unwilling to share it with this 'Group of Experts' or purposely mislead us by offering wrong information. Evidence was destroyed or manipulated. This 'Group of Experts' has therefore augmented the standard by the rule, that facts are only considered to be true if and when they are confirmed by other information.

Last but not least Justice Sheen sets a third example when he draws conclusions only that are fully supported by and not in contradiction with the facts collected and found to be correct. This 'Group of Experts' has accepted that standard as well and complied with it.

The methodology of this 'Group of Experts' can be summarized in three sentences:

1. Collect and describe all facts provided they pertain to the Casualty.
2. Ensure confirmation of the facts and state which relevant facts are not obtainable or not ensurable.
3. Draw conclusions only provided they match with all confirmed facts.

The JAIC - according to their own statements - applied a completely different methodology. They commenced their work by the establishment of a hypothetical assumption of the cause of the accident. Already on the 1.10.1994 Kari Lethola informed the press, the JAIC strongly believed that failure of the visor caused the casualty. See Subchapter 37.2 . On the 17.10.1994 the JAIC published their 2nd Interim Report containing the assumption that the visor had separated from the ship as a result of failure of all three locking mechanisms. When this statement was made, the accident had just happened 19 days ago, the visor had not even been officially located - that happened a day later - see Chapter 24 - and it took another month before it was brought to the surface for inspection on 18.11.1994 - See Chapter 26 - and another two weeks before it was inspected on 2.12.1994 - See Subchapter 37.2. In a press release of 16.12.1994 the JAIC was already able to confirm its opinion that the strength of the locking devices for the bow visor in combination with the sea loads on the visor in the prevailing wave condition and headway of the ship was the main cause of the accident.

For investigators to work out a theoretical assumption first and then to see whether the facts fit into it, is unusual because such procedure contains the danger of a biased selection or treatment of facts given the nature of human beings. Such method does not merit criticism however if and as long as the investigators have the will and the intellectual flexibility to abandon their preconceived assumptions if not all the facts fit them.

Despite numerous discussions between the members of the two investigating bodies, described in detail in Subchapters 38.1 to 38.3 and the presentation of new facts by this 'Group of Experts', the JAIC on 02.04.1995 published its Interim Part-Report the conclusions as to the cause of the accident had not changed, which did not surprise us, but we were stunned to read that the findings published in this interim report 2,5 years before the publication of the Final Report will remain unchanged See Subchapter 38.3.

The fact that the JAIC did not find a path out of its own prejudice was however by far not the worst malpractice exercised by them in the course of their investigation. Contrary to generally accepted standards again emphasized by Justice Sheen the JAIC from the very beginning of its investigation destroyed evidence vital to any attempt to find the actual cause for the catastrophe. An outstanding example is the bolt of the Atlantic Lock. Having established and published that it was the locking devices, which had failed due to faulty design; the JAIC should have made every possible effort to present the essential piece of evidence to prove their allegation. If nothing else fairness and decency vis-à-vis the accused builder should have commanded such action leave alone the order of the three Prime Ministers, who had founded the JAIC, to find the true causes for the disaster. Given the importance of this piece of evidence the reason for dumping it into the sea and thereby into oblivion can only be qualified as affront: against everybody affected by the catastrophe: It seemed more important to Mr. Stenström to take the ship's bell with him in the helicopter and it did not appear to him that the bolt could have been sent by normal surface mail if he attributed such importance to the bell. For the sordid details see Chapter 27.

But evidence was not only destroyed, it was also tampered with to an extent unheard of in modern history for an investigation instituted by Westeuropean governments. Again one example will suffice. Reference is made to Chapter 34.6 where the manipulation of the underwater video-tapes is described.

As the reader might now assume evidence was also disregarded when it did not fit into the hypothetical assumptions. Again just one example out of all those described in the previous Chapters of Part C of this Report: The recordings made with video cameras of the wreck by divers of the Swedish Navy, when they surveyed it in the first days of the month of October 1994 and those of the divers, who were in the wreck during the investigation of the wreck by the divers of Rockwater A/S have never been presented to the public although members of the JAIC were present on the diving platform at least during the inspection by the divers of Rockwater A/S. See Chapter 27 and Subchapter 34.6.

#### 41.3 Summary

In comparing the two Reports the following conclusions seem appropriate:

**1. The Report of the 'German Group of Experts'**

Apparently this investigating body was overwhelmed by the magnitude of facts they have collected in the course of their investigation. Although all these facts pertain to the casualty, reading and memorizing them is a nearly impossible task. The reader is therefore sometimes thankful for repetition. The Report assures the reader however that no fact was "left out" whether important for the conclusions or not.

The conclusion drawn on the status of the vessel when she left Tallinn on her last voyage is convincing. A Passengerferry, which carries a false PSSC, is open to the Sea at her bow allowing the sea to gain access to the car deck uncontrolled and finally sets to sea with an unexplained list of 10 degrees - imperfectly corrected by counter ballasting of the port heeling tank - which was however due to a holes in the underwater hull, is unseaworthy to an extent which renders this verdict undebatable.

Whether the casualty scenario complies precisely with the last chaotic minutes of the vessel might be debatable. There are indications of further facts not yet known or still unconfirmed which - if found correct - might necessitate some change in the described scenario.

In methodology the Report complies with good practice. and is insofar based on the Court Report of Justice Sheen on the Capsizing of the HERALD OF FREE ENTERPRISE.

**2. The Report of The Joint Accident Investigation Commission of Estonia, Finland and Sweden**

The layout and presentation of the Report are impressive. Also here the amount of facts collected is stunning but - to compare - it should be noted that this Report deals with quite a few subjects, the German authors have not concerned themselves with.

The casualty scenario is not convincing. It is indisputable that the ramp is still fixed to the wreck. Had the ship indeed steamed against the sea with her ramp resting on the forepeak deck, the ramp would no doubt have been torn off by one of the first waves hitting it in that status.

The Report furthermore reveals an astonishing lack of basic knowledge of seafaring. A vessel of 14,5 years of age which has been subjected to substantial strain, as ferries are, does nowhere in its structure show the same criteria it had as a newbuilding. Fatigue and corrosion are every vessels worst enemies. And furthermore: No shipping expert puts much weight on the statements of crew members after a collision or other accident for which the faulty party is being sought.

There are however other problems with the JAIC Report which actually render it worthless:

The first such problem is the composition of the JAIC. Member of same was Mr Neidre. Mr Neidre was the head of the Navigation Department of ESCO still at the time of his participation in the investigation. The investigation of the activities of precisely this department in conjunction with ESTONIA was one of the tasks of JAIC.

Neidre therefore did indeed investigate his own doings. And he kept doing so even after his dismissal, tolerated by the other members of the JAIC. One of the few principles that are generally accepted in democratic states is that no judge or civil servant is allowed to make a decision in the exercise of the public powers vested into him/her which concerns himself. Any violation of this principle renders such decision invalid and subject to removal by the judiciary.

The second problem are the methods chosen by the JAIC for the treatment of evidence. The destruction, manipulation and suppression of vital evidence by public servants in the execution of their duties constitutes a behaviour totally unacceptable in democratic societies and usually subjects the offender to criminal prosecution. The evidence presented by the German 'Group of Experts' for such treatment of evidence vital to the investigation into the causes for the ESTONIA catastrophe is - unfortunately - overwhelming.

The two flaws in the Report of the JAIC described above disclose a third, namely sloppiness. Whether the JAIC had instructions to perform an investigation with predefined outcome - as is indicated by remarks of Mr. Meister and Mr. Stenström - or whether they did not adhere to such instructions or - finally - whether they were never given to them is irrelevant because by application of due diligence owed by public servants to society the Report would have been flawless in any case. As matters stand now the Report of the JAIC can best be described by repetition of one phrase used by Justice Sheen in his Court Report: From top to bottom the Joint Accident Investigation Commission of Estonia, Finland and Sweden was infested with the disease of sloppiness. It is however appropriate to add here the words "and dishonesty", because the members of the JAIC knew or must have known that their sloppiness would result in harm to all those affected by the catastrophe who had put such great hopes on the due fulfilment of their duties by the members of the JAIC.

Despite the lack of excuse for sloppiness and dishonesty of the magnitude found here, two persons bear special responsibility for the failure of the investigation of the JAIC : Mr. Olof Forssberg and Mr. Kari Lethola. Both are trained legal minds and have been the appointed chairmen of the official accident investigation bodies in their respective countries. It seems inconceivable that they could permit the work of the JAIC to be stained with the flaws described. Whatever their duties were, they have both completely failed in their execution.

## CHAPTER 42

### FINDINGS

This Chapter is purposely written in the same order as the corresponding Chapter 20 in the Report of the JAIC in order to facilitate an easy comparison for the reader. Where no corresponding remarks are found, this 'Group of Experts' either agrees or has not investigated the specific subject.

#### Accident

- The car/passenger ferry ESTONIA sank during the early hours of 28 September 1994 in the Northern Baltic on its voyage from Tallinn to Stockholm. According to the official figures only 137 passengers and crew members survived. The wreck lies in international waters.

#### Weather / Sea state

- At the time of the casualty the wind was blowing from SW-ly directions with a speed of 18-20 m/sec. The significant wave height was about 4 metres. Neither wind speed nor sea state were exceptional for the season.  
 - Before the sequence-of-events of the casualty commenced the ESTONIA was pitching extremely hard in bow seas from port forward due to a speed which must be considered excessive under the prevailing conditions.

#### Ship's Condition

- When the ferry left Tallinn she was unseaworthy for the following reasons: Her bow was open to the sea. The bow visor and the bow ramp, which should both be water(weather)tight, were leaking with the consequence that seawater had uncontrolled access to the car deck, a condition which must be avoided by all means, as it severely endangers the safety of the vessel and its passengers.  
 A part of the underwater hull was corroded to the extent, that seawater had free access to certain tanks and void spaces. The consequence of this fact was, that about 200 mts of unknown weights were in the vessel creating a 10 degrees list which could only be partly rectified by the ballasting of the port heel tank. The vessel's Passengership Safety Certificate was false, the same is true for her Load Line Certificate.  
 Trucks and cars on the car deck were not properly secured although the upcoming heavy weather was known to the master.

#### Sequence-of-events

- Due to missing rubber seals and damage to its bottom the visor became quickly filled at sea up to the outside water level with seawater, which penetrated through the partly open bow ramp into the car deck.  
 - The existing starboard list was increased by the wind pressure from port.  
 - The vessel therefore heeled 2 to 4 degrees to starboard and the water that had penetrated through the bow ramp accumulated on starboard aft of the car deck as the vessel was trimmed by the stern at the commencement of the voyage.  
 - There are indications that the crew opened the starboard stern ramp slightly in an attempt to drain the car deck thereby.  
 - The bilge pumps were running and pumping from compartments of the 1st and/or 0-decks. It has to be assumed that the watertight doors in the engine room area were closed, whilst the watertight doors in the passenger area of the 1st deck were still open after the big heel.  
 - At about 00.40 / 00.45 hours heavy metallic bangs were heard and felt from the foreship and the movements of the vessel changed to softer pitching and rolling. The metallic bangs continued. It has to be assumed that the starboard hinges and side locks of the visor failed at about this time. The visor was now moving forward/aft between the hinge parts on the forecastle deck and the deck beam at frame 159.  
 - The speed was reduced and the damaged bow turned to starboard away from the waves, however when the vessel started to roll excessively the bow was turned back to port and wind and sea were now taken from straight ahead. The vessel now made soft, deep pitch movements for a while.  
 - At some time later also the port hinges and the port side lock failed, whilst the Atlantic lock held somewhat longer.  
 - At about 01.00 hours the vessel was shaken heavily and noises and vibrations as if the vessel was proceeding through ice were heard and felt by those on the 1st deck, shortly followed by another, even more severe impact, followed by a very wide heel of the vessel to starboard at 01.02 hours. The vessel, however, came back to almost upright condition, heeled again, came back to 10-15 degrees starboard heel and subsequently heeled in steps to about 30-35 degrees to starboard and stabilized in this condition for some time.  
 - While the visor moved forward/aft and the lugs underneath the visor arms were slowly cutting through the deck beam of frame 159, both bow ramp actuators broke and the unsecured ramp fell into the visor.  
 - After some time the lugs underneath the visor arms had worked their way through the deck beam - most likely first at the port side - and the visor now also moved to starboard following the increasing starboard heel and fell onto the bow ramp which rested in the visor.  
 - In the meantime the forepeak deck had penetrated the bottom structure of the visor whilst the shell plating edges were overlapping the forepeak deck.  
 - The visor was now held by the bow ramp and by the port side plates overlapping the forepeak deck, whilst the vessel continued to heel to starboard and the stern sank deeper.

#### Capsize

- The main engines stopped at about 01.10 / 01.12 hours at a heel of 25-30 degrees. At this time the vessel had turned to a North-Easterly heading.  
 - The vessel stabilized at a heel of 30-40 degrees for some time and the diesel generators stopped at about 01.15 / 01.20 hours whereafter the emergency generators started and supplied power to a limited number of consumers.  
 - The vessel continued to heel and was on the side at 01.30 hours and some time later completely upside down whilst the stern continued to sink deeper and the bow to raise higher.  
 - It has to be assumed that the visor did glide off the bow ramp and forepeak deck when the heel had reached some 130-140 degrees and sank to the bottom of the sea as it was unable to float.  
 - The stern finally settled on the sea bottom with the bow still raised to about 40-45 degrees out of the water. The bow ramp was almost closed.

- The bow sank slowly deeper and -  
at 01.53 hours the echo of the ESTONIA disappeared from the radar screen of the nearest vessel "MARIELLA".

#### Action by the Crew

- Nothing can be stated with some degree of probability from the bridge for the time after 00.35 hours.
- It has to be assumed that a first "Mayday" was transmitted at around 00.45 hours, which for unknown reasons was not picked up.
- It has further to be assumed that after the problems with the bow ramp and visor were realised, the speed was reduced and attempts were made to take the loads off the visor.
- It is likely that the crew worked on the car deck attempting to hold the visor and the bow ramp to the vessel by different means. This attempt, however, failed.
- There are also indications that the engine crew was working on the starboard stabiliser. All attempts of the crew were apparently abandoned at about 01.00 hours.
- A warning for the passengers "Alarm, Alarm" was shouted in Estonian language a few times over the loudspeakers. No other information was given to the passengers.

#### Technical Matters

- At the time when the ESTONIA was designed and built, there were no specific design requirements for visors in the rules of the Classification Society Bureau Veritas. The SOLAS Convention at that time was not yet part of the B.V. Rules.
- The Finnish Board of Navigation considered itself exempted from the inspection of structural matters in newbuildings - such as locking devices - by the Copenhagen Convention of 1924 and hence had to rely on authorised Classification Societies for plan approval and inspection of structural matters on newbuildings. B.V. was authorised.
- The visor design load and the assumed load distribution on the attachments was in accordance with L.R. Rules and the then state-of-the-art and technique.
- The visor locking devices installed by Meyer Werft, were manufactured in accordance with the design and good shipbuilding practice. These devices were not identical to those found onboard after the casualty.
- The SOLAS requirements for the upper extension of the collision bulkhead above bulkhead deck were never complied with. Nevertheless Passenger Ship Safety Certificates were issued by The Finnish Board of Navigation and - after the vessel had changed its flag - by B.V. on behalf of the Estonian National Maritime Board. It may be debated whether the issuance of these certificates during the time the vessel spent under Finnish flag was completely in line with the requirements of SOLAS but that debate is irrelevant, because any such failure cannot have contributed to the Catastrophe.
- The Load Line requirements for a tight vessel were not complied with on 9.9.1994 although BV confirmed the Load Line Certificate on this date, i.e. 19 days before the casualty, on behalf of the Estonian National Maritime Board.
- The general maintenance standard of visor and bow ramp was unacceptable which fact was the main cause for the casualty.

#### CHAPTER 43

##### CONCLUSIONS

1. The vessel was designed in accordance with the state of the Art and the Rules and Regulations applicable at the time of design and building by one of the shipyards most experienced in the building of such type of ships, which had just completed a Near-Sister-Vessel. (See Chapters 2.1, 2.2, 2.3, 2.4.1 and 2.4.2.and Chapter 15 JAIC)
2. The vessel was constructed in accordance with the state of the Art, the approved design and under the supervision of a very experienced and competent Class-surveyor. (See Chapters 2.4.2, 2.4.3, 2.4.5, 2.4.6 and 2.6). JAIC maintains, that the building yard did not adhere to its own design criteria (Chapter 15 JAIC). This conclusion however is based on the wrong assumption, that the welding seams found on the wreck were laid during the construction of the vessel. (See Chapters 3.3, 12.5, 29.2 and 30.)
3. The procedure chosen by the Finnish Board of Navigation (FBN) in the issuance of Passengership Safety Certificates whilst the vessel was under its jurisdiction did not completely comply with the SOLAS Regulations in force at that time, but this failure of FBN did not contribute to the accident. (See Chapters 2.4.4 and 6.5.2)
4. Whilst being owned and managed by her previous Finnish owners (Sally and Silja) the vessel was reasonably well maintained. Design or construction defects were not noted, although the vessel cruised for twelve years in the Baltic Sea. At the time of delivery of the vessel to her new Owners, she had deficiencies, which were however quite normal for a ship of her age and in her trade. These deficiencies were reported by the staff on board to Silja, the then managers of the vessel. This report became known to the new managers, being Nordström & Thulin, who however chose not to take note. These deficiencies then developed fast to the worse and into a substantial contributing cause of the accident. (See Chapters 3.4 and 6.5.1)
5. Acting as mandatory of the Estonian National Maritime Board (ENMB), Bureau Veritas on 7.2.1993 issued an Interim Passengership Safety Certificate for MV ESTONIA. This was done in obvious violation of the relevant Regulations of SOLAS. Had the responsible inspector of Bureau Veritas complied with his duties and refused the issuance of a Passengership Safety Certificate, the new Owners would have been forced to install the extension of the collision bulkhead above main deck and had this been done, the vessel would - with all probability - have survived, despite of all her other deficiencies. (See Chapters 6.4, 6.5 and 9.1)
6. At Sea the vessel was operated recklessly in ice and during bad weather, which caused a further worsening of the deficiencies taken over with the vessel and added new ones, the most outstanding of which was, that the visor was pushed out of its geometry, vibrated and was constantly filled with water to the outside water level at sea. No attempt was made to rectify these deficiencies. It has to be assumed, that the responsible staff at Nordström & Thulin was aware of these further deficiencies as well. (See Chapters 12.1 to 12.6, 16.2 and 30)
7. The most crucial deficiency developed in 1994: The port outer hinge of the bow ramp became twisted, could consequently not be secured properly anymore and lost its watertightness. Ever since water from the filled visor flowed into the car deck at sea, despite the efforts of the crew to prevent the ingress of water by plugging the gaps with linen and mattresses. As the watertightness of the bow ramp - when deemed to be the extension of the collision bulkhead above main deck - is a mandatory condition of SOLAS, the Rules of Bureau Veritas and the Load Line Convention, MV ESTONIA had lost its class notation and its seaworthiness, when being traded with an untight bow ramp. (See Chapters 12.4.3, 12.4.4, 12.5, 16.2 and 29.2)
8. It is common knowledge with the Owners or Operators of Ro-Ro Passengerships, that water on the car deck must under any and all circumstances be avoided as it unavoidably lessens the stability of the vessel, being the vital safety criterion of each passengership. It has to be assumed, that the responsible staff at Nordström & Thulin was aware of the loss of watertightness of the bow ramp and the consequential ingress of water onto the car deck from the water-filled visor. No attempt was made however to rectify this unacceptable condition. (See Chapter 12.5)
9. It should have been detected at least by those whose duty it was, to control safe operation of Passengerships trading between Estonia and Sweden for the benefit of their passengers. This refers especially to the inspections conducted by the inspector of Bureau Veritas - also acting as mandatory of ENMB - shortly before the casualty and - especially - the inspection of MV ESTONIA on the day before the casualty by leading personnel of Sjöfartsinspektionen (SHIPINSPEC) and ENMB. During this inspection the most serious deficiencies at the bow area were found and noted, but - although the vessel could have been stopped by order of the Estonian members of ENMB in Tallinn or by refusal to permit entry into Swedish waters or ports through the leading personnel of Sjöfartsverket - nothing was done. (See Chapters 9.1, 9.3, 12.5, 15 and 16)
10. There were further grave deficiencies in the vessel, when she left for her last voyage:
  - I. Due to fatigue cracks caused by the vibrations of the visor and unqualified repair work the hinges of the visor had lost nearly all of their design strength. (See Chapters 12.5, 16.2, 29.2, 34.8 and 34.9)
  - II. The stempost of the visor had been cracked four times due to fatigue caused by the vibration of the visor. Consequently it could not support the weight of the visor anymore. The visor did instead rest on the forepeak deck which fact caused misalignment of the visor and all its locking- and holding devices far exceeding the permissible tolerances. (See Chapters 12.5, 30)

III. The vessel left port with a starboard list, which was caused by uncontrolled water ingress into the vessel through a hole in the shell plating. (See Chapter 17.1) The cargo in the vessel was not lashed according to regulations despite knowledge of vessel's command of the coming heavy weather. (See Chapters 17.2, 18)

11. The grave deficiencies described in 5, 7 and 10 above rendered the vessel unseaworthy. When she left the port of Tallinn, she was not permitted to carry passengers, cargo or crew under all relevant international or Estonian national regulations.

12. The vessel was run on full engine power in very rough seas up and until the casualty. This fact constitutes a gross violation of the principles of good seamanship and shows disrespect for the comfort of the passengers. (See Chapter 20) Had the vessel been in a seaworthy condition however, such facts would not have mattered, as they did not over the past 14,5 years of her trade in the Baltic Sea. Under conditions as given on the night of the 28th of September 1994 this excessive speed started the known deficiencies to interlink and thereby the chain of causes to unravel which led irreversibly to the foundering of MV ESTONIA.

13. This 'Group of Experts' has used all efforts and possibilities available to it to investigate the actual casualty scenario. All available crew members and survivors were interrogated by members of this 'Group of Experts' or by experts instructed by it. (See Chapters 20 and 21) Substantial evidence unknown so far was collected. (See Chapters 22 to 30) The Group purposely refrained from taking refuge to hypothetical assumptions in its attempt to establish the casualty scenario but rather made it their point to seek the truth based on facts only. Only evidence confirmed by other facts was considered permissible evidence in the establishment of the casualty scenario by this 'Group of Experts'. The result of these efforts is the casualty scenario described in Chapter 31. It demonstrates that the vessel was already in a crucial situation, which should have prompted immediate return at 20.45 hours at which time it was still under coastal shelter. (See Chapter 20) That occasion having been missed the vessel was doomed to death as the water ingress into the car deck constantly increased until it finally became overwhelming.

14. When scrutinizing the underwater videos made available to this 'Group of Experts' by JAIC astonishing facts were discovered. Although these facts do not contribute to the task of the Group, the most important of them shall be reported here briefly:

I. The underside of the port bridge wing had apparently been torn open, when the vessel was already resting on the seabed. (See Chapters 27 and 34.6)

II. Divers of the "official" teams took time to search for, find and salvage a certain suitcase belonging to a gentleman with the reputation of being engaged in the smuggling of weapons. (Chapter 27 and 34.6)

III. There is evidence, that there has been movement of the bow ramp, when the vessel was already resting on the seabed. (See Chapter 34.6)

IV. There is evidence, that other than the "official" diving teams were in the vessel, especially in the car deck. (See Chapters 25.1, 27 and 34.6) It has to be assumed that the other divers had entered the wreck with the knowledge and permission of Swedish Government Authorities. No records of their activities are available.

After thorough investigation of some of the underwater videos a world renowned expert came to the conclusion, that explosions had occurred on MV ESTONIA's bow. (See Chapters 32.1, 7 and 34.7.1) These conclusions have not been taken into consideration when establishing the casualty scenario. The sole reason was, that these conclusions have to be seen in conjunction with the repeated reports about a "big hole on the starboard side" (See Chapter 36.3). Whether there were explosions can only be established with certainty by metallurgical examination of the metal affected from the wreck and whether there actually is a big hole on the starboard side can only - but easily - be established with certainty, if and when the Swedish authorities release the underwater video tapes taken of the wreck by different diving teams in their original version i.e. without any tapering therewith. Only after such further investigations have been held, is it possible for anybody to establish the true causes for the foundering of MV ESTONIA.

15. This 'Group of Experts' has commented on the quality of the work of the JAIC and on the legal and ethical standards applied by that Commission in detail in Chapter 41. The reader is referred to those comments.

Hamburg, May 2000

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Captain Werner Hummel