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NORWEGIAN OFFICIAL REPORTS

The Scandinavian Star Disaster of 7 april 1990

MAIN REPORT

NOR 1991: 1E

Norwegian Official Reports
1991

The series is edited by:
GOVERNMENT ADMINISTRATION SERVICES
GOVERNMENT PRINTING SERVICE

Translated from the Norwegian by Alison Arderne Olsen.
In case of discrepancies between the Norwegian and English texts, the Norwegian text is to be considered the authoritative version.

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The Scandinavian Star Disaster of 7 April 1990

**Report of the Committee Appointed by
Royal Decrees of 20 April and 4 May 1990**

**Submitted to
the Ministry of Justice and the Police in January 1991**

GOVERNMENT ADMINISTRATION SERVICES
GOVERNMENT PRINTING SERVICE

OSLO 1991

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by Alison Arderne Olsen.
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ISSN 0333-2306
ISBN 82-583-0236-1

PDC · Printing Data Center a.s, Aurskog, Norway

The Ministry of Justice and the Police

Pursuant to an agreement concluded between Sweden, Denmark, and Norway, a "committee for the investigation of the circumstances surrounding the damage by fire of the passenger ferry *Scandinavian Star* on 7 April 1990" was appointed by Royal Decree of 20 April 1990. Four members were appointed to the committee. Two further members were appointed by Royal Decree of 4 May 1990, one of them pursuant to a proposal made by the Bahamas.

The committee's findings are submitted in the following report. The report is unanimous on all points. The committee member Knud Skaareberg Eriksen did not take part in the committee's deliberations concerning port state control. The reasons for this are stated in Chapter 2 under point 2.8. The remaining work on the report was carried out by all the members of the committee.

Tore Schei
Chairman

Svend Bojesen *Stian Erichsen* *Knud Skaareberg Eriksen*

Olof Forssberg *Knut Kaasen*

Fredrik Charlo Borchsenius

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1. The Disaster

On 30 March 1990, at 1820 hours, the VR DaNo group took over the passenger ship *Scandinavian Star* from the shipping company SeaEscape Ltd., in Fredrikshavn. The ship's crew were all new at the time of the takeover, except for nine members who had sailed with the ship when it was owned by SeaEscape. On 1 April 1990 the *Scandinavian Star* was put into service on the Fredrikshavn-Oslo run, and the first voyage started from Fredrikshavn on Sunday 1 April 1990 at 2305 hours.

On Friday 6 April the *Scandinavian Star* left Oslo at 2145 hours. There were 99 crew members and 383 passengers on board. Between 0145 hours and 0200 hours on 7 April a fire started in a pile of bedclothes outside cabin no. 416 on deck 4 (Ybor Deck). This fire was put out. A little after 0200 hours a new fire started, aft in the starboard corridor of deck 3 (C Deck), probably near cabin 219. This fire was almost certainly started by a naked flame. Within a few minutes of ignition, flames and toxic smoke spread rapidly through the cabin sections on decks 4 and 5 and further upwards in the ship. Later the fire developed more slowly.

Mayday was signalled from the *Scandinavian Star* at 0224 hours. The ship's position at this time was N 58 34', E 10 43'.

One hundred and fifty-eight people died in the fire. They had probably all died by 0245 hours. At about 0320 hours the captain gave the ship up for lost and the crew abandoned ship. The *Scandinavian Star* was taken in tow at 1155 hours and berthed at Lysekil, Sweden, at 2117 hours. The fire on board was extinguished on Sunday 8 April at 1600 hours.

2. The Investigation Committee and its Work

2.1 SETTING UP AND APPOINTMENT OF THE COMMITTEE

Within a few days of the disaster, Sweden, Denmark, and Norway agreed to set up a joint investigation committee, with members to be appointed by the Norwegian Government.

The original composition of the Committee was as follows:

1. Chairman: Mr. Tore Schei, Supreme Court judge, Norway
2. Professor Stian Erichsen, Norway
3. Mr. Knud Skaareberg Eriksen, senior ship surveyor, Denmark
4. Mr. Olof Forssberg, director general of Statens Havarikommission, Sweden

These members were appointed by Royal Decree of 20 April 1990.

On the Committee's initiative, the following member was later asked to join:

5. Mr. Svend Bojesen, head of division, Danish authority for navigation and hydrology (Farvandsvæsenet), Denmark

The *Scandinavian Star* was registered in the Bahamas. The Bahamas raised the question of whether it should be represented on the Committee, and as a result of this, the following member was appointed:

6. Professor Knut Kaasen, Norway, at the request of the Bahamas

Mr. Bojesen and Professor Kaasen were appointed by Royal Decree of 4 May 1990.

The secretary of the Committee was Fredrik Charlo Borchsenius, a senior executive officer in the Ministry of Justice.

2.2 THE STATUS AND INDEPENDENCE OF THE INVESTIGATION COMMITTEE

Because several different countries were involved in setting up the Committee, it was considered essential that the Committee act as a single unit at all times, and that there should be no question of reports from any member to the country at whose suggestion he was appointed. In the Royal Decree of 4 May 1990 it is stated that "all members of the committee have a free and independent status, without any duty to report back to or to act on the instructions of the states that have proposed their appointment".

Since it was appointed in Norway, the Committee decided to take up all questions concerning budgets, expenses, etc., with the Norwegian Ministry of Justice. All expenses, with the exception of the remuneration of the individual members, have been charged to this Ministry. The Committee wishes to state that it is aware that the Ministry of Justice has discussed the sharing of the cost of the investigation with Sweden, Denmark, and the Bahamas. The Committee has considered the question of the actual cost sharing to be outside its sphere of competence.

2.3 THE BACKGROUNDS OF THE MEMBERS OF THE INVESTIGATION COMMITTEE

The names of the members of the Committee are given under 2.1. The Committee considers it appropriate to list the qualifications and occupational backgrounds of the individual members.

Tore Schei
Born 1946
Bachelor of law (cand. jur.) 1971
Supreme Court Counsel 1974
Assistant counsel and counsel at the Office of the Attorney General 1972-81
(Leave of absence 1975-76)
Studies in England 1975
Deputy judge 1975-76
High Court Judge in the Eidsivating High Court 1981-86
Supreme Court judge since 1986
President of the Council for the Further Training of Judges 1987-90
Chairman of the Stock Exchange Complaints Committee since 1989

Svend Bojesen
Born 1945
Sjøfartsskole (Maritime College) and training ship 1960-61
Training as mate and ship's master 1966-68
Bachelor of law (cand. jur.) 1988
Employed by DFDS and J. Lauritzen 1961-66
Navigator employed by ØK and DFDS 1968-83
Ship surveyor for Skibstilsynet (Danish Ship-

ping Inspectorate) 1983-89
Head of Division in Farvandsvæsenet (Danish authority for navigation and hydrology) since 1989

Stian Erichsen
Born 1929
Degree in marine engineering (siv.ing. skiplinjen) from the Norwegian Institute of Technology (NTH) 1955
PhD from Department of Naval Architecture and Marine Engineering, University of Michigan, USA, 1971
Employed at shipyards in Norway and Germany 1956-62
Employed at Ship Research Institute of Norway (now MARINTEK A/S) 1962-72
Professor in marine design at the Norwegian Institute of Technology (NTH) since 1972
Chairman of "Sjøfartsadministrasjonsutvalget" (Maritime Administration Committee) 1976-78
Author of *Management of Marine Design* 1989

Knud Skaareberg Eriksen
Born 1935
Engineer's certificate of competency 1962
Naval officer, marine engineering, 1965
Employed at Rigshospitalet, the National Hospital, Denmark, with main responsibility for plant and equipment for gases, and for systematic maintenance, 1969
Ship surveyor for Danish maritime authority (Søfartsstyrelsen) 1970
Deputy head of engineering department, Danish Shipping Inspectorate (Directoratet for Statens Skibstilsyn), 1974
Senior ship surveyor, engineering department, Danish Shipping Inspectorate (Directoratet for Statens Skibstilsyn), 1978
Senior ship surveyor in Danish maritime authority (Søfartsstyrelsen) on its establishment, 1988
Mr. Eriksen's main fields of responsibility as senior ship surveyor in 1978-88 were machinery, electrical installations, automation equipment, fire extinction and alarms, transport of dangerous cargo by sea, gas and chemical tankers, pollution prevention installations, diving, etc.
From 1988 to 1990 he also had responsibility for all existing ships and platforms.
Since 1 January 1990 Mr. Eriksen has been head of the investigation and control section of the Danish maritime authority (Søfartsstyrelsens Opklarings- og Kontrolenhed). This section deals with the investigation of accidents at sea, shipwrecks, certain work accidents, pollution disasters, and diving accidents, and also takes care of internal quality control in the maritime authority.

Olof Forssberg
Born 1937
Bachelor of law (jur.kand.), University of Uppsala, Sweden, 1961
Court practice in Ludvika, Sweden, 1961-64
Court practice in the Øvre Norrland High Court 1964-70
Legal secretary, Ministry of Defence, Sweden, 1971-79
High Court judge (hovrättsråd) in the Øvre Norrland High Court 1979
Legal adviser, Ministry of Defence, Sweden, 1979-87
Director general of Statens Havarikommission, Sweden, since 1987

Knut Kaasen
Born 1951
Bachelor of law (cand.jur.), University of Oslo, 1977
PhD in law, University of Oslo (doctoral thesis on safety regulations in oil-drilling activities) 1984
Lecturer at the Nordic Institute of Maritime Law, University of Oslo, 1978-79, and 1981-84
Deputy judge 1979-81
Counsel, Norsk Hydro a.s. [Norwegian company], Oslo 1984-88
Professor of jurisprudence, University of Oslo, since 1989

Fredrik Charlo Borchsenius
Born 1961
The College of Business and Economics (Økonomisk College), Oslo, 1980-82
Assistant lecturer, Nordic Institute of Maritime Law, University of Oslo, 1986-87
Bachelor of law (cand.jur.), University of Oslo, 1989
Employed at Department of Legislation, [Norwegian] Ministry of Justice, since 1989

2.4 THE COMMITTEE'S MANDATE

In the preamble to the Royal Decree of 20 April 1990, the Committee's mandate is described as follows:

> The Committee is to examine the cause of the disaster and the reasons why it attained such magnitude.
>
> The Committee is to consider whether the technical standard of the ship, its equipment, and the composition of its crew were satisfactory and in accordance with international and national rules.
>
> The Committee is to examine the ways in which national and international rules and internal routines for the operation of the ship and for emergencies functioned in the event of the disaster.

The Committee may also consider other factors related to the disaster if it considers this necessary, including the conduct of the rescue operation.

This mandate is very broad and somewhat vague. It also leaves the Committee free to investigate any other factors that are not specifically mentioned. The Committee considers that the tasks it was assigned to carry out under the mandate, together with the additional questions that arose in connection with these tasks, have been dealt with in Chapters 4 to 13 of the Report. The Committee wishes to point out that it has assumed that part of its mandate was to present proposals for measures that would help to prevent the future occurrence of a disaster like that on the *Scandinavian Star*. This is the basis for the recommendations presented in Chapter 13.

There are other questions that the disaster has raised, at any rate indirectly, that have not been taken up by the Committee. The Committee considered it essential that the Report be issued within a reasonably short time, and considers that an equilibrium has been established between the scope of the questions dealt with in the report and the necessary speed. The Committee wishes to emphasize that it spent the time necessary for a sound and thorough consideration of all the questions that it has taken up.

The Committee also wishes to emphasize that it has understood its mandate to consist of a clarification and evaluation of the actual course of events, for example the making ready of the ship and the behaviour of the crew during the disaster. The Committee has not interpreted its mandate as an injunction to decide whether persons or institutions have behaved in such a way as to justify criminal indictment, administrative action, or civil legal action. The comments made by the Committee on the actions of individuals or institutions imply no comment on the legality or otherwise of such actions.

2.5 THE WORK OF THE COMMITTEE

The work of constituting the Committee began as soon as the agreement described under 2.1 had been concluded between Denmark, Sweden, and Norway. The chairman and the Swedish member, Mr Olof Forssberg, were appointed on Wednesday 11 April. The remaining two of the original members were appointed within a few days. The Committee began work at once, without waiting for formal appointment.

The Committee's first visit to the *Scandinavian Star* took place on 18 April, while the ship was still docked in Lysekil, Sweden. The first committee meeting was held on 19 April in Copenhagen.

Mr. Svend Bojesen attended the Committee's meetings from 24 April. Professor Knut Kaasen attended meetings from 11 May.

The Committee has had 15 internal meetings, lasting a total of 30 days. It has also had four short meetings in connection with meetings held with others. In addition to meetings of the whole Committee, meetings were held by two or more members for the preparation of reports on special subjects for the consideration of the whole Committee. As mentioned above, the Committee's secretary was Mr. Fredrik Charlo Borchsenius of the Ministry of Justice. Reports, etc. were submitted by Professor Hans Jacob Bull (dr. jur.), Ms. Alexandra Beck (cand. jur.), Mr. Stein Ove Erikstad (siv. ing.), Mr. Jens Petter Fabricius (stud. jur.), Mr. Tore Hagen (legal secretary of the Supreme Court committee of appeals), Ms. Karita Bäck Mirchandani (jur. kand.), Mr. Bo S. Pedersen (stud. jur.), and Mr. Jens Ole Pedersen (navigator).

The Committee wishes to express its gratitude to all those who have provided assistance. Besides a number of official bodies and civil servants, these include organizations, companies, institutions, and individuals. In the course of its work the Committee encountered very willing responses to its questions and requests and a great eagerness to contribute to the successful outcome of this investigation into the *Scandinavian Star* disaster.

2.6 APPOINTMENT OF EXPERTS. MANDATE OF THE EXPERTS

In accordance with its mandate, the Committee was to examine the causes of the disaster and the reasons why it attained such a magnitude. In order to find out how the fire started and how it had such catastrophic consequences, the Committee needed to consult specialists in fire research. Furthermore, the preamble to the Royal Decree of 20 April 1990 stated that the Committee was entitled to consult specialists. In consideration of the importance of the specialists' reports, experts had to be chosen whose competence could not be questioned in any way. The following were appointed:

1. Mr. Ejnar Danø, head of department for the National Institute for Testing and Verification (Dantest), Denmark
2. Mr. Kjell Schmidt Pedersen, director of SINTEF – NBL, Norwegian Fire Research Laboratory.

These specialists made a number of studies of the ship and laboratory tests, full-scale experiments, etc. The full-scale experiments were particularly noteworthy. They were undertaken to obtain evidence concerning the spread of the fire. The specialists intended initially to carry out the full-scale experiments in the ship itself, in a corridor that had been left relatively undamaged by the fire, under the supervision of the Copenhagen fire service. For a number of reasons this was not done; instead wallboards and other elements were removed from the ship and transported to the Fire Research Laboratory in Trondheim, Norway, where models of a corridor and a stairwell from the *Scandinavian Star* were reconstructed. The two full-scale experiments were carried out in these models. The specialists consider that the full-scale experiments provide a very good foundation for describing the initial phase of the fire and the initial spread of the flames and smoke.

The fire research experts delivered their report to the Committee in September 1990. It consists of a main report and 17 detailed reports, with a large number of photographs. The Committee issued a press release on 21 September announcing the main conclusions of the expert group. The main report and some of the detailed reports have been published as annexes to the present Report. These are:

Statement describing the physical course of the fire by Mr. Danø, Dantest, and Mr. Schmidt Pedersen, SINTEF – NBL (STF25 F90014)

Note on doors in the corridors and opening onto the car deck by Mr. Høyland, SINTEF-NBL

Note concerning fire doors by Dantest (Sag F6846)

An evaluation of the significance of the ventilation system during the early phase of the fire by Mr. Øystein Meland, SINTEF-NBL (STF25 F90010)

Full-scale experiment – surfaces in corridor and stairway from *Scandinavian Star*. Report by Mr. Øystein Meland and Mr. Lars E.Lønvik, SINTEF-NBL (STF25 F90011)

Estimation of spread of smoke during the fire on the *Scandinavian Star* by Mr. Ragnar Wighus, SINTEF-NBL (STF25 F90012)

At the maritime inquiry in Copenhagen, it became clear that many of the people on board the *Scandinavian Star* during the disaster had not heard the fire alarm, or had only heard it faintly. It thus appeared that deficiencies in the alarm system might have contributed to the large number of deaths. The Committee therefore needed to know more about the whole alarm system, the quality, the sound level of the alarms in the various cabins, and so on. The Committee requested the Danish fire protection authority (Dansk Brandværn Komité) to undertake this task. The investigation was mainly carried out by Mr. Kjeld Fogde and Mr. Ole Falkengaard. The Report refers to this investigation, which is included as an annex.

It also became clear at an early stage that it would be necessary to chart the evacuation possibilities on board the *Scandinavian Star*. These needed to be known partly to explain why the disaster attained such a magnitude and partly in order to see whether improvements could be made that might prevent such disasters in the future. The evacuation possibilities were investigated by Mr. K. Harald Drager, Mr. Helge Soma, and Mr. Thorbjørn Hauge, of A/S Quasar Consultants, Oslo, Norway, which had been commissioned by the Committee for this purpose.

2.7 DISQUALIFYING CIRCUMSTANCES APPLYING TO ONE MEMBER OF THE COMMITTEE

Senior ship surveyor Knud Skaareberg Eriksen is head of the investigation and control section of the Danish maritime authority (Søfartsstyrelsens Opklarings- og Kontrolenhed). Until 1 January 1990 Mr. Eriksen was responsible for port state control in Denmark. Since the Committee decided to evaluate the standard of the port state control practised in Norway and Denmark, Mr. Eriksen considered that the above-mentioned circumstances disqualified him from taking part in the Committee's treatment of port state control. The remaining members of the Committee were unanimous in their agreement, and Mr. Eriksen therefore took no part in the discussions and recommendations relating to sections 10.4.3 and 13.2.4.1 of the Report.

2.8 COLLECTION OF EVIDENCE

The Committee has not fulfilled the conditions for a commission of inquiry pursuant to section 314 of the Maritime Act, and has therefore not been able to carry out a maritime inquiry.

The members of the Committee followed the progress of the maritime inquiry in Copenhagen, and used the transcript as evidence. The Committee has also had access to all police interrogations, etc.

The Committee or representatives of the Committee have received declarations from:

Captain Hugo Larsen
Chief Officer Oddvar Finstad

First Officer Sverre Aashildrød
Purser Grete Forslund
Nautical Inspector Kenneth Hofstra
Captain Lennart Nordgren
Mr. Dorey, Wallem Shipmanagement
Mr. Simon Mathiessen Knudsen Hansen
Mr. César Martins
Mr. Joao Manuel Geraldes

The Committee has put questions to Mr. T.B. Skinner over the telephone.

Members of the Committee have had meetings with representatives of the main rescue coordination centre at Sola, MRCC Göteborg, the rescue services in Lysekil, and the Institute of Forensic Medicine, The National Hospital, Rikshospitalet, Oslo, Norway.

The Committee also had a meeting at Sola on 22 August which was attended by 74 of the persons who had taken part in the rescue operation. The meeting was highly informative, and the minutes have been included as an annex to the Report.

The Committee has also received important information from meetings with senior officials in the maritime administrations in Norway, Sweden, and Denmark, and with Captain Morris of the Bahamas High Commission in London and representatives of Lloyd's Register, London. The minutes of the latter meeting were summarized by Lloyd's Register and are appended as an annex to the Report.

The Committee or individual members have also had meetings with representatives of the British maritime administration, and with representatives of shipmasters', engineers', and seamen's unions and of shipowners' associations in Sweden, Norway, and Denmark. The Committee has also had meetings with representatives of Det norske Veritas and of the Central Union of Marine Underwriters, Norway. All these individuals have contributed information and views that have been of great value to the Committee in its work.

Members of the Committee have also attended meetings arranged by others in connection with the disaster.

The shipping company Stena Line has provided the Committee with important evidence, in the form of sound recordings of the radio communication over VHF on the *Stena Saga* on the night of the disaster, recorded radar pictures, etc. and a video recording made on board the *Stena Saga* of the *Scandinavian Star* on fire and of rescue activities in the area. At the request of the Committee a video has been made containing all this information, which has been of great help to the Committee. The Committee wishes to thank Stena Line for its helpful contribution to the investigation.

2.9 THE OTHER PARTY'S RIGHT TO COMMENT

The Committee has attached considerable importance to giving those who might be affected by the report the opportunity to comment on the evidence. The shipowners were notified of many of the Committee's interrogations, and sent representatives, including legal counsel, to attend them. The same applies to the captain of the *Scandinavian Star*. Those particularly affected by the Report have been sent drafts of the relevant parts of the report, apart from the Committee's conclusions. The Committee has studied their comments and taken them into account where the Committee considered that there were grounds for doing so.

3. The Main Points of the Investigation Committee's Report

3.1 INTRODUCTION

The present chapter gives an outline of the Report, chapter by chapter. The more significant findings and central issues and considerations are presented. It should be noted that when the main points are summarized in this way, shades of meaning may be lost. The points made in Chapter 3 must therefore be evaluated in the context of their more thorough examination in the appropriate chapter.

3.2 CHAPTER 1

The chapter gives a brief description of the disaster.

3.3 CHAPTER 2. THE INVESTIGATING COMMITTEE AND ITS WORK

This chapter describes the appointment and mandate of the Committee, the meeting schedule, collection of evidence, area in which one member is disqualified, the right of other parties to comment, etc.

3.4 CHAPTER 4. THE SHIP

The plans of the ship in profile and of each deck are given in the Annexes to the Report.

The Committee gives a relatively detailed description of the ship under 4.1, including when and where it was built and more general information on the hull, arrangement, machinery, size, and capacity. Each deck is described in detail, along with the plan of each deck and of each fire zone on the deck.

The decks are numbered consecutively from 1 to 9, starting with the lowest, a short deck amidships, containing a mess and common room for the crew, which is deck 1. The deck above this is deck 2, and so on. Since the ship was built the decks have been given a number of different names. The most recent of these are sometimes referred to as well as the deck number, but to avoid misunderstanding, the deck numbers are used consistently throughout the Report.

The ship is divided into three vertical fire zones, as can be seen in the plan of the ship in profile shown in Fig. 4.1. Each fire zone on each deck is described, with appropriate plans. The entrances to and escape routes in the fire zones are described. In each zone the places where the deceased were found are indicated and so are areas where no bodies were found after the fire.

After the description of the ship, some of the most important formal requirements applying to the ship are listed under 4.2, particularly those involving fire prevention. Some of these rules are also dealt with in Chapter 10, Safety, Regulation, and Control, in which the Committee deals in a more general way with the national legislation and international rules applying to ships and crews and control and follow-up systems established to verify compliance. Chapter 4 contains a review of the more fundamental requirements for construction, etc. as applied to fire prevention, including the main vertical division into fire zones. Among others the requirements for deck surface materials, protection of stairways, etc., and for other surface materials are reviewed.

Under 4.3 the Committee gives a fairly detailed description of the parts of the accommodation and equipment that are particularly important as regards fire prevention, and the standard of this equipment. In general it should be noted that most of the equipment and arrangements were satisfactory from the point of view of fire prevention and fire fighting. However, there were a number of obvious defects. In 4.4 a list is given of the faults and defects found in the ship and its equipment as of 7 April 1990:

A fire door was missing on deck 6 (Main Deck), aft on the starboard side; the opening was only filled in by a glazed door.

Many of the sprinkler heads, probably about half, in the two sections of the car deck that were tested after the fire were blocked by rust.

The main alarm system had obvious defects. Three alarm bells appeared to be missing, and the sound level was too low in places. The alarm system was examined and evaluated by experts appointed by the Committee, and the presumed sound levels in the cabins were calculated on the basis of the measurements made by the experts. In a very large number of cabins the sound level was too low for safety.

The Committee has correlated the sound levels in the various cabins with the cabins in which deceased passengers were found. The results showed that cabins with low levels of sound were evacuated to a lesser extent than

cabins with high sound levels. No other factors, such as the spread of smoke or heat release, have been found that could explain such differences. Thus the strength of the warning signals seems to have had an effect on whether or not passengers vacated their cabins.

The lifeboats appeared to be generally poorly maintained since rust had attacked the rudder system and since areas of rot in the wooden frames and rust on hooks and hook attachments had been painted over.

The signposting of escape routes, etc. was deficient in several ways. It was obviously an error not to have issued boarding cards to the passengers, since many of the signs on board were designed to be used in connection with coloured boarding cards. A further defect was that the notices were written in English, Spanish, and Portuguese, and a few in French. There were no notices in a Scandinavian language. This is not in accordance with SOLAS requirements. The Committee also points out that the signposting was sometimes confusing and could not be seen in spaces that were filled with smoke.

The question of the faults and defects that were present on the ship in January 1990, when it was surveyed, is dealt with under 4.6.2, where the survey is evaluated. 4.5 gives an overview of the ship's certificates.

Under 4.7 the Committee reviews in detail the possibilities of escape from each deck. All the bodies except one were found on decks 4 and 5 in fire zones 1 and 2. The Committee has described the possibilities of escape from these fire zones on deck 4 as being good "in theory". The reason why so many passengers died here is probably that toxic smoke seeped into the corridors before the passengers had been given the alarm. Thus in the actual circumstances of the fire the possibilities of escape were in practice poor.

Most of the deceased passengers were found in fire zones 1 and 2 on deck 5. As regards fire zone 1, the Committee points out that the escape route was difficult because the exit doors aft were not at the ends of the corridors but set into the side bulkheads, about 3 metres before the ends of the corridors, and because the centre longitudinal corridor involved too many changes of direction. There were also other factors making escape from this fire zone on deck 5 difficult.

The escape possibilities were also poor in fire zone 2. Among the factors pointed out by the Committee are the fact that the centre corridor ended in a dead end just before the reception lobby, and that the arrangement of corridors made it difficult to retain a sense of direction when following an escape route.

The Committee has also considered the time it takes to evacuate passengers from their cabins. The times calculated by the experts consulted were used as references. The Committee has concluded that if a large number of passengers remain in their cabins after the alarm is given, which is a usual occurrence, the evacuation would have been both time- and resource-consuming.

3.5 CHAPTER 5. THE OWNERS. TRANSFER OF OWNERSHIP

In this chapter the Committee first describes the ownership situation of the *Scandinavian Star* on the assumption that it was owned by the VR DaNo Group on 7 April 1990. However, the question of whether the VR DaNo Group were in fact the owners of the ship on this date is the subject of a judicial dispute. Since the outcome of this dispute will only have consequences in the private sphere, the Committee considered it right to refrain from an examination of this question. Certain important aspects of the transfer of ownership, however, are described under 5.3.

The Committee describes several companies associated with the VR DaNo Group who are in some way linked with the ownership or running of the *Scandinavian Star*. It is impossible to summarize these main points here. A considerable number of companies are involved, and their structure and relations are illustrated by diagrams.

The Committee found, in its examination of the various companies involved, that the VR DaNo Group has a relatively complex structure, probably owing to considerations based on financing possibilities and risk spreading.

The Committee takes up the question of what would have happened if the ship had not been completely covered by third party liability insurance. The Committee has also discussed this in a more general context in Chapter 12, which deals with compensation to the injured persons and survivors.

After examining the question of ownership, etc., the Committee goes on to describe the land-based organization of the shipping company, including the staffing and expertise of the various companies involved in the operation of the *Scandinavian Star*. The Committee concludes by criticizing the fact that no representative of the shipping company's management was made sufficiently responsible for supervising safety on board the *Scandinavian Star*. In this context it is pointed out that the sound operation of a passenger ship of this size is dependent on continual attention being paid to the safety aspects of the operation, not only

by the crew but also by the management of the responsible shipping company.

At the end of Chapter 5 the Committee reviews the transfer of ownership of the ship, etc. The previous owners are listed and the transfer of ownership from SeaEscape to VR DaNo ApS is described. The sales agreement between these two companies was signed on 23 January 1990. For further developments the reader is referred to 5.3.

3.6 CHAPTER 6. MANNING THE SHIP

The chapter deals with the manning of the *Scandinavian Star*, including where the crew came from, how they were recruited, and what their qualifications were.

When the *Scandinavian Star* left Oslo on 6 April 1990, there were 99 crew members on board. They came from several different countries, and can be divided into three groups on the basis of the way they were recruited. One group consisted of previous members of the crew of the *Holger Danske*. These included the deck officers and several of the catering officers. The second group had sailed with the *Scandinavian Star* under the ownership of SeaEscape. Many of these were engineering crew. The third and by far the largest group had been recruited by the owners through Wallem Shipmanagement Ltd., of the Isle of Man, in cooperation with the crewing agents D.A. Knudsen & Co. Ltd. of Lisbon, Portugal.

The work of engaging the crew for the *Scandinavian Star* was actually begun before the final decision had been made to buy the ship. In the middle of January 1990 Mr. Ole B. Hansen, managing director of VR DaNo, travelled to Florida to look over the *Scandinavian Star*. He made a provisional agreement with the chief engineer that some of the engineering crew would stay with the ship if it changed owners.

During a visit to the ship at the end of February, Mr. Ole B. Hansen made an agreement with SeaEscape that a carpenter and two able seamen from the current crew would be engaged by VR DaNo when it took over the ship. At the same time it was agreed that a total of five of the engineering crew, in addition to the chief engineer, would be employed by VR DaNo (cf. 6.2.1).

After the agreement concerning the sale of the *Scandinavian Star* had been signed at the end of January, the shipping company contacted several management companies about recruiting the rest of the crew. In mid-February the shipping company began, through Wallem Shipmanagement, to investigate the possibility of recruiting a crew from Portugal. No final agreement with Wallem seems to have been made until 15 March, and not until then did Wallem receive the request to obtain a Portuguese crew by 27 March. Wallem employed Knudsen as crewing agent for the work, and Wallem's and Knudsen's recruitment of the crew is described under 6.2.4.

The third group of crew members consisted as mentioned above mainly of personnel who had previously served on the *Holger Danske*. Some of them had also sailed with the *Sardinia Nova*, which VR DaNo had chartered from November 1989 to the end of March 1990. An agreement was also made to engage Captain Hugo Larsen and Chief Officer Oddvar Finstad, both of whom had sailed with the *Holger Danske*, for the *Scandinavian Star*. A verbal agreement to this effect was made with Captain Larsen at the end of February or the beginning of March 1990. A final agreement was not made with Mr. Finstad until the day before he joined the ship at Cuxhaven on 28 March. The recruiting of the personnel from the *Holger Danske* is described under 6.2.2 and 6.2.3.

The recruitment of the crew for the *Scandinavian Star* was characterized by the same forced pace as the rest of the project to make the ship ready for sailing by 1 April. This applied especially to the hiring of the Portuguese crew, as shown under 6.2.4.

The crew's qualifications are treated under 6.3 and 6.4.

The size of the *Scandinavian Star*'s crew satisfied existing requirements as laid down in international conventions and by the Bahamas. Thus the ship was not under-manned, and it should be noted that the maritime authorities in Norway and Denmark would have accepted such a crew size on a corresponding ship.

Taken as a whole, the crew possessed the necessary qualifications and certificates for the functional operation of the ship. As regards the safety functions, the Committee's comment is that the navigation officers should have had a better training in safety routines. The chief officer had no formal training in fire fighting or smoke diving. Two of the remaining senior navigation officers had received a good deal of their formal training some considerable time previously. It must be assumed that the ship did not have the prescribed number of crew members qualified to handle lifeboats and liferafts.

The language proficiency of the crew as a whole was unsatisfactory. Many of the Portuguese crew had little or no knowledge of English.

3.7 CHAPTER 7. PREPARING THE SHIP FOR SERVICE, ETC.

This chapter deals with the various aspects of preparing the ship for service, apart from the hiring of the crew, which is dealt with in Chapter 6 (see 3.6 above).

The chapter starts with a chronological overview from November 1989, after the sale of the *Holger Danske* (see 7.2). The shipping company's efforts to find a suitable new ship for the Fredrikshavn to Oslo route, and the finding of the *Scandinavian Star* are described, and the shipping company's investigations concerning the ship, the sales agreement (see 7.3), manning, preparations on board, and so on, are reviewed.

The preparations organized by the shipping company and those made by the crew are dealt with separately under 7.5 and 7.6 respectively. Under 7.6 the deck, engineering, and catering crews are all dealt with separately. The work of the senior officers is described and the preparations carried out by the deck, engineering, and catering crews are dealt with more generally.

With regard to the deck crew, the Committee has examined the inspection of the ship and equipment carried out by the captain, staff captain, chief officer, and first officer on arrival on board, especially with respect to the safety equipment, etc. Their working hours are also reviewed.

The Committee comments that the rest of the deck crew had a heavy workload throughout the period from 30 March to the time of the disaster. A good deal of clearing up had to be done, among other things. Moorings and hawsers had to be gone over and repaired. The deck crew worked over 11 hours a day and often more. Many of the deck crew were not familiar with the emergency plan or their functions in it.

Several of the deck crew spoke little or no English. This interfered with the performance of their work.

With regard to the engineering crew, those who had already served on the ship under SeaEscape's ownership mostly continued to work as before. Neither their work nor their hours were any different. But the crew members hired through Wallem and Knudsen had to take part in the ordinary preparations on board, and this group of crew had a very long working day. In consequence some of the engineering crew were unfamiliar with the ship at the time of the disaster.

The Committee investigated whether each particular member of the engineering crew was familiar with the emergency plan and the ship. Most of them did not know their functions under the emergency plan.

As regards the catering personnel, the Committee emphasizes that as a whole they had a very heavy workload during the preparation period and that some of them worked extremely long hours. This was the group with the greatest pressure of work, and they had very limited opportunities to become familiar with the ship. Mr. Christensen, the chief steward, was the only member of this group of personnel who was familiar with the emergency plan and probably the only one who had had time to get to know the ship.

Many of the Portuguese catering crew had difficulty in speaking and understanding English, which caused difficulties in the working situation.

Under 7.7 the Committee examines the aspects of the preparation work that affected safety. SeaEscape's emergency plan, which Captain Larsen decided to use for the *Scandinavian Star*, is described in detail, and so is the adaptation of the plan to the new personnel. The Committee points out weaknesses in SeaEscape's emergency plan, but in general considers it to be a useful practical tool in an emergency. Its adaptation to the new crew, however, was unsatisfactory. Because of the difference in the sizes of the crews employed by SeaEscape and VR DaNo, the original plan was very difficult to apply directly to the new situation of the *Scandinavian Star*. The responsible officers did not devote the necessary care and attention to converting the emergency plan, and their attempts to utilize the existing system were largely unsuccessful. This may be partly due to their having too little time and too little information about the crew's qualifications. It is also doubtful whether they had understood the strategy behind the emergency plan. In the form in which it existed on 7 April, it was largely unsuitable for coping with an emergency. The evacuation group had too few members to be able to function efficiently, and there were several areas where the resources of the crew had not been properly deployed.

The crew's inspection of the safety equipment is also reviewed. It is concluded that a systematic inspection of important safety equipment should have been made by the navigation officers. Furthermore, the crew should have familiarized themselves with the use of the equipment by means of drills and other methods.

The training of the fire patrol received special attention. The Committee has concluded that their training was to a very large extent defective.

Under 7.8 the Committee sums up its views and conclusions as regards the preparation of the ship. In addition to the factors mentioned above, the Committee points out that the fact that fire and abandon ship drills were not held within 24 hours of the ship leaving Fredrikshavn on 1 April constituted a clear infringement of SOLAS regulations.

The Committee's conclusion is that the *Scandinavian Star* was not ready to sail with passengers on 1 April. The fact that the ship was pressed into service in spite of its obvious unfitness from a safety point of view must be have been due to pressure from the owner. The Committee is in no doubt that the crew, and especially the Captain, felt under considerable pressure from the shipping company, through Mr. Ole B. Hansen, to put to sea. The company should have understood that considerations of safety were being ignored when it put into operation a ship for so many passengers, with such an untrained crew, within such a short time.

The Committee has examined the situation on the *Scandinavian Star* on 6 April with special attention. It concludes that on this date it was still not justifiable to have undertaken a journey with passengers on board. It points out that the senior officers were naturally aware of the situation on board at the beginning of the disastrous voyage. It further points out that the owners had no reason to think that the situation was any different on 6 April from that on 1 April in that it had become any more justifiable from a safety point of view to sail with passengers.

3.8 CHAPTER 8. THE DEVELOPMENT OF THE FIRE AND ITS CONSEQUENCES ON BOARD

The chapter begins with a description of the development of the fire that caused the disaster. The sources of the Committee's information are described. These include calculations and experiments carried out by the National Institute for Testing and Verification (Dantest), Denmark, and SINTEF NBL Norwegian Fire Research Laboratory.

The fire probably started a little after 0200 hours. The source of the fire was almost certainly in the corridor by the entrance to stairway 2 on the starboard side of deck 3. All the evidence indicates that it was ignited by a naked flame. Between 2 and 8 minutes after being ignited the fire had attained an effect of 200 kW, which was enough to start the corridor wall burning rapidly. From this point the fire progressed very rapidly.

The further progress of the fire, with the spread of flames and smoke to various parts of the ship, is then described. The remaining course of the fire was divided into three phases: phase II, intense and rapid spread; phase III, further spread into the cabin areas; and phase IV, persisting, slowly spreading fire.

The progress of the fire and of the spread of smoke is then described deck by deck under 8.3, including the locations where the bodies of the deceased were found.

Under 8.4 the Committee examines the factors that influenced the development of the fire and the production of smoke. It starts by considering the properties of the materials used in the accommodation areas. The plastic laminated surfaces of walls and ceilings in the corridors and stairways were examined and found to have a calorific value of just over 48 MJ/m^2. In this context, it should be noted that in SOLAS 1974 the upper limit for surface materials in corridors is set at 45 MJ/m^2. SOLAS 1960 only contains requirements governing the total volume of surface materials, and requires that they be tested by a method approved by the administration. Thus the calorific value of the surface materials in the corridors on board the *Scandinavian Star* lay only 3 MJ/m^2 above the present limit stipulated in SOLAS 1974.

The Committee also pointed out, among other things, that, when ignited, the laminated plastic produced large quantities of carbon monoxide and hydrogen cyanide. The regulations applying to material on board ship do not include criteria for the toxicity of smoke gas components.

The carpeting and cabin fixtures had no significant effect on the progress of the fire.

The significance of the fire doors is dealt with separately under 8.4.2. Most of the fire doors were eventually closed, although there is some uncertainty about the exact time. However, some of the fire doors in the zones affected by fire and smoke remained open during the whole course of the fire. These included a door into a corridor on the starboard side of deck 4, a door leading from the transverse corridor between starboard stairway 2 and port stairway 2 into a corridor on deck 5, a door from starboard stairway 2 opening onto deck 6, and a door from the port stairway 2 opening onto the car deck, deck 3. The last-named fire door, opening onto the car deck, deck 3, should have been kept closed by an automatic closing mechanism. The way the fire developed indicates that this door remained partly open, and this factor had a considerable effect on the course of the fire. A fire door was missing on deck 6, but this had no effect on the course of the fire because the sliding fire door from

stairway 2 on deck 6 remained open.

The fact that some of the fire doors remained open while others were closed created much stronger draughts through the open doors, which helped the rapid spread of the fire. The open passage created along the transverse corridor between stairway 2 on the starboard side and stairway 2 on the port side on deck 5 also created a draught that favoured the fierce and rapid spread of the fire.

The Committee then reviews the ventilation system and examines its effect on the fire, under 8.4.3. The effect took several different forms. The ventilation system may not have been turned off until about 0230 hours. As long as it was functioning, it created an overpressure in the cabins, which prevented smoke from seeping in.

The effect of the fire on the condition of escape routes is treated under 8.5. In this connection it is pointed out that within 8 to 12 minutes of the start of the fire, most of the corridors where people died were filled with smoke. Around the stairways the smoke contained deadly concentrations of hydrogen cyanide and carbon monoxide, with decreasing concentrations further along the corridors. Inhaling smoke with the highest concentrations leads to unconsciousness within about 30 seconds and to death within 2 to 3 minutes. Furthermore, there were relatively high concentrations of carbon dioxide, which increases the risk of hyperventilating, which again reduces the time taken to inhale a fatal dose of other gases. The fire also consumed large quantities of oxygen, so that there was probably a lack of oxygen in the escape routes. Lack of oxygen normally increases the speed of the body's uptake of toxic substances.

In an evacuation, the density of the smoke affects passengers' opportunities for finding their way to safety. In many of the escape routes the smoke was very thick, with a visibility well below one metre.

Under 8.6 the Committee examines the consequences of the fire. It points out that 158 people died during the fire. For 125 of these, inhalation of carbon monoxide is thought to have been the major cause of death. Many of these 125 also had high concentrations of cyanide in the blood. The remainder are thought to have died mainly from other causes. Some of these deaths were probably mainly due to cyanide poisoning, although carbon monoxide may also have contributed. About ten persons are thought to have died from heat injuries before the concentration of toxic gases had attained a fatal level.

The positions in the ship where the bodies were found are described, and the question of late effects in the survivors is discussed.

The material damage is treated briefly.

3.9 CHAPTER 9. THE CONDUCT OF THE CREW DURING THE DISASTER

Between 0145 hours and 0215 hours, two separate fires occurred on the *Scandinavian Star*. The conduct of the crew in connection with these fires is described and examined in Chapter 9.

The first fire was discovered and extinguished before any noticeable damage was done. Several members of the crew were involved in giving the alarm and extinguishing this fire. Their efforts are examined under 9.3. The actions of some of the crew during and especially after the first fire were open to criticism. Both the officer on watch and the captain suspected arson, and this should have prompted them to undertake a thorough search of the whole ship. However, no such initiative was taken, as described under 9.3.3.

The second fire, and this is the fire that will be discussed in the following, precipitated the disaster. During this fire some of the crew, mostly on their own initiative, played significant roles in sounding the alarm and evacuating passengers. Their efforts are examined under 9.4. The conduct of the crew as a whole during the disaster is open to criticism for several reasons. The most serious is that they never acted as an organized unit. All their efforts were characterized by this lack of organization, as shown under 9.5.

The warning to the bridge of the existence of the disaster fire is treated first, followed by the immediate measures taken. It is emphasized that, in case of fire, there are certain precautions that must be taken at once. These include giving the alarm, within the ship and to external agencies, attempting to control the fire, and manoeuvring the ship into a favourable position.

The internal main alarm was sounded immediately. A great many of those on board did not hear the alarm. This may be partly due to technical reasons, since in some cabins it was difficult to hear the alarm. But one of the reasons was probably that the alarm was sounded relatively few times over short periods. Obviously a large number of those on board were asleep when the alarm went off. Thus, the organized waking of sleepers by other means should have been started as soon as possible in addition to sounding the alarm. Early organized waking of sleepers was not carried out on the *Scandinavian Star*.

The closing of fire doors was triggered from the bridge on the basis of the individual fire

alarm buttons that had been pressed. However, the signals from the fire alarms to the fire panel on the bridge showed very early on that large parts of the cabin areas were affected by fire or smoke. The signals succeeded each other rapidly, indicating that the fire was spreading fast, although its actual extent was unclear. In such a situation all the fire doors should have been released at once, at any rate on decks 4 and 5, where the alarm buttons had been pressed. This criticism is directed at the captain.

With regard to the manoeuvring of the ship, in the Committee's opinion attempts should have been made to maintain steerageway for as long as possible. This would have necessitated instructions to the watch engineer and instructions to keep the engines manned. The engineer on watch received no instructions to adjust the propeller pitch, start the bow thrusters, or take any other action that might have helped to maintain the ship's manoeuvrability. The blame for this must be primarily directed at the chief engineer, but the first officer and the captain could also have acted more rationally.

Under 9.4.3 the Committee examines the exercise of leadership functions during the fire. Particular attention is paid to certain functions: acquiring an overview, directing and supervising the crew, information to crew and passengers, and external communication. The Committee concludes that on several points the ship's command failed to do what could be done during the fire. In relation to the four above-mentioned functions, those in command could and should have done more than they did.

Fire fighting and fire limitation are treated under 9.4.4. The Committee concludes that no real attempts were made to fight the fire. It points out that even large ship fires can be put out by a determined use of fire hoses with spray and jet nozzles, and it cannot be excluded that such action might have produced results in this particular case. But however uncertain the results of such efforts might have been, this does not excuse the crew for not having at least tried. The Committee also points out that it would have been understandable if all the smoke-diving equipment had been used for evacuation purposes. But it must be assumed that an organized evacuation search in the relevant areas, which in places were extremely hot, would in itself have required the use of fire hoses to achieve entry. In any case the crew must be blamed for not having assembled or established a fire group using the remaining smoke-diving equipment. If evacuation had been found to require priority later, the equipment could have been diverted to this purpose.

The evacuation of the interior of the ship is treated under 9.4.5. The actions of several members of the crew as individuals were commendable, but the evacuation efforts as a whole lacked an overall leadership.

The evacuation of the ship is described under 9.4.6. In its comments the Committee points out that the ship was not evacuated according to the preestablished evacuation plan. The crew did not act in an organized way, except that the captain ordered the lifeboats to be prepared, appointed an officer to take command of each side of the boat deck, and later ordered the boats to be lowered.

The impression given by the evacuation was that the crew lacked experience in working together and in handling the ship's equipment. This applied to all phases of the evacuation, from the distribution of life jackets and lowering of the boats to the releasing of the boats from the ship's side and manoeuvring them over to the rescue vessels.

The most serious consequence, however, of the lack of organization was that the ship's command had no idea of how many people had left the ship in the lifeboats, nor did they seem to be aware that they ought to have known this.

The Committee considers the question of whether the captain should have remained longer on board and should have ordered some of the crew to remain with him. The Committee concludes that the captain had a duty to remain longer on board the ship, and that he had the opportunity to do so without exposing himself or any other crew members to unacceptable risks.

Under 9.5 the Committee reviews the crew's actions during the fire and evacuation as a whole.

3.10 CHAPTER 10. SAFETY, REGULATION, AND CONTROL

In this chapter the Committee first reviews, under 10.2, the requirements that apply to the ship pursuant to both international conventions, etc. and national legislation. The national legislation in question is that of the Bahamas, Denmark, Norway, and Sweden. The findings are summarized and compared.

Under 10.3 the Committee reviews the requirements applicable to the crew. Here, too, it considers first the international body of rules and then the national provisions in the above-mentioned countries, followed by a summary and comparison.

Under 10.4 the Committee reviews the rules

governing certification, inspection, and control. Flag state control is described. The international rules are reviewed, and the provisions governing the practical implementation of flag state control in the Bahamas, Denmark, Norway, and Sweden are described. These are then summarized, compared, and evaluated. Port state control is also examined, also in the light of international conventions, etc. and national legislation. The port state control implemented by Denmark, Norway, and Sweden is reviewed and compared with the practice of the USA and the UK. This too is summarized, compared, and evaluated.

The Committee pays particular attention to the role of the classification societies in the classing of ships and as regards their exercise of the functions delegated to them by flag states.

In its review of the international rules, etc. applicable to the ship, the Committee gives a survey of the most important SOLAS regulations and compares the requirements in SOLAS 1974 with those in SOLAS 1960 (see 10.2). As regards national provisions, the Committee concludes that the material requirements stipulated by the Bahamas as regards safety, especially fire precautions, on board its ships differ very little from those required of Danish, Swedish, and Norwegian ships. In general the standard of these requirements is up to that of SOLAS and other international conventions, with certain additional requirements.

The Committee also concludes that in general there is little difference between the Bahamas and the Scandinavian countries as regards the qualifications required for ship's personnel.

When dealing with flag state control, the Committee first examines the international rules, and then describes and evaluates the flag state control carried out on behalf of the Bahamas (10.4.2.2 and 10.4.2.2.6). The Bahamas has delegated all flag state control to the seven largest classification societies, and exercises a certain measure of follow-up control by means of its nautical inspectors.

A feature of the Bahamas flag state control emphasized by the Committee is that such control is chiefly concerned with the technical condition of the ship and takes very little account of the crew and their ability to act in the interests of safety. The Committee concludes that this limited form of flag state control does not contravene the provisions of SOLAS, but that a satisfactory flag state control should obviously incorporate the verification of important operational practices in the interests of safety. The Committee mentions a number of factors in support of this view. The Committee also points out that the traditional maritime nations regard the verification of the crew's ability to act in the interests of safety as an obvious and important part of the inspection of passenger ships. The Committee finds reason to criticize the Bahamas for not ensuring that its flag state control incorporates the verification of important operational practices. The Committee further considers that Lloyd's Register should also have noted the need for verification of important operational practices and should have consulted with the Bahamas as to whether this need was being satisfactorily met. Since the Bahamas has de facto delegated the major part of its flag state control to the classification societies, it should be in the interests of these societies, and this naturally applies to the other six societies as well as Lloyd's Register, to ensure that flag state control is on the whole as good as it ought to be.

The Committee points out that after a change of class the new classification society may not always be supplied with the necessary documents for the ship, including plans, etc., and that this may affect the classification society's ability to carry out the delegated flag state control in a responsible manner.

The Committee further points out that, given the very modest size of the maritime administration of the Bahamas, it has only very limited possibilities for dealing with the important issues that will always arise in connection with the control of a fleet of the size registered in the Bahamas.

The flag state control in the Scandinavian countries is also examined.

In the section on port state control the international rules are considered first. One of the points made is that the most important IMO conventions have provisions governing port state control. Special attention is paid to the SOLAS provisions in this regard, and the Paris Memorandum of Understanding (which has been agreed on by the maritime administrations in 14 European countries) on the performance of port state control is examined. The Committee then examines the port state control carried out by Denmark, Norway, and Sweden, and by the UK and the USA, in order to form a standard of comparison. The port state control implemented by the latter two countries differs in several respects from that in the Nordic countries.

Under 10.4.3.2.7 the Committee summarizes, compares, and evaluates its findings. It points out that there are definite weaknesses in the port state control practised by Denmark and Norway, and there are many indications in favour of a reorganization of this control to

ensure more thorough and frequent inspections.

The Committee has considered whether criticism should be levelled at the Danish and Norwegian authorities for not having made changes in their system of port state control. In this connection it must be noted that the system practised in these countries seems to be in accordance with the type of control indicated in SOLAS and the Paris Memorandum, and that most of the countries that are party to the Paris Memorandum have practised port state control along the same lines as Denmark and Norway, as far as the Committee has been in a position to judge.

The Committee further points out that the UK carries out more thorough and frequent inspections as part of its port state control, and has to a greater extent verified the ability of the crew to act in the interests of safety. This intensification of port state control on the part of the UK can to a large extent be justified within the framework established by SOLAS and the Paris Memorandum.

The Committee concludes that criticism of the unsatisfactory port state control carried out by Norway and Denmark is primarily a criticism of the system that SOLAS and the Paris Memorandum appear to lay the foundation for. However, the Committee considers that Norway and Denmark cannot be entirely exempted from blame. It points out that it is the duty of the maritime authorities to register the actual requirements of the control system and to adapt the system, within the limits of the legislative framework, to these requirements. The fact that others' control systems are also unsatisfactory may explain why the system has not been changed, but does not exempt the authorities from their duty to try to correct existing faults in their own system.

The Committee raises the question of whether the blame lies with the maritime administrations in Denmark and Norway (Søfartsstyrelsen and Sjøfartsdirektoratet respectively) or in some other quarter. It concludes that the maritime administrations cannot be exempted from their responsibility for establishing adequate control systems, unless they receive clear political instructions regulating the form and content of the system.

The Committee then considers the fact that the *Scandinavian Star* was not inspected by the Danish or Norwegian authorities before being put into service. In the Committee's opinion this must be regarded as a consequence of the way in which port state control has been implemented.

As mentioned above, the role of the classification societies is dealt with in a separate section. The duties of the classification societies as regards the actual classing of the ship, on the one hand, and the delegation of the authority to carry out flag state control to certain societies, on the other, are discussed. The Committee mentions certain reservations in principle as regards the classification societies' role as representatives of the authorities, and also allegations against classification societies for poor quality surveys.

3.11 CHAPTER 11. THE RESCUE OPERATION

This chapter deals with the external rescue operation, the operation mounted by outside agents to provide assistance to the *Scandinavian Star* and those on board.

Under 11.2 the Committee describes the rules for and organization of rescue services in the Nordic countries, including both international and national rules, and the practical organization of the rescue services in these countries.

The Committee reviews the actions of the various participants in the rescue operation and examines the way in which a large rescue operation should be coordinated.

The Committee also reviews the resources available for rescue operations in the Skagerrak, including rescue vessels, coast guard vessels, naval vessels, helicopters, aircraft, etc. and including non-dedicated rescue units. Emergency medical services and the supply of smoke divers and other resources for fire fighting and the like are reviewed.

Under 11.4 the actual conduct of the rescue operation is examined. The receipt of the warning and initial organization of the rescue work by the rescue coordination centre are described and evaluated. The Committee concludes that neither the main rescue coordination centre at Sola nor the rescue coordination centre in Göteberg, Sweden, can be criticized for agreeing that the centre at Sola should be the main rescue centre. The Committee further points out that the team that was called in to report to the centre at Sola on the night of the disaster was deficient in some respects. It lacked among other things medical expertise and an expert in fire fighting.

The Committee then reviews under 11.4.3 the actual rescue forces that were mobilized, the vessels that were available during the rescue operation, the medical resources mobilized, and the methods used to mobilize smoke divers and fire extinguishing personnel and material. The calling up of the various rescue forces is also examined. The Committee concludes that smoke divers should have been

summoned by the centre at Sola at the same time as the other rescue units were called up.

The Committee then reviews the actual rescue efforts, and points out that after the initial scrambling, the direction of the rescue operation by the centre at Sola seems to have been characterized by a lack of information about what was happening at the scene of the disaster. It is pointed out that the centre at Sola had no possibility of listening to or communicating directly with the *Stena Saga* over channel 16.

The Committee finds no grounds for blaming the CSS (commander surface search), the *Stena Saga*'s captain, Lennart Nordgren, for this, and gives its reasons. The Committee points out that when it became obvious to the centre at Sola that it was having difficulties in keeping abreast of developments at the scene of the disaster, it should have made it clear to CSS, if necessary via the Göteborg centre, that the centre at Sola was the main rescue centre, that it had to be informed of all developments, and that as far as possible it ought to be consulted before important decisions concerning the rescue operations were taken (cf. 11.4.5.1).

The Committee examines the view that seems to have rapidly become established at the Sola centre that all those on board the *Scandinavian Star* had boarded lifeboats and been saved, i.e. that there was no one left on board the ship. The Committee reviews the reports received by the Sola centre concerning developments at the scene of the disaster, and concludes that the information that the Sola centre actually received did not give it sufficient grounds to suppose that everyone had been saved and to base its conduct of the rescue operation on this.

In connection with the role played by Tjøme Radio (the coastal radio station) in the rescue operation, the Committee points out that obviously some selection of information had to be made. Unimportant information and reports should not have been transmitted from the radio station to the centre at Sola. However, on one important point – the question of whether everyone had left the ship – the information passed on by the radio station was incomplete, considered as a whole. Tjøme Radio cannot be exempted from blame in this respect.

The Committee examines the actions of the CSS and the direction of operations at the scene of the disaster. It points out that decisions were made on the spot by CSS without first informing or consulting the centre at Sola. The Committee finds it difficult to blame Captain Nordgren for this. At no time did he receive any instructions regarding the conduct of the operation, nor was he notified that the centre at Sola had to be informed and if possible consulted.

The Committee conducts a thorough examination of whether Captain Nordgren provided correct information regarding the evacuation of the ship, or whether incorrect information from Captain Nordgren was the reason for the erroneous impression in some quarters that the ship had been completely evacuated. In this connection important extracts are reproduced from the recorded transmissions of *Stena Saga*'s dialogues over VHF on the night of the disaster. The Committee does not consider that anything in these messages substantiates the claim that CSS reported from the scene that there was no one left on the ship. On the contrary, Captain Nordgren clearly states that there may still be people on board. The Committee concludes that Captain Nordgren cannot be criticized for the information he provided regarding whether or not there may have been people still left on the ship.

The Committee also examines whether Captain Nordgren can be blamed for not having raised the question of calling in smoke divers from the mainland at an earlier stage. The Committee concludes that Captain Nordgren cannot be criticized on this point.

The Committee devotes a separate section to communication and related problems between the various agencies in command of the operations. In this context the Committee points out that the communication equipment at the Sola centre is definitely below standard, and that the centre does not have the equipment to keep abreast of events and maintain direct communication with the CSS or other commander at the scene of the disaster over channel 16. During this rescue operation, monitoring and communication were essential if the main rescue coordination centre was to be able to perform its function. The Committee is aware that strong objections have been voiced, among others by the centre at Sola, to the idea that the main rescue coordination centre should have such equipment and should be required in certain rescue operations to follow the operation and communicate over channel 16. The Committee examines the main objections of the rescue coordination centre. The objections have not caused the Committee to modify its conclusion in any way.

The Committee reviews the assistance given to survivors by ships and on shore. The registration of survivors and the dissemination of information are discussed.

Under 11.5 the Committee outlines certain important recommendations regarding rescue services, etc. It presents relatively detailed proposals for measures to improve the organi-

zation and command of rescue work at the scene of the disaster. It also takes up questions of communication equipment, as mentioned above, deployment of smoke divers, and the like.

The Committee's decision to present its recommendations separately in Chapter 11, and not simply in Chapter 13 with the others, is based on the fact that the rescue operation in many ways represents a separate issue in the Report. The contents of the other chapters are interconnected to a greater extent. However, the recommendations presented under 11.5 are also included in Chapter 13.

3.12 CHAPTER 12. THE PAYMENT OF COMPENSATION TO INJURED PASSENGERS AND SURVIVORS

In this chapter the Committee deals with the rules governing economic compensation to injured and surviving persons after this type of disaster. The main principles governing the regulation of liability and insurance are outlined. The Committee discusses the question of whether third-party insurance should be made compulsory and whether other types of insurance schemes should be established. A special point is made of the idea of introducing compulsory collective accident insurance in favour of the victims of accidents involving passengers. In the Committee's opinion the disaster on the *Scandinavian Star* has made relevant the question of legislative measures to ensure that victims and survivors receive adequate economic compensation.

3.13 CHAPTER 13. RECOMMENDATIONS

The Committee considers it an important part of its function to present recommendations that can help to prevent the future occurrence of extensive fires on board ship. The Committee starts by pointing out the faults, defects, and weaknesses revealed by the *Scandinavian Star* disaster. The recommendations must be considered in this context.

Under 13.1 the Committee outlines certain general and theoretical considerations on which its recommendations are based. It discusses whether amendments in existing rules, etc. governing ships, crew, control systems, rescue services, and the like should be implemented internationally or whether it would be better to settle for national or regional amendments. The Committee concludes that although it would naturally be best if the amendments were to be implemented internationally, the proposals presented by the Committee should, and in fact must, be implemented for passenger ships in service to Scandinavian ports, whatever their flag, until such time as they can be adopted at an international level.

The Committee points out that the international aspects of the traffic under discussion here – regular passenger traffic to Scandinavian ports – are not as prominent as they are in for example international bulk or cargo transport. These passenger ships are normally permanently attached to a particular region for relatively long periods. It therefore does not affect international competition in the region if such ships are subjected to stricter requirements than corresponding ships in regular service in other regions, providing the requirements apply irrespective of the ship's flag.

After weighing other objections to its proposal for a regional solution, the Committee points out that such considerations must give way to the interests of the "passenger states" in securing their passengers against harm during their journeys. It is pointed out that in international law such "passenger state interests" have a parallel in the interests of continental shelf states in enforcing safety requirements on the part of all ships engaged in petroleum operations on their continental shelf, whatever the ship's flag. The regulation and control implemented by continental shelf states have been made possible in spite of the fact that the shipping traffic involved in petroleum operations has a far more international character than regular passenger services.

The Committee then reviews the work on international conventions in the field of shipping, and emphasizes the impressive efforts made by the IMO. The Committee considers that as a result of the present conventions, many countries, including Norway, Sweden and Denmark, have abolished a number of special provisions that had previously been applied over and above the convention-based requirements. Consideration of the international character of the shipping industry has largely been responsible for this attitude. However, the Committee points out that when special national requirements are abolished in a large number of areas, much of the impetus for raising standards by means of conventions disappears. There are no longer "competing" national requirements against which to measure the standards laid down in the conventions. In the same way, if countries are cautious in their application of discretionary provisions, and take other countries' less strict practices into account, the system will become increasingly static.

The Committee describes in general how a sectoral approach has influenced many of the standards applied to ships, control systems,

safety precautions, etc. in the shipping industry. It points out how necessary it is to examine the safety measures implemented by other sectors, such as petroleum extraction, to a much greater extent than formerly.

The Committee emphasizes the importance of providing the maritime administrations in the three countries with the necessary resources to enable them to evaluate and where appropriate implement the Committee's recommendations.

The Committee presents its recommendations under 13.2 and 13.3. 13.2 contains the principal recommendations. These deal with the really important weaknesses that were shown up by the fire. The remaining recommendations are presented under 13.3.

The principal recommendations are concerned with technical standards, operational factors, and inspections. The Committee's most important recommendation concerns technical standards: it recommends that all ships in passenger traffic to Scandinavian ports should be required to install sprinkler systems. The requirement must be applied to existing as well as new ships. A further principal recommendation is that smoke detectors be made compulsory in corridors, stairways, saloons, and cabins. The smoke detectors must be connected with indicators on the bridge and they must be installed in sufficient numbers and in such a way that they can both detect possible sources of smoke as soon as possible and provide the bridge with adequate indications of the spread of smoke in the accommodation areas.

The Committee's principal recommendation with respect to operational conditions is that crews serving on passenger ships be required to have followed courses in safety procedures approved by the maritime administrations. The Committee also examines some of the necessary requirements for such courses.

In its principal recommendation with regard to port state control, the Committee proposes that all passenger ships in service to Scandinavian ports be subjected to an initial inspection before they are allowed to take passengers on board. Such inspections must then be followed up by periodical inspections, scheduled and unscheduled. Such inspections must include verification of operational practices.

The Committee further recommends that regulations be laid down governing the duty of shipowners to establish systems for the safe operation of ships in accordance with the principles laid down in IMO Resolution A.647(16). These regulations must be made to apply to all shipowners with passenger ships in service to Scandinavian ports. The verification of compliance with this regulation must be part of the inspection routines for passenger ships.

It is the opinion of the Committee that if the recommendations presented under 13.2 are implemented for passenger ships in regular traffic to Scandinavian ports, this will result in a very great improvement in standards of safety on board these ships. The recommendations presented under 13.3 are regarded by the Committee as important, but it is pointed out that even if they were all to be implemented, this would not achieve the desired standards of safety on board passenger ships unless the proposals under 13.2 are also carried out.

4. Description of the Ship

4.1 DESCRIPTION OF THE SHIP

4.1.1 General remarks

The *Scandinavian Star* was built in 1971 at the Dubigeon-Normandie shipyard at Prairie-au-Duc in Nantes, France, as a combined passenger ship and ferry for cars and trailers. The ship has a welded steel hull pursuant to the rules and regulations of the French classification society Bureau Veritas, Paris. Until September 1987 the ship was classed with Bureau Veritas, but after this it was classed with Lloyd's Register. Thus it was Lloyd's Register that carried out the last surveys in compliance with international rules on behalf of the flag state, the Bahamas.

The ship has an inner bottom, three full, complete decks in the hull and three complete decks in the superstructure. There is also a narrow length of deck on either side of the space for cars and trailers, as explained below.

The ship is divided into 12 watertight compartments with bulkheads extending from the keel to the freeboard deck. The car deck is the freeboard deck. The openings in the watertight bulkheads have watertight doors. The division into watertight compartments meets the requirements laid down in SOLAS 1960 and in the International Convention on Load Lines.

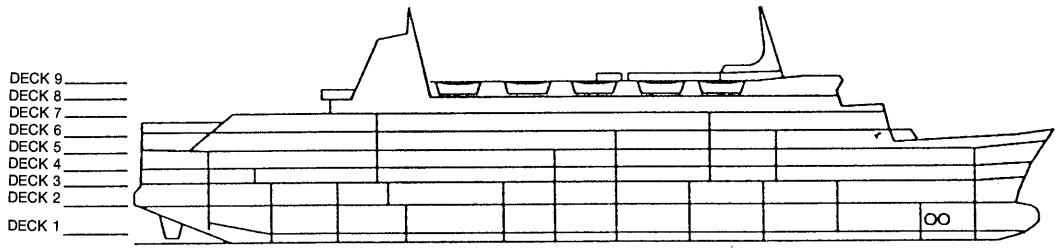
The space for cars and trailers (the car deck) forms a hangar running almost the whole length of the ship, but bordered on either side by cabin sections extending two decks up. Thus halfway up the height of the car deck there is a deck with cabin sections on the port and starboard sides. The ship has no bowport, so the vehicles can only be loaded and unloaded through the sideport.

About halfway along the length of the ship there is a deck about 11 metres long with galleys, messrooms, and common rooms for the crew. All the rooms on this deck are below the waterline. There is no sleeping accommodation in this section.

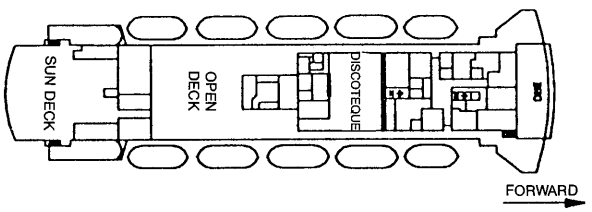
The ship has two propulsion engines of 5880 kW (8000 hp), each connected to a propeller. It has five diesel generators, each of 660 kW, and two transverse bow thrusters, each with a capacity of 440 kW (600 hp), which facilitate the manoeuvring of the ship in and out of dock.

Fig. 4.1.1 contains diagrams of the ship in profile and each deck in cross section, showing the arrangement of each deck.

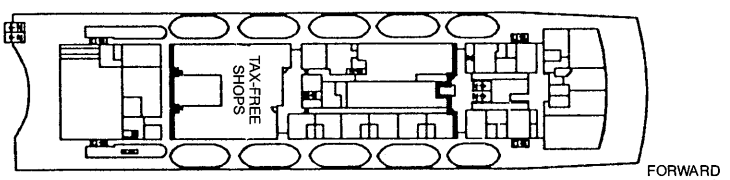
Fig. 4.1.1 *The ship in profile and in cross section showing the arrangement of each deck*



DECK 8, BRIDGE deck

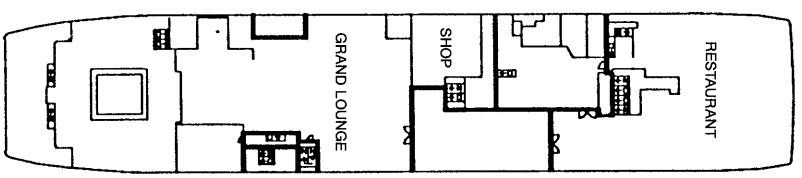


DECK 7, SUNSET deck

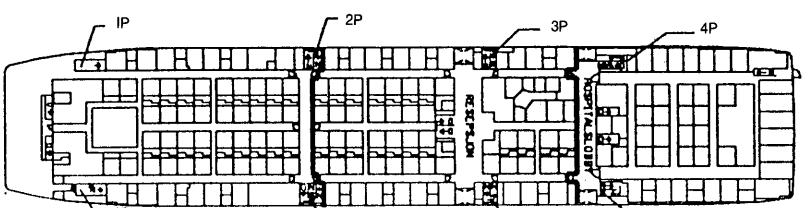


FIRE ZONE 1 FIRE ZONE 2 FIRE ZONE 3

DECK 6, MAIN deck

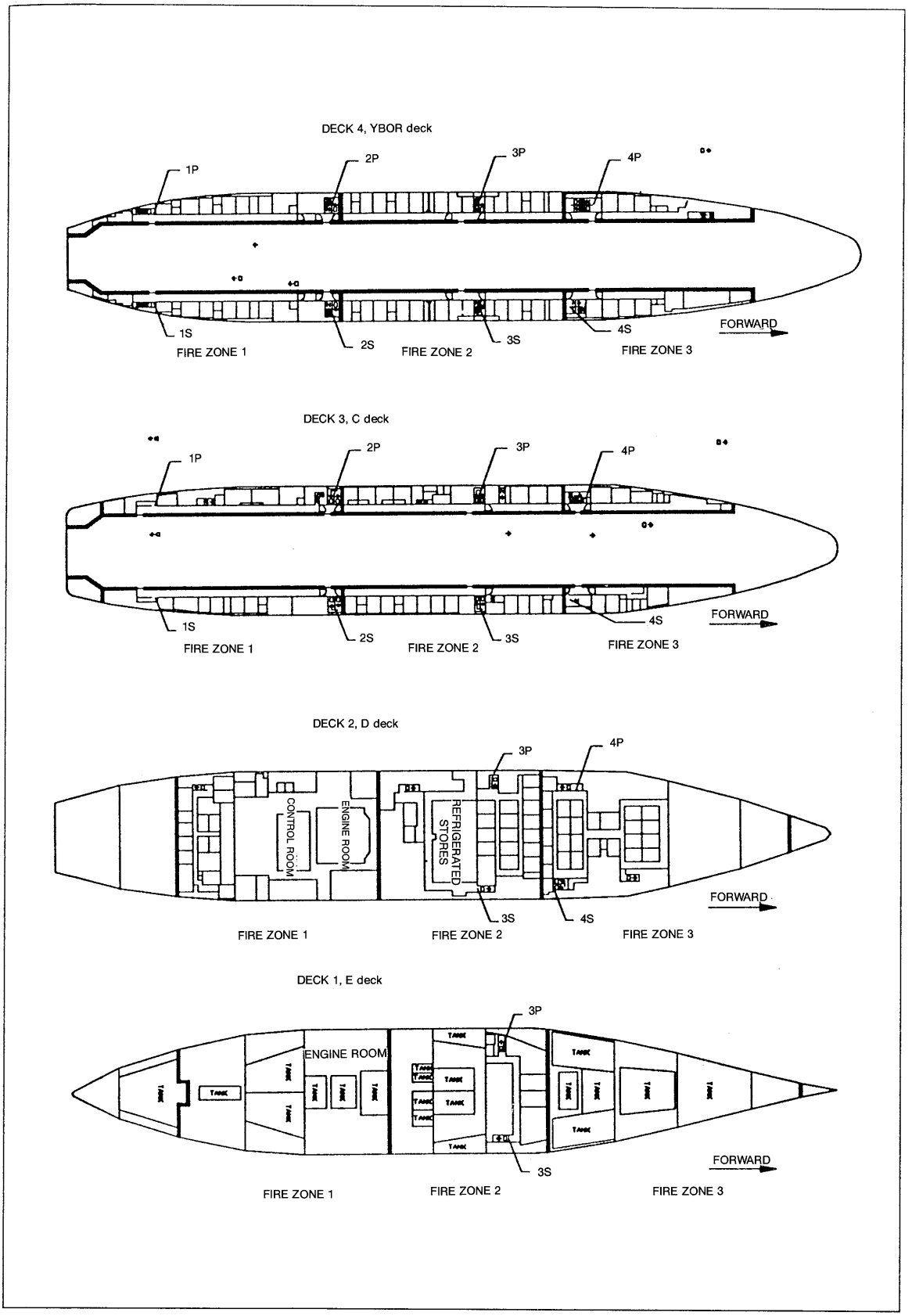


DECK 5, GULF deck



FIRE ZONE 1 FIRE ZONE 2 FIRE ZONE 3

Fig. 4.1.1


DECK 4, YBOR deck
1P
2P
3P
4P
1S
2S
3S
4S
FORWARD
FIRE ZONE 1
FIRE ZONE 2
FIRE ZONE 3
DECK 3, C deck
1P
2P
3P
4P
1S
2S
3S
4S
FORWARD
FIRE ZONE 1
FIRE ZONE 2
FIRE ZONE 3
DECK 2, D deck
3P
4P
CONTROL ROOM
ENGINE ROOM
REFRIGERATED STORES
3S
4S
FORWARD
FIRE ZONE 1
FIRE ZONE 2
FIRE ZONE 3
DECK 1, E deck
3P
ENGINE ROOM
TANK
3S
FORWARD
FIRE ZONE 1
FIRE ZONE 2
FIRE ZONE 3

4.1.2 Size and capacity

The car deck has room for 280 cars or 30 trailers. Before the ship was used as a ferry between Oslo and Fredrikshavn, it was used for day trips from Miami, Florida. It was then certified to take 1402 persons, including a crew of 250. For the traffic between Denmark and Norway the shipping company had decided on a full complement of 1052 passengers and a crew of 100.

The ship's measurements, as far as can be ascertained, are as follows:

Length overall (bow to stern) ..... 141.60 m
Beam ..... 21.90 m
Height from keel to freeboard deck (car deck) ..... 7.75 m
Height from keel to boat deck ..... 19.00 m
Draught ..... 5.50 m
Service speed ..... 21.50 knots

To summarize, the ship's size was comparable to that of many of the passenger ships in regular traffic between Norway and Denmark.

4.1.3 The individual decks

A more detailed description of the various decks is given below. The decks are designated by *numbers*, starting with the lowest deck, the foreshortened deck containing messrooms, galleys, and common rooms for the crew, which is numbered 1. The tanks, which are on a level with deck 1, are included in the description of this deck.

The deepest part of the ship, the double bottom, is also included.

4.1.3.1 Double bottom

The space between the outer and the inner bottom is called the double bottom. On the *Scandinavian Star* the double bottom was used in the usual way for tanks of ballast water, oil, and fresh water.

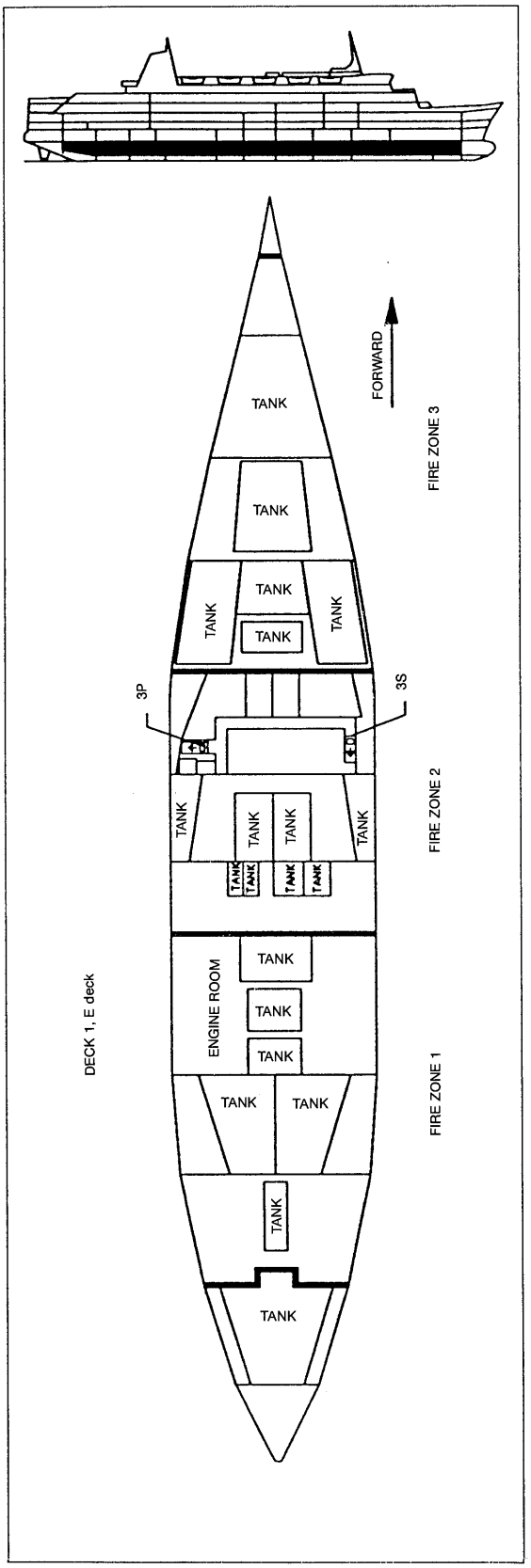
The height of the double bottom is about 1.3 m.

4.1.3.2 Deck 1 (E Deck), also called C Deck and Tanktop

At the level of this deck are the sewage tank, compressor and pump room, engine room, fuel tanks, stabilization tanks, fresh water tanks, ballast tanks, and the bow thruster room. As mentioned above, this deck also has a few rooms at the disposal of the crew.

The rooms for the crew extend lengthways from frame 104 to 119 and are thus more or less amidships. Crossways they extend from side to side. The whole section is below the waterline. It contains the crew's galley, dishwashing room, messroom, and bar. There is no sleeping

Fig. 4.1.2 *Layout of deck 1 (E Deck)*



accommodation. Access to the section is by a stairway on the port and one on the starboard side. These stairways also act as escape routes in an emergency.

4.1.4.3 Deck 2 (D Deck), also called B Deck

This deck extends from bows to stern and from side to side of the ship. It contains cabins for the crew, the diesel generator room, control room for the engines, engine room, food stores, frozen and refrigerated stores, and rooms for the crew. Like the rest of the ship, the deck is divided into three fire zones.

Fire zone 1

In this zone there are 16 crew cabins with a maximum capacity of 37 persons.

From the crew's cabins on the port side there is a stairway leading up to the deck above. On the starboard side there is an emergency exit via a vertical ladder. Between the stairway and the emergency exit there runs a transverse corridor 16.5 m long and 1 m wide. The section also has short longitudinal corridors leading to bathrooms and lavatories for the crew. These have an emergency exit on the starboard side leading down to the forward part of the after sewage tank space.

Fire zone 2

Fire zone 2 on deck 2 contains food storage rooms, refrigerated stores, and a crew accommodation section.

In the crew section there are 18 crew cabins with accommodation for up to 38 persons. The section has two transverse corridors internally linked by two short longitudinal corridors on the port and starboard sides. There are two blind corridors, 2.5 m long, leading to the foremost transverse corridor.

There are stairways leading to the deck above on the port and starboard sides.

Fire zone 3

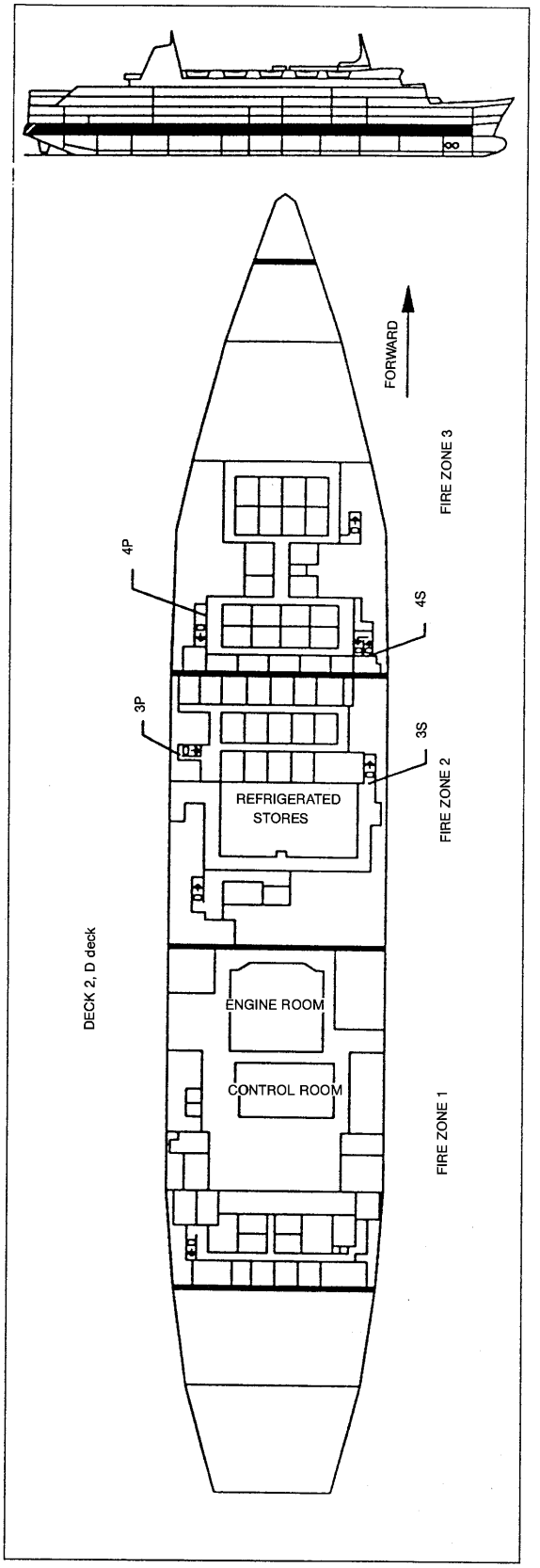
Fire zone 3 on deck 2 contains 27 crew cabins divided into two sections. It also contains a laundry and the bow thruster room.

Section 1 has 17 crew cabins with accommodation for up to 36 persons. The section has two transverse corridors linked with short longitudinal corridors on the port and starboard sides. A port and a starboard stairway lead to the deck above.

Section 2 contains 10 cabins with accommodation for up to 36 persons. The section has two 10 m-long transverse corridors and two 7.5 m-long longitudinal corridors.

A stairway on the starboard side leads to the deck above. There is also an alternative escape route through a watertight door and into the

Fig. 4.2.3 *Layout of deck 2 (D Deck)*



laundry, which has a ladder on the port side leading up to the deck above.

Sections 1 and 2 are also connected by a 5 m-long longitudinal corridor that may be used as an emergency exit.

4.1.3.4 Deck 3 (C Deck), also called A Deck and car deck

This deck is mainly for cars and trailers, but has accommodation spaces on either side, as explained above. The space for cars and trailers has fireproof insulation separating it from the accommodation spaces. This means that on this deck there are longitudinal fire zone divisions as well as the ordinary transverse divisions.

The car deck extends the length of the ship from the stern almost as far as the bows. Access is by a ramp in the stern. There is no access to the car deck from the bows.

The accommodation spaces on either side of the car deck have longitudinal corridors running almost the whole length of the ship. In the bulkheads between the fire zones the corridors have fire doors that are supposed to be closed in the event of fire. Fire doors are also situated at the entrances to stairways from the corridors. The longest corridor section between fire doors is 29 m.

Fire zone 1

Fire zone 1 in the accommodation space is divided into a port and a starboard section, with the car deck in between.

Fire zone 1 on deck 3 contains four passenger cabins on the starboard side. On the port side there are two crew cabins, a laundry, and an office.

On both port and starboard sides there are stairways leading right up to deck 5, where they open directly onto the after mooring deck. There is also access to the car deck through a steel fire door. There are also stairways at the forward ends of the corridors, leading to deck 6 on the starboard side and deck 5 on the port side. The stairways are protected by fire doors fore and aft.

The fire doors between the car deck and the accommodation area are self-closing sliding doors.

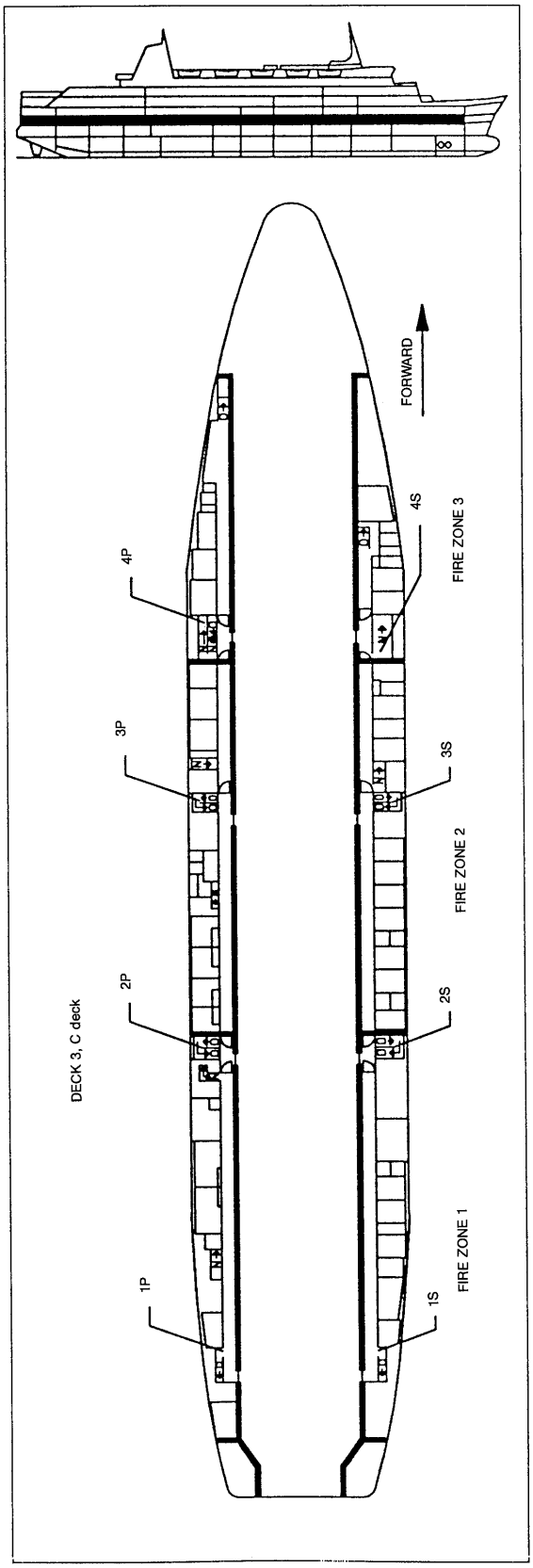
The cabins in this zone were not in use. No bodies were found in this zone. The fire started on the starboard side of this zone.

Fire zone 2

Fire zone 2 on deck 3 has nine passenger cabins on the starboard side and seven crew cabins on the port side.

Near the middle of fire zone 2 on both port and starboard sides there are stairways leading

Fig. 4.1.4 *Layout of deck 3 (C Deck)*



up to deck 4 and on to deck 5. There are also stairways down to the crew cabins on the deck below on both port and starboard sides.

Fire zone 3

Fire zone 3 on deck 3 has three crew cabins on the starboard and three on the port side.

On both port and starboard sides there are stairways leading down to the crew section on the deck below and upwards to decks 4 and 5. The stairways are protected by fire doors fore and aft.

The car deck can be reached from the port and starboard sides through self-closing sliding fire doors. On the starboard side there is also a stairway at the forward end of the corridor, which leads down to the crew cabins on the deck below. At the forward end of the cabins on the port side there is a fire door opening into a stairway that leads up to deck 4 and deck 5 and from there to an exit onto the open forward deck.

The fire doors between the car deck and the accommodation are self-closing sliding doors.

No bodies were found in this section.

4.1.3.5 Deck 4 (Ybor Deck), also called the Caribbean Deck and upper car deck

Like the deck below, this deck also has sections on either side of the car deck, and is also divided transversely into three fire zones. The space for cars is two decks high to accommodate trailers. Under deck 5 is a suspension deck that can be lowered to the level of deck 4 to accommodate cars. When it is lowered it can be reached through self-closing sliding fire doors.

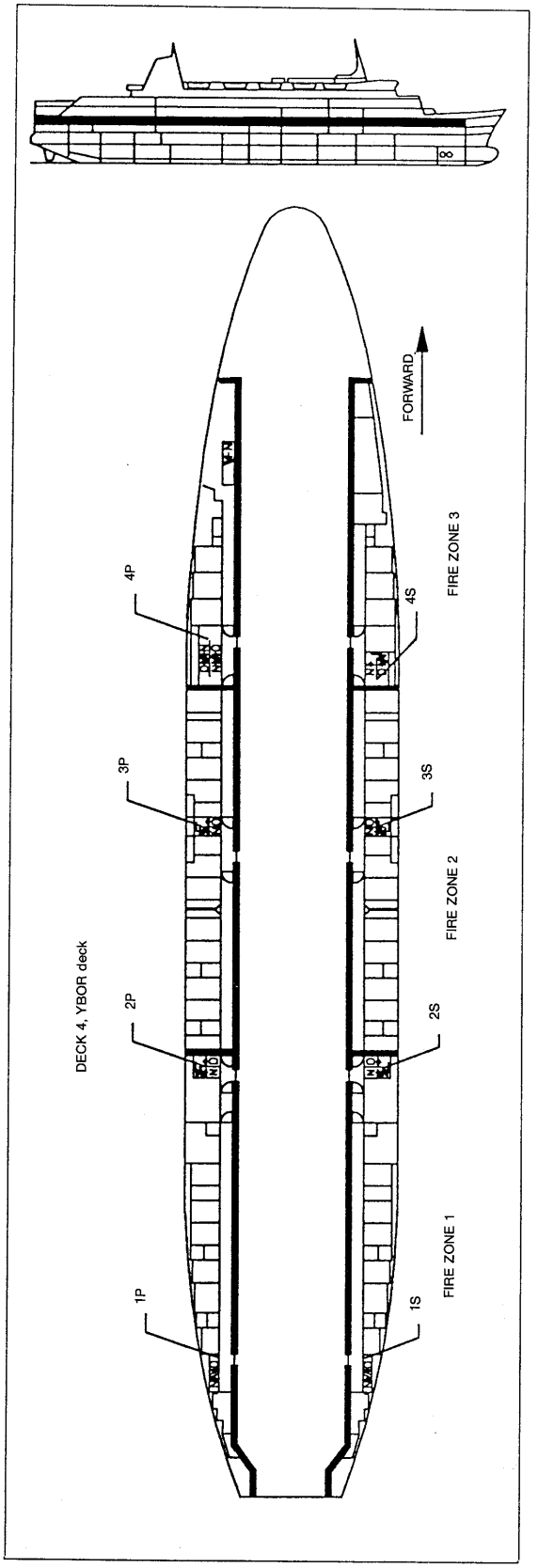
On deck 4 there is accommodation on both port and starboard sides for a total of 160 passengers and six crew. The cabin sections have corridors running almost the whole length of the ship. Where the corridors traverse the bulkheads between the fire zones there are fire doors.

Fire zone 1

Fire zone 1 on deck 4 has a total of 12 passenger cabins and two crew cabins on the port and starboard sides.

At the after end of the fire zone there are stairways running from deck 2 up to deck 5 on both port and starboard sides. On deck 5 there is an exit directly onto the open after mooring deck. At the forward end of the fire zone there is a stairway on the starboard side running from deck 3 to deck 6, and on the port side there is one running from deck 3 to deck 5. The stairways are protected by fire doors fore and aft. As mentioned above, there is also an exit from the cabin sections through the fire door to

Fig. 4.1.5 *Layout of deck 4 (Ybor Deck)*



the upper car deck when this is lowered.

Nineteen bodies were found in the cabins on the starboard side of this section, and two in the corridors.

Fire zone 2

Fire zone 2 on deck 4 has a total of 22 passenger cabins on the port and starboard sides. About halfway along the longitudinal corridors on both sides there is a stairway with fire doors fore and aft. The stairways run from deck 3 to deck 5. Just outside the fire zone on the port and starboard sides there are stairways fore and aft that lead up to the deck above. These stairways can be reached through fire doors.

A total of 14 bodies were found in the cabins on the starboard side in this fire zone.

Fire zone 3

Fire zone 3 on deck 4 has accommodation for up to 20 passengers on the starboard side and 12 passengers and four crew on the port side.

At the after end of the fire zone, on the port and starboard sides, there are lobbies directly linked with stairways that run from deck 2 to deck 5. On the port side there is also a stairway running from deck 3 to deck 5 and from there out to the forward mooring deck, which is an open deck.

There are exits at both ends of the corridor on the port side, while on the starboard side there is a 15.2 m-long corridor with an exit at the after end only.

There was no spread of smoke to this part of the ship, and no bodies were found here.

4.1.3.6 Deck 5 (Gulf Deck), also called Coral Deck

This deck forms the ceiling of the car deck and extends the full width of the ship. It has more cabins than any other deck, with six in a row, reached by three longitudinal corridors linked by ten transverse corridors altogether. Because the centre longitudinal corridor is not a through corridor, the corridor network gives the impression of a labyrinth.

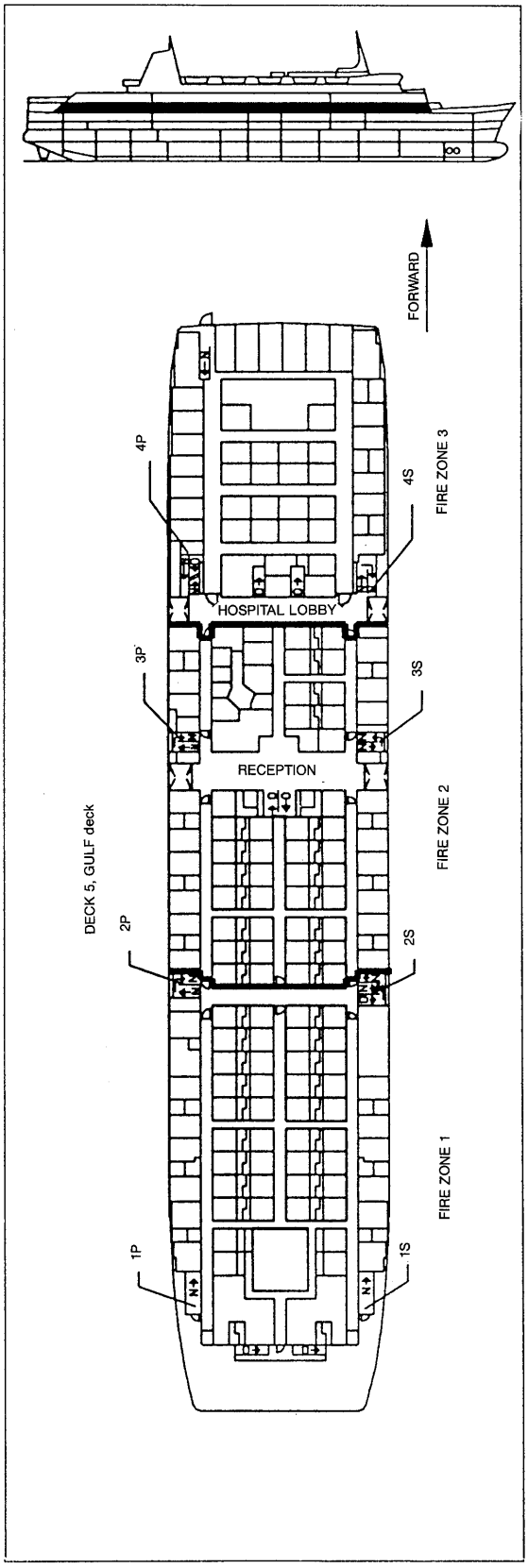
The deck has a total of 138 passenger cabins, accommodating up to 396 passengers, and eight crew cabins for eight crew members. There are also two storerooms, two offices, an information desk, and a hospital, consisting of a doctor's office and sick bay.

Like the other decks, deck 5 is divided into three fire zones.

Fire zone 1

Fire zone 1 on deck 5 has 21 cabins accommodating up to 126 passengers. It also has a swimming pool, two storerooms, and engine-

Fig. 4.1.6 *Layout of deck 5 (Gulf Deck)*



room casings on the port and starboard sides.

At the forward end three longitudinal corridors (port, centre, and starboard) end in a broad transverse corridor, from which they are separated by fire doors. At the after end the port and starboard corridors are blind, but not far from the ends are doors leading to stairways and the open deck.

The centre longitudinal corridor leads to the open deck aft of the cabin section, but has four right-angled changes of direction before it ends in a door. The changes of direction are caused by the swimming pool, which was installed after the ship had been built.

From the broad transverse corridor at the forward end of the zone, there is a stairway on the starboard side that runs from deck 2 up to deck 6. On the port side there is a similar stairway, but this only leads down to deck 2 and not up to deck 6.

In this zone 16 bodies were found in cabins and 18 in the corridor on the starboard side, and 13 in cabins and seven in the corridor on the port side. Ten bodies were found in cabins opening onto the centre longitudinal corridor, and 12 in the corridor itself. Four more bodies were found on the open deck aft of the cabin section.

Fire zone 2

This zone contains 56 cabins with accommodation for 146 passengers and also the hospital (doctor's office and sick bay), information desk, and two offices. The reception lobby is situated slightly forward of the middle of the fire zone, with cabins fore and aft. Two of the corridors in this zone have blind ends.

Aft of the reception lobby on the port and starboard sides there is access from the corridors through fire doors to stairways leading down to other decks. At the forward end the corridors open into the lobby through fire doors. From the lobby the deck above can be reached by a stairway amidships.

The centre corridor aft of the lobby has a blind forward end. The after end leads through a fire door to the after fire zone.

In the area aft of the reception lobby, 10 bodies were found in cabins opening into the starboard longitudinal corridor. No bodies were found in the corridor itself. In the cabins opening into the port longitudinal corridor there were eight bodies, and again, none in the corridor. Nine bodies were found in the cabins opening into the centre longitudinal corridor, 10 in the corridor itself, and one in an adjoining transverse corridor.

Forward of the reception lobby there are longitudinal corridors on the port and starboard sides. At the forward end of the port corridor there is a fire door leading into the hospital lobby, in fire zone 3.

There is also a centre corridor with two blind ends, from which the starboard longitudinal corridor can be reached by means of a transverse corridor about halfway along. The starboard longitudinal corridor has openings at both ends.

The smoke did not spread to this part of the ship, and no bodies were found here.

The reception lobby is separated from the adjacent corridors by fire doors. In the after part of the lobby, as mentioned above, there is a stairway amidships that leads to the deck above. Forward of the lobby there are stairways on the port and starboard sides running down to deck 2.

As mentioned above, the lobby has an information desk, offices for the purser and chief steward, and lifts and embarkation ports on the port and starboard sides.

The only escape route open to people in the lobby is the midship stairway to the deck above.

No bodies were found in the lobby.

Fire zone 3

The hospital lobby is situated at the after end of fire zone 3 on deck 5. The lobby has fire doors fore and aft between it and the adjoining corridors.

On the after side of the lobby, on the port side, there is access through a fire door to the port longitudinal corridor in fire zone 2. On the after side amidships there is a fire door leading to the doctor's office and sick bay. On the starboard side is a door into the longitudinal corridor aft of the lobby in fire zone 2. This was marked with a sign saying: NO ENTRY GANGWAY CLOSED, but otherwise unlocked.

On the forward side of the lobby there are stairways leading down to deck 2 on the port and starboard sides. Two stairways amidships lead up to the deck above. This is deck 6 (Main Deck), where the restaurant is situated.

In this lobby, as mentioned above, there is an entrance to the sick bay, and also a bar office, lavatories, and video games. The lobby is spacious, but the video games take up a lot of space.

The passenger accommodation in fire zone 3 lies forward of the lobby. The cabins open off the longitudinal corridors on the port and starboard sides and off four transverse corridors connecting these longitudinal corridors. The port longitudinal corridor leads to an exit onto the poop deck. There are 31 passenger cabins and eight officer's cabins, accommodating a total of 132 persons.

The layout of the corridors is relatively simple, but involves many changes of direction.

No bodies were found in this part of the ship.

4.1.3.7 Deck 6 (Main Deck), also called the Restaurant Deck

Deck 6 is mainly a saloon and restaurant deck, but there is also an open area in the after part containing a swimming pool. The saloon and restaurant areas on deck 6 are used as two of the ship's six muster stations.

Like the other decks, it is divided into three fire zones.

Fire zone 1

Fire zone 1 on deck 6 contains the Broadway Lounge, which is also a muster station. The lounge is very large and parts of it extend the full width of the ship. The lounge is over 30 m long.

There are also two "Casino Slots", one on the port and one on the starboard side. An open stairway leads up to deck 7 and down to deck 5.

From this zone there are alternative escape routes to the open deck, with access via stairs to the deck above. It is also possible to go through fire doors into zone 2.

One body was found in this part of the ship.

Fire zone 2

Fire zone 2 on deck 6 is divided into two longitudinal zones, one on the port and one on the starboard side.

The starboard side has a videogame room, a "Photo Display Area", and shops.

The escape route from this zone is aft through a fire door into the Broadway Lounge and forward through a fire door into the restaurant. There is also another fire door leading to a stairway near the centre of the ship which leads up to the deck above.

The fire zone on the port side contains the main galley, bakery, refrigeration, and garbage and dishwashing facilities.

On the port side there are stairs up to the deck above and an exit through a sliding fire door to fire zone 3.

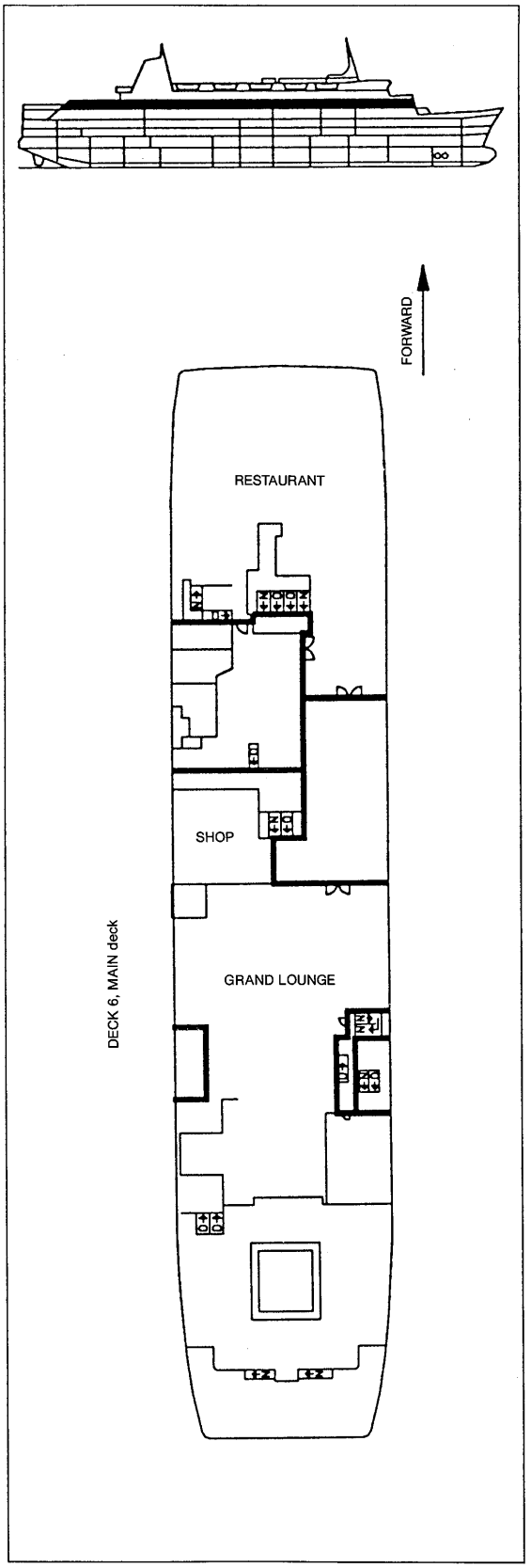
Fire zone 3

Fire zone 3 on deck 6 comprises a large restaurant (the Ocean View Dining Room), the cold galley, and stairways.

A fire door leads to the shopping area and further aft to the Broadway Lounge. There are also two separate stairways to the deck above.

No bodies were found in this area.

Fig. 4.1.7 *Layout of deck 6 (Main Deck)*



4.1.3.8 Deck 7 (Sunset Deck), also called the Promenade Deck

This deck contains eight officers' cabins altogether, but no passenger cabins. This is the deck where passengers embark in the lifeboats.

The ship's three stairway systems, one for each fire zone, have exits onto deck 7.

The deck has an open area and a closed area. The open area contains the liferaft and lifeboat stations, and the closed area the Sunset Lounge, shops, the officers' mess, and officers' cabins.

There are davits for 10 lifeboats, five on each side of the ship. At the stern there are liferaft stations on the port and starboard sides, each with five inflatable liferafts that can be lowered.

There is plenty of space on the deck, and easy access to lifeboats and liferafts.

The Sunset Lounge is situated aft. It has doors opening aft onto the open deck and on the port side a stairway leading down to the deck below. On the port and starboard sides there are stairways leading to the deck above.

Forward of the Sunset Lounge are the emergency generator and air conditioning rooms on the port side. These two rooms are in a deck house. Forward of the deck house is a transverse passage which is open at both ends. Forward of this again is a group of shops in a deck house, which extends as far as a network of corridors and stairways. The deck house also contains a second air conditioning room, an officer and staff mess, a pantry, and two offices. There is a stairway ending in the centre of the deck house. Forward of the deck house lies, as mentioned above, a system of stairways and corridors, and forward of this are cabins for senior officers.

The fireproof divisions consist of transverse bulkheads aft of the shopping area and on the forward side of the deck house where it adjoins the stairway and corridor network.

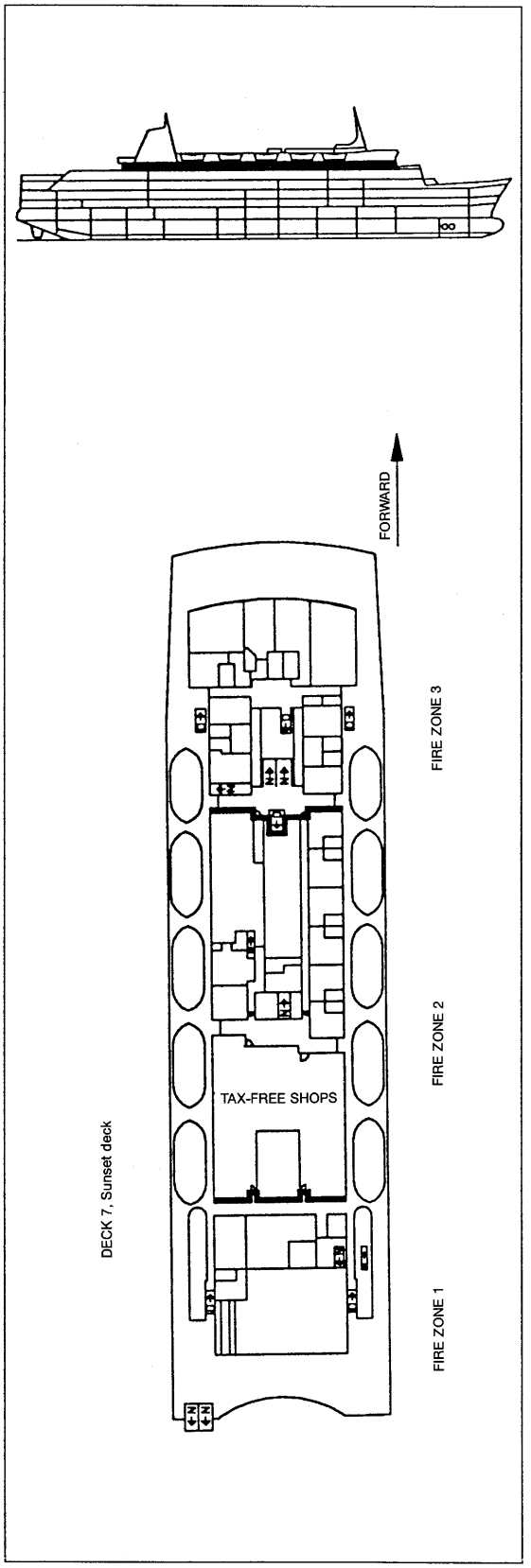
There are reasonably broad areas of deck on both sides of the deck houses.

No bodies were found in this part of the ship.

4.1.3.9 Deck 8 (Bridge Deck), also called Sun Deck

At the forward end of this deck lie the bridge, which is the ship's centre of command, the deck and engine office, and the radio room. Aft of these are officers' cabins, a battery room, a discoteque and lavatories, a bar, a ventilation room, a telephone exchange, and a CO_2 room (a room containing pressure bottles of carbon dioxide for smothering flames). The telephone exchange and CO_2 room are situated amidships, with open deck on both sides. There is

Fig. 4.1.8 *Layout of deck 7 (Sunset Deck)*



also a large open deck area aft of the CO_2 room. Aft of the open deck area are two officers' cabins and a ventilation room, and aft of these there is more open deck.

There are two muster stations on deck 8, one on the open deck forward of the discoteque and one on the aftermost area of open deck.

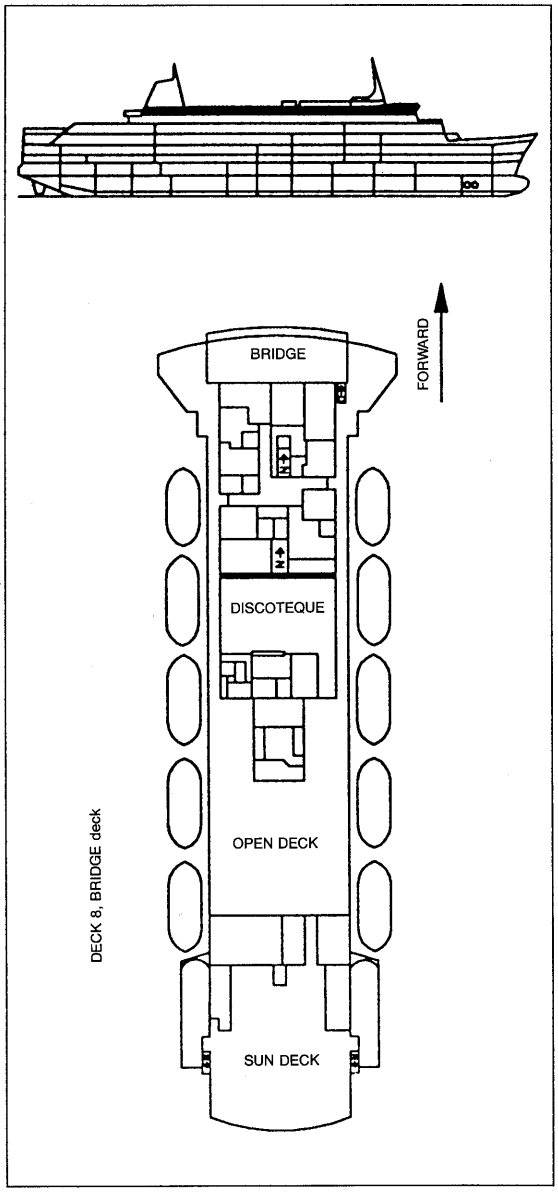
The open area of the deck is the Sun Deck.

The bridge has port and starboard wings, both of which have equipment for navigating and manoeuvring the ship.

All the rooms and areas on this deck have escape routes to muster stations and lifeboats.

No bodies were found in this area.

Fig. 4.1.9 *Layout of deck 8 (Bridge Deck)*



4.1.3.10 Deck 9 (Sun Deck), also called House Top

This deck is the roof of the built over part of deck 8.

Deck 9 is an open deck lying above deck 8. The escape routes down from this deck consist of two exterior companionways situated aft of the bridge wings.

4.1.4 Engine room

The engine room consists of a diesel generator room, an insulated, air-conditioned control room for the engines, the room containing the main engines, an auxiliary engine room, a separator room, and a room for pumps and compressors. The engine rooms lie beneath deck 3, the car deck.

The diesel generator room and the control room are situated on a level with deck 1, while the other engine rooms are directly on the inner bottom.

On the port and starboard sides there are engine room casings running through the accommodation spaces and up to the funnel.

There is also a room for sewage tanks on the double bottom aft of the auxiliary engine room.

The exits are as follows:

From the *sewage tank room* there is an exit through a watertight door to the auxiliary engine room and an emergency exit leading to the crew's bathroom on the deck above.

From the *auxiliary engine room* there is a ladder leading up to the diesel generator room and emergency exits through watertight doors aft into the sewage tank room, and forward into the main engine room.

The room for pumps and compressors, which is situated forward of the main engine room, has an exit to the engine room through a watertight door, and two emergency exits leading up to the food stores on the deck above.

From the *diesel generator room* there is only one direct exit, by a ladder on the starboard side leading up the engine room casing to deck 7 (Sunset Deck) and thence onto the deck. An alternative exit is through a watertight door into the main engine room on the port side.

The *control room* has exits on the port and starboard sides to the main engine room and an emergency exit up a ladder and through a hatch on the car deck, deck 3.

Two ladders lead from the deck of the *main engine room*, on a level with deck 1, up to the level of deck 2. From deck 2 there is only one exit upwards, aft on the port side and well to one side. The alternative escape routes are through watertight doors, also on the port side, into the diesel generator room and through

this across to the starboard side and up the casing. In addition there is an exit via the control room, through the emergency exit from this room to the car deck.

4.2 RULES APPLICABLE TO THE SHIP

4.2.1 Safety provisions and certificates for passenger ships

There are international and national rules governing the building, operation, and management of ships. In order to be applicable, the international rules have to be ratified by a certain number of nations. The entry into force of international rules has so far always been stipulated to take place one or more years after ratification. The drawing up of international rules for ships is carried out under the auspices of the International Maritime Organization (IMO), a United Nations agency with its headquarters in London.

The main principle has been that the rules, particularly those applying to construction, have not had retroactive application. This means that when they come into force they only apply to ships that are to be built in the future, and not to ships that already have been or are being built.

Safety on board passenger ships is regulated internationally by a number of conventions such as the International Load Line Convention (ILLC), the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (the STCW Convention), the International Convention on the Prevention of Pollution at Sea (MARPOL), and the International Convention on the Safety of Life at Sea (SOLAS). These are discussed in more detail in Chapter 10.

The International Convention on the Safety of Life at Sea is usually referred to as SOLAS. Passenger ships operating today may have been built according to SOLAS 1948, SOLAS 1960, or SOLAS 1974. SOLAS 1974 entered into force on 25 May 1980. Thus for ships whose keels were laid after 26 May 1965 and before 25 May 1980, SOLAS 1960 is applicable, along with a few additional requirements laid down in SOLAS 1974.

The SOLAS conventions are supplemented by IMO recommendations and resolutions. These are not binding under international law, but may be made applicable in individual countries through national legislation.

4.2.2 SOLAS 1960

The *Scandinavian Star* was built in 1971 and therefore has to comply with the requirements of SOLAS 1960. The Committee therefore considers it appropriate to summarize the fire protection measures required by SOLAS 1960.

4.2.2.1 General remarks

SOLAS 1960 contains the existing provisions relating to safety, safety equipment, and construction, including provisions relating to the structural aspects of fire protection.

The provisions relating to construction prescribe one of three alternative methods, which are summarized below.

Method I

Use of fire-resistant materials for internal bulkheads which have thermal and structural resistance.

Method II

Detection, containment, and extinction of any fire in its space of origin, i.e. the ship must be equipped with an automatic sprinkler, fire alarm, and fire-indication system (fire detection system) in accommodation spaces.

Method III

Protected evacuation routes within each vertical main zone and restricted use of combustible materials combined with automatic fire alarm and fire detecting systems.

Method I was chosen for the *Scandinavian Star*. Parts of the ship also conformed with the proposal for Part H of SOLAS 1960. This proposal was never incorporated in SOLAS 1960, since it was overtaken by SOLAS 1974.

The hull, superstructure, and deck houses had to be divided into vertical main zones by A class bulkheads and further subdivided by corresponding bulkheads for the protection of accommodation spaces adjoining machinery spaces, cargo spaces, service spaces, and other spaces. In order to prevent a newly ignited fire from spreading, accommodation and service spaces also have to be protected by one of the methods mentioned below or by a combination of these methods approved by the administration. The method or combination of methods chosen has to be combined with the prescribed system of fire patrols and of fire alarm systems and fire-extinguishing installations.

Method I

Construction of internal divisions by means of B class bulkheads, normally without the installation of fire alarm or sprinkler systems in accommodation or service spaces. Or:

Method II

Installation of an automatic sprinkler or fire alarm system for signalling and extinction of fires in all spaces where a fire may be expected

to start, but normally in spaces where such precautions have been taken. Or:

Method III

A system of divisions within each vertical main zone by A class and B class bulkheads according to the importance, size, and type of space. This is to be combined with an automatic fire warning system in all spaces where a fire may be expected to break out and also with restricted use of combustible and easily inflammable materials and fittings, but normally without the installation of a sprinkler system.

Only method I will be discussed below.

4.2.2.2 Construction

The hull, superstructure, structural bulkheads, deck, and deck houses must be built of steel or a corresponding material.

4.2.2.3 Vertical main zones

The hull, superstructure, and deck houses have to be divided into vertical main zones. Any displacement of the main division lines should be avoided, but if it cannot be avoided it should be constructed as an A class division.

The bulkheads forming the partitions between the vertical zones above the bulkhead deck should as far as possible continue the watertight divisions immediately beneath the bulkhead deck.

These bulkheads should extend from deck to deck and to the shell plating or other outer limits.

In special-purpose ships, e.g. car or train ferries, where the construction of such bulkheads would be incompatible with the purpose of the ship, similar precautions should be taken to contain a newly started fire and prevent its spread. These must in every case be approved by the administration.

4.2.2.4 Openings in A class divisions

Where electric cables, pipes, shafts, scuppers, etc. are carried through A class divisions (bulkheads) to ribs, beams, or other structural elements, precautions must be taken to ensure that the fire resistance of the bulkheads is not impaired.

Ventilation shafts and ducts that pass through bulkheads in vertical main zones must have dampers that can be operated from both sides of the bulkhead from an easily accessible position which is marked in red. There must be an indicator denoting whether the damper is open or closed.

Doors and door frames in A class divisions (bulkheads) and the devices for securing them when closed must as far as as is practicable have the same degree of resistance to fire and to the passage of smoke and flames as the bulkheads in which the doors are situated. Watertight doors do not have to be insulated.

Each door must be capable of being opened from both sides by one person. Fire doors in vertical main zones, apart from watertight doors, must be self-closing and capable of being easily released from an open position. The doors must be of an approved type and construction and self-closing at an inclination of up to 3 1/2°.

4.2.2.5 Bulkheads within vertical main zones

In the accommodation spaces all subdivision bulkheads that are not required to be A class divisions must be constructed as B class divisions of non-combustible material, although they may be surfaced with combustible material. All door openings and similar openings must be equipped with closing devices appropriate for the type of bulkhead in which they are situated.

All bulkheads in corridors must extend from deck to deck. Ventilation openings are allowed in doors in B class divisions, preferably in the lower half. All other subdivision bulkheads must extend vertically from deck to deck and transversely to the shell plating or other boundaries unless there are continuous ceilings or linings of non-combustible material to maintain integrity against fire. In such cases the bulkhead may terminate at the ceiling or lining.

4.2.2.6 Divisions between accommodation and machinery, cargo, and service spaces

Bulkheads and decks dividing the accommodation from the machinery, cargo, and service spaces must be constructed as A class divisions and must have a standard of insulation approved by the administration as appropriate to the adjoining space.

4.2.2.7 Protection of stairways in accommodation spaces

All stairways must have a steel frame construction unless the administration has approved the use of other similar material, and must be enclosed by A class divisions. The openings into stairways must have secure means of closure from the lowest cabin deck and at least up as far as a level where there is direct access to an open deck. The following exceptions are permitted:

a) A stairway that only links two decks does not have to be enclosed by bulkheads provided that the fire integrity of the decks

concerned is maintained by appropriate bulkheads or doors on this deck.

b) Open stairways may be situated in a public space, provided that the entire stairway is situated inside the space.

Stairways must have direct communication with corridors, and must be spacious enough to prevent congestion considering the number of people likely to use them in the event of an emergency. Stairways must have the fewest possible number of openings into accommodation or other spaces containing combustible materials where a fire might originate.

Bulkheads enclosing a stairway must have a standard of insulation appropriate to the adjoining space and approved by the administration. The means of closing the openings in such bulkheads must have the same degree of resistance to fire as the bulkheads.

Lift shafts must be designed so as to prevent smoke and flames from spreading from one deck to another, and must be supplied with means of closure that allow the control of draught and smoke. Lift shafts in stairways do not have to be insulated.

Where a lighting and ventilation shaft is connected with more than one 'tweendeck space, and the administration considers that smoke and flames may spread from one 'tweendeck space to another, smoke dampers must be installed in appropriate places so that in the event of fire each space can be closed off.

All the other shafts (e.g. for the electric cables) must be constructed in such a way that fire cannot spread from one 'tweendeck space to another.

4.2.2.8 Surface materials

Combustible materials used for covering surfaces must not "exceed a volume equivalent to 2.54 mm veneer on the combined area of the walls and ceilings". All exposed surfaces in corridors and stairways must have low flame-spread characteristics.

4.2.3 International Load Line Convention (ILLC) 1966

The ship had to meet the requirements in the International Load Line Convention (ILLC) 1966.

This convention contains requirements as regards division into watertight compartments, load limits, and stability of the ship in intact and in damaged condition.

4.2.4 The International Convention for the Prevention of Pollution at Sea 1973-78 (MARPOL)

The ship has to comply with the requirements laid down in the International Convention for the Prevention of Pollution at Sea 1973 (MARPOL 73), and has to have a certificate showing this.

The convention imposes limits on the amount of sewage that passenger ships are permitted to discharge, and contains rules governing the treatment of sewage before it is discharged. There are also rules concerning where sewage may be discharged.

4.2.5 Class 100 A1 in Lloyd's Register

The *Scandinavian Star* was classed in class 100 A1, Passenger/Ro-Ro Cargo/Ferry, LMC in Lloyd's Register of Shipping. This means that "the ship was considered suitable for sea-going service, that the ship had been accepted into class and had been maintained in good and sufficient condition, that the anchoring equipment had had been found in good and efficient condition in accordance with the Rules, and that although the propelling and essential auxiliary machinery was neither constructed nor installed under the Society's Special Survey, the existing machinery, its installation and arrangement, had been tested and found acceptable to the Society." (Letter from Lloyd's Register dated 14 December 1990.)

4.2.6 National provisions

The conventions described above have been made applicable in the Bahamas through national legislation.

Lloyd's Register was given the authority by the Bahamas to interpret the rules as regards the *Scandinavian Star*.

4.3 THE TECHNICAL STANDARD AND CONDITION OF THE EQUIPMENT ON BOARD THE SHIP

The judgments made here apply to the parts of the construction and equipment that had or that could have had a significant effect on the fire on board.

In certain areas the Committee has compared the ship's standard with national requirements, and in such cases Danish legislation is the basis of comparison.

4.3.1 Fire protection systems and equipment

4.3.1.1 Fire and safety plan

In principle the ship's fire and safety plan complied with the rules that applied in 1971 to Danish ships and the rules of SOLAS 1974. In order to be readily accessible to external agents coming to the aid of the ship, the plan was enclosed in a protective covering and posted on the after mooring deck (the poop

deck) on deck 5 (Gulf Deck), and on the car deck, deck 3 (C Deck).

The plan is reproduced as Annex 2.

4.3.1.2 Automatic fire-detection system

The ship was equipped with an automatic fire alarm and fire detection system in the steering gear room, control room, engine room, laundry, storerooms on deck 3, some of the food stores, and the bow thruster room. The system consisted of ion alarms. Their number and positions were satisfactory. Neither SOLAS 1960 nor Danish regulations require such systems as long as there is an engine room watch at all times, as was the case on the *Scandinavian Star*. None of the rooms with this protection system were touched by the fire. The system seems to have been installed after the engine room fire in 1988.

4.3.1.3 Car deck sprinkler system

The *Scandinavian Star* was equipped with an open sprinkler system on the car deck, deck 3. The system had seven separate sections and could be supplied with water by a separate pump and by the ship's fire pumps. This system complies with the requirements in SOLAS 1960. Danish regulations require a ship built in 1971 to have pressure ventilation. This requirement was included in SOLAS 1974, and the ship does in fact comply with it.

The sprinkler system did not appear to have been tested for a long time, since many of the heads seemed to be blocked with rust. When the two aftermost sections were tested before the ship left Copenhagen after the fire, over half the sprinklers proved to be blocked. The sprinkler system was not used during the fire, but this had no effect on the fire's spread and development.

4.3.1.4 Fire pumps

The ship had four fire pumps, each with a capacity of 90 m^3 per hour. They were situated in different engine rooms, separated by watertight bulkheads. At least one of the pumps had an additional power supply from the emergency generator. The pumps could be started from the wheelhouse, control room, and locally, at each pump. A general service pump could be used for pumping out water. The fire pump system complied with the Danish regulations for corresponding ships and with the provisions of SOLAS 1960, which do not require a remote control starting system for pumps.

4.3.1.5 Pipelines and hydrants

The arrangement of the pipelines and the positions and number of the hydrants complied with SOLAS 1960 and 1974 and with Danish regulations. Many of the hydrants were double and supplied with corresponding numbers of hoses with spray and jet nozzles. Double hydrants are not required by SOLAS 1960 or 1974 or by Danish regulations.

4.3.1.6 Fire hoses and spray and jet nozzles

The equipment that remained on the ship after the fire was present and correct, and that used by the fire fighters from shore also seems to have been in order. Each hydrant was equipped with hoses with spray and jet nozzles, and with a ventilation spanner and hook spanner.

The spray and jet nozzles were good quality and complied with the requirements in SOLAS 1960 and 1974 and the Danish regulations.

4.3.1.7 Portable fire extinguishers

The number, position, type, and size were suitable and correct, and complied with the requirements in SOLAS 1960 and 1974 and the Danish regulations for corresponding ships. However, no reserve supplies were found, and such supplies are required by SOLAS and Danish regulations. SOLAS requires the administration to specify requirements for reserve supplies, and the Danish regulations do so. The fire extinguishers in the corridors in accommodation spaces and similar areas were inside cabinets, which were also supplied with double fire hydrants and appliances. The cabinets were flush with the bulkheads and were the same colour, but had a sign on the door in red, marked "Fire Equipment".

4.3.1.8 Firemen's outfits

There were at least seven complete smoke-diver's outfits on board, which have been judged to be of good quality. The ship also had a reasonable number of reserve cylinders. There was a separate compressor system for refilling the smoke divers' cylinders, which was installed on the bridge deck near the CO_2 room. This was found to be completely undamaged after the fire.

4.3.1.9 The CO_2 system

The auxiliary engine room, main engine room, separator room, and tank rooms were equipped with a CO_2 system that could be released from the port corridor on the car deck, deck 3, and from the bottle room on the bridge deck, deck 8. The system was not used during the fire.

Before the system was partly dismantled for safety reasons on the orders of the Danish maritime authorities when the ship had arrived in Copenhagen after the fire, it was

almost certainly in full working order. It complied with the requirements in SOLAS 1960 and the Danish regulations for similar ships, except that in a Danish ship a blind flange would have been installed beyond the main stop valve for safety reasons during, for example, repairs in a shipyard. The system would also have had other additions such as a leakage alarm.

4.3.1.10 Foam stations

The ship was equipped with a system of permanent foam stations in various parts of the engine room and separator room and on the car deck. These seemed to have been reasonably well maintained. The system was not used during the fire.

4.3.1.11 The halon 1301 system

The paint locker aft on the port side of the car deck, deck 3 (C Deck), was protected by a permanent halon 1301 (a fire-extinguishing gas) system, consisting of three separate containers, each with a separate release mechanism. The system is released manually by teleflex immediately outside the locker. It was not used during the fire.

The system was not prescribed either by SOLAS 1960 or by the Danish regulations.

SOLAS 1960 contains no provisions covering such a halon system and the system does not comply with Danish provisions, which in this case would be those laid down in "Skibstilsynets Meddelelser nr. 314". However, it was in working order.

4.3.1.12 Communication equipment

The number and quality of the walkie-talkies cannot be established. According to the evidence at the maritime inquiry there were nine sets on board.

The telephones could not be tested afterwards, but there were no indications of any malfunction just before the fire.

The ship's radio was functioning satisfactorily when the fire started, since contact with the shore radio stations and other ships was excellent.

4.3.1.13 Structural fire protection

The ship was divided into three main fire zones by two main bulkheads.

The bulkheads in the accommodation spaces were constructed of 30 mm-thick asbestos silicate, covered by a 1.5 mm-thick layer of laminated plastic, in some places by two layers. The ceilings consisted of 10 mm-thick asbestos silicate covered by a 1.5 mm-thick layer of laminated plastic.

The deck above the car space, deck 5, was covered by a 75 mm-thick layer of vermiculite fireproof insulation.

The doors to stairways were A-60 class self-closing fire doors. The doors were held open by magnetic catches, which could be released locally and from the bridge. The doors to the car deck were A class self-closing sliding doors. The sliding doors opening onto the car deck were supposed to be kept permanently closed, but there were no indicators on the bridge showing whether they were open or closed.

The other doors were equipped with indicators to the bridge except for the doors to the port and starboard cabins aft on deck 4 (Ybor Deck), doors to the storerooms, and doors between the stairways and corridors aft on the lower car deck.

When released locally or from the bridge, the magnetic catches were permanently deactivated.

The plans available to the Committee show that some doors had switches that were activated when the door was completely shut. In each group of fire doors the switches operated on series transition, so that when all the doors in the section were shut, an indicator lamp lit up on the control panel on the bridge.

The cabin doors were B-15 fire doors. In about 90 of the cabins amidships on deck 5 (Gulf Deck), the asbestos silicate below the ceilings was covered with a 4 mm-thick layer of PVC.

The insulation in the engine room consisted of a 50 mm-thick layer of rock wool covered by perforated steel plates.

A class bulkheads and deck insulation consisted of 2-25 mm rock wool, kept in place by hoops about 300 mm apart, joined by wires.

Parts of the corridors adjoining the car deck were insulated by a layer of 5 mm glass wool and 30 mm asbestos silicate.

The workmanship was of good quality.

The structural fire protection complied with the provisions of SOLAS 1960 apart from the following:

a) There should have been a fire door on deck 7 (Sunset Deck) aft on the starboard side. The opening only had a glazed door.
b) The doors to the cabins off the aftermost stairway on deck 4 should have been equipped with automatic closing devices, since they opened onto a stairway.

On deck 5, on the port side of the reception lobby, there was a door missing into a stairway that led down to the deck below. Only the door frame had been installed. The door appears to have been missing for a very long time, but this has not been considered a fault because it was

not a fire door. The door appears to have been removed for convenience.

4.3.1.14 Ventilation to engine room and car deck

The fire dampers supplying ventilation to the engine room are operated locally and from the control room. Neither SOLAS 1960 nor the Danish regulations for corresponding ships contain a requirement for remote operation of fire dampers for the engine room. The fire dampers for the supply of fresh air to the car deck, deck 3 (C Deck), were situated at the forward end of the built-up part of deck 5 (Gulf Deck), facing the forecastle. These consisted of hinged flaps that were kept open by props.

When the props were released (manually), the flaps fell under their own weight and could be secured by wing nuts. The flaps were found to be closed but not fastened after the fire. The fire dampers for the car deck ventilation were satisfactory and complied with the requirements of SOLAS 1960 and the Danish regulations.

4.3.1.15 Ventilation in the accommodation spaces

According to the fire plan there were 92 fire dampers altogether in the accommodation spaces. Of these, 78 required local manual operation and the rest closed automatically at a temperature of 60-70°C. The manual fire dampers were mainly of the type that takes a relatively long time to close, since a cover has to be removed by unscrewing four wing nuts, and then mounted over the opening and screwed on with four new wing nuts. This is a time-consuming operation considering that fire dampers normally need to be closed in a hurry. However, SOLAS 1960 has no provisions stipulating that this arrangement is not allowed.

The above-mentioned fire dampers were distributed as follows: 11 on deck 8 (Bridge Deck), 38 on deck 7 (Sunset Deck), 2 on deck 6 (Main Deck), 20 on deck 5 (Gulf Deck), 1 on deck 3 (C Deck), and 6 on deck 2 (D Deck).

It would require a considerable number of people to close all or most of these dampers in a hurry.

The ventilators were installed amidships on deck 8 (Bridge Deck). The arrangement and installation of the ventilation shafts, etc. showed a high standard of workmanship.

4.3.1.16 Emergency energy sources and lights

The emergency generator was completely burned out, but according to the plans it complied with the requirements of SOLAS 1960 and with the Danish regulations for corresponding ships. The efficiency of the generator cannot of course be established.

In the corridors, emergency lights were only installed where there were fire doors, so that there was a relatively long distance between each light. The same fixtures were used for normal and emergency lighting. The emergency lights were fitted with 25 W light bulbs. The fixtures were constructed in such a way that the light was directed mainly downwards.

4.3.1.17 The main alarm system

The installation of the whole alarm system showed a high standard of workmanship. The electricity supply to each alarm passed through a distributor with a fuse for each alarm. Thus a short circuit in a single alarm or in the cables supplying a single alarm would not affect the others.

The cables, etc. were well protected against fire since they had been laid behind non-combustible materials.

The alarms that were activated were mainly klaxons with a robust and reliable construction. According to the fire and safety plan the ship had 53 alarms. It appears that three of the horns marked on the plan were missing. The missing horns were supposed to have been situated on deck 5 (Gulf Deck) by the purser's information desk, on deck 6 (Main Deck) by the lavatory section, and on deck 7 (Sunset Deck) by air conditioning room no. 3.

The sound level in the accommodation spaces was measured, and found to vary from 80 to 30 decibels (dB). In about 90 of the cabins the sound level was less than 58 dB (see 4.7.4), which must be characterized as too low. No measurements were made against the normal background noise of the ship, which is not known. Normally an alarm system should have a sound level at least 10 to 15 dB above the background noise.

The above indicates that the system did not comply entirely with SOLAS 1960 or SOLAS 1974 or the Danish regulations, in that reservations have to be made as regards the number and position of the alarms.

The connection between the sound level of the alarms and the number of passengers who did not leave their cabins is discussed under 4.7.

4.3.1.18 Public address system

The public address system was completely destroyed by the fire. Nor has it been possible to obtain any plans of it. It may, however, be concluded that the system was not fire-resistant. It has not been possible to establish the sound level. SOLAS 1960 does not require a public address system, but an amendment to

SOLAS 1974 includes such a requirement, and it applies to existing ships. For further details, see 4.7.

4.3.1.19 Manual fire alarm system

The number and positions of the fire alarms appeared to be satisfactory, as far as could be ascertained. The system complied with the requirements of SOLAS and the Danish regulations. The main cabinet in the wheelhouse was destroyed by the fire, and the make and type, and the electrical supply cannot be verified. All the fire alarms were also registered in a cabinet in the control room.

The manual fire alarms were distributed as follows: 11 on deck 8 (Bridge Deck), 27 on deck 7 (Sunset Deck), 13 on deck 6 (Main Deck), 19 on deck 5 (Gulf Deck), 23 on deck 4 (Ybor Deck), 23 on deck 3 (C Deck), 16 on deck 2 (B Deck), and 12 on deck 1 (E Deck).

It has not been possible since the fire to discover how the system was divided into sections, since the plans, etc. were lost in the fire, but according to evidence at the maritime inquiry it was divided into 34 to 36 sections.

If any of the buttons was pressed, this triggered an auditory signal in the main cabinet in the wheelhouse and an indicator showing which section the alarm was coming from. The reception of a signal did not prevent other signals from being received from other sections. Even if the auditory signal from the cabinet was turned off, this did not prevent the receipt of new signals in the cabinet. It was stated at the maritime inquiry that the system was in use during the fire, and the main cabinet on the bridge received signals from several of the sections.

4.3.2 Evacuation equipment

4.3.2.1 Life jackets

The ship was equipped with two different makes of life jacket – one of which is approved in the UK and USA, and one in Norway. This would not have been allowed on a Danish ship, where all the life jackets have to be of the same make.

Most of the life jackets were stored on the open part of deck 9 (Sun Deck). The remainder were stored in chests on the port and starboard sides of deck 7 (Sunset Deck), which was the deck with the embarkation stations for the lifeboats.

4.3.2.2 Liferafts and lifeboats

The ship was equipped with the prescribed number of liferafts and lifeboats. The rafts for 250 persons were of the type to be lowered. This is more than is required by SOLAS 1960 or the Danish regulations.

The davits were of a suitable kind with a simple securing arrangement and lowering procedure. The crank handle was painted red. There were also arrangements for bringing the lifeboat up against the ship's side and keeping it in place during embarkation. No notices with operating instructions for the boats were posted on the boats or anywhere outside in the vicinity. Whether or not instructions were posted inside near the exits to the deck cannot be established because of fire damage. The ladders for embarkation into the lifeboats and rafts were in the appropriate places.

4.3.2.3 Motorized lifeboats

The ship had ten lifeboats, of which only eight were used for evacuation. It was stated by the master at the maritime inquiry that there was no need for more than eight boats. These eight boats were inspected after the fire by representatives from the Swedish maritime administration and by the Committee. Lloyd's Register had been requested to attend the second inspection, but did not do so. The Committee has been informed that this was due to an internal failure of communication within the firm.

The lifeboat engines were two-cylinder Lister diesel engines with manual starting mechanisms, except for boat no. 9, which had a four-cylinder Lister diesel engine with an electrical and a manual starter.

Boat no. 1

The motor was missing. It had been taken out for repairs during the journey to Cuxhaven and left on the quay in Fredrikshavn when the ship was put into service. The transverse and longitudinal structures of the boat showed rot damage and spreading rot, the rudder stock and rudder hinge were heavily corroded, and there were old cracks right through the glassfibre on the upper sides of the boat.

Boat no. 2

The motor would not start. The fuel tank was only half full. The transverse and longitudinal structures of the boat showed rot damage and spreading rot, the rudder stock and rudder hinge were heavily corroded, and there were old cracks right through the glassfibre on the upper sides of the boat.

Boat no. 3

The motor was missing. It had been taken out for repairs during the journey to Cuxhaven and left on the quay in Fredrikshavn when the ship was put into service. The transverse and

longitudinal structures of the boat showed rot damage and spreading rot, the rudder stock and rudder hinge were heavily corroded, and there were old cracks right through the glassfibre on the upper sides of the boat.

Boat no. 4

The air filter in the motor had been dismantled. There appears to have been an attempt to start it. The transverse and longitudinal structures of the boat showed rot damage and spreading rot and there were old cracks right through the glassfibre on the upper sides of the boat.

Boat no. 5

The motor could not be started even after several attempts. There was heavy corrosion of the rudder stock and rudder hinge.

Boat no. 8

The starting handle for the engine was missing. The fuel tank was only half full. There was heavy corrosion of the rudder stock and rudder hinge.

Boat no. 9

The motor may have been used during the evacuation. It had an electric starter.

Boat no. 10

The engine starting handle was missing. The transverse and longitudinal structures of the boat showed rot damage and spreading rot, the rudder stock and rudder hinge were heavily corroded, and there were old cracks right through the glassfibre on the upper sides of the boat.

Conclusion

The boats appeared to be poorly maintained, especially considering that the patches of rot had been covered by fresh paint and corrosion on hooks and hook attachments had been painted over. Although the boats were not in a satisfactory condition, their defects had no effect on the extent of the disaster. See 4.4 for details of missing equipment.

4.3.3 Equipment for manoeuvring

4.3.3.1 Steering gear

The ship had two rudders that were controlled by a common electrohydraulic steering gear with two pumps. The steering gear was supplied with power from the main switchboard in the control room and from the emergency switchboard. The steering gear room had a distributor for selection of the electricity supply.

There were two permanent means of communication with the steering gear room: ordinary telephone and a telephone without batteries.

A set of instructions for emergency steering from the steering gear room was found attached to a board and lying on top of the steering gear. The instructions were typed and supplied with drawings of the components that have to be changed in order to couple the engine to a different electrical circuit for emergency steering. The instructions were in English and were easy to understand.

The steering gear room was clean and tidy and had satisfactory access.

The steering gear complied with SOLAS 1960 and the Danish regulations for similar ships.

4.3.3.2 Manoeuvring machinery

The ship had two bow thrusters with adjustable blades, a type known as a kamewa system. The machinery was fairly recent and functioned as follows (the description applies to both sets of machinery, since they were identical).

The position of the propeller blades was regulated by a hydraulic unit beside the propeller axle and hydraulic oil was transferred to the propeller through a kamewa box on the propeller axle.

The hydraulic unit consisted of two sets of pumps. One set acted as a main pump while the other acted as standby and started automatically when the oil pressure began to fall. The pump engines were supplied with power from the main switchboard in the control room.

Starting, stopping, and changing from one set of pumps to another were controlled from the control panel in the control room.

The manoeuvring of the hydraulic valves and thus the adjustment of the propeller pitch were done electronically. The system can be switched over to the bridge or to the control room from the manoeuvre panel in the control room.

When the system is controlled from the bridge it functions as follows:

When the steering lever is in the forward position the electronic steering unit in the engine room sends a signal to the magnetic valves on the hydraulic unit to pitch the propellers forward, and to the propulsion engine to change to a higher rpm (combinator regulation). The signal is transformed into a pneumatic signal by means of a box in the control room. The regulator for the propulsion engine is pneumatically controlled, so that the rpm increases as the air pressure rises.

When the system is being controlled from

the control room, the engine rpm is driven by a pneumatic regulator in the manoeuvre panel, while the propeller blades are controlled by the electronic regulator.

There is an engine room telegraph for each engine connected with the manoeuvre panel.

The electronic steering units are supplied with electricity from two independent systems that can be switched over from the manoeuvre panel in the control room. If the electronic steering units are not working because of repairs or defects, the engine rpm can still be controlled by means of the pneumatic regulator in the manoeuvre panel in the control room. The propeller pitch can also be adjusted by manually operating the steering and hydraulic valves in the hydraulic unit on the propeller axle.

The hydraulic unit has an electronically operated indicator showing the propeller pitch. The propeller pitch can also be seen from a ring on the propeller axle in front of the kamewa box, which is moved back and forth along the axle as the propeller pitch changes.

The hydraulic unit by the kamewa box had no engine room telegraph.

Conclusion

Both the propellers and the engines could be controlled in three different ways.

1. Control of propellers and engines from the bridge

The propeller pitch and engine revolutions could be operated from the bridge by a single lever for each propulsion system.

2. Control of propellers and engines from the control room

Orders from the bridge were received over the engine room telegraph for each propulsion system and carried out by adjusting the engine rpm by means of the pneumatic regulator in the manoeuvre panel, while the propeller pitch was regulated electronically by means of a special knob.

3. Emergency manoeuvring

Orders from the bridge would be transmitted to the control room over the engine room telegraph and carried out by adjusting the engine rpm by means of the pneumatic regulator in the manoeuvre panel. At the same time signals adjusting the propeller pitch are transmitted to the hydraulic unit and the pitch is adjusted manually by opening the hydraulic valves.

This means that even if the cables from the steering system to the bridge had been burnt through, there were still two possibilities for operating the propulsion machinery as long as the engine room was manned.

The reason why the Committee has gone so thoroughly into the possibilities for manoeuvring the ship is that it was necessary in order to decide whether the ship could have been manoeuvred during the fire, see 9.4.2.2.5.

4.3.4 Marking of escape routes

4.3.4.1 Rules and regulations

SOLAS prescribes that clear instructions must be provided for passengers and crew to follow in the event of an emergency. These instructions, in the appropriate language and with illustrations, have to be posted at muster stations and in other passenger spaces.

There must be easy access from accommodation and working spaces to muster stations and embarkation stations for lifeboats.

Corridors, stairways, and exits with access to muster and embarkation stations must have emergency sources of illumination.

There are no specific provisions concerning the signposting of escape routes. Text or symbols may be used. Examples of the two types of signs are shown below.

It is the usual practice to have well signposted escape routes in passenger ships.

As mentioned above, the passengers are supposed to be issued with life jackets at muster stations and if necessary be accompanied from there to the lifeboats.

In order to ensure an even distribution of passengers between the muster stations, each passenger should be given a boarding card on arrival on board. The colour of the card shows the station where the passenger is supposed to muster in the event of an emergency.

All the escape routes to a particular muster station should be marked by signs in the same colour as the muster station.

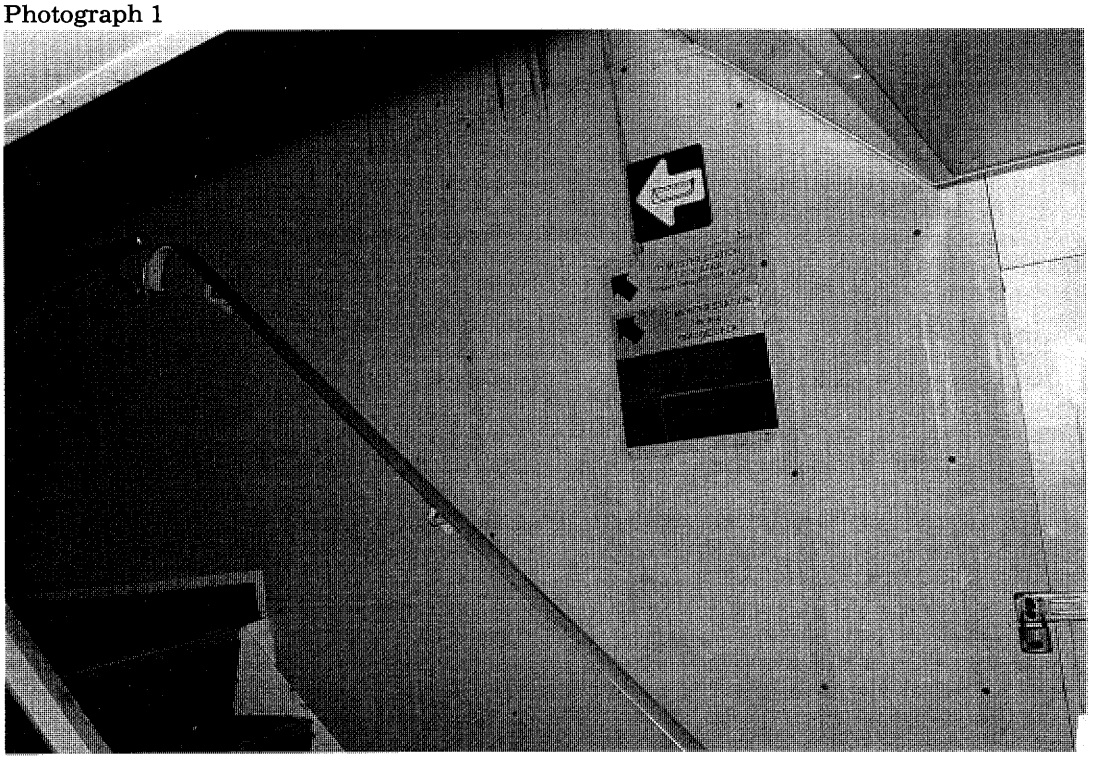
4.3.4.2 Signposting and use of boarding cards on the Scandinavian Star

Boarding cards were not used on the *Scandinavian Star* on the disaster voyage.

The following description of the way the escape routes were marked is based on the photographs reproduced below. The photographs were taken by the technical department of the national police authorities and the maritime authorities in Denmark, and by the Norwegian firm A/S Quasar Consultants and the Norwegian Fire Research Laboratory, SINTEF – NBL. They were taken on board the *Scandinavian Star* when it had docked in Copenhagen after the fire.

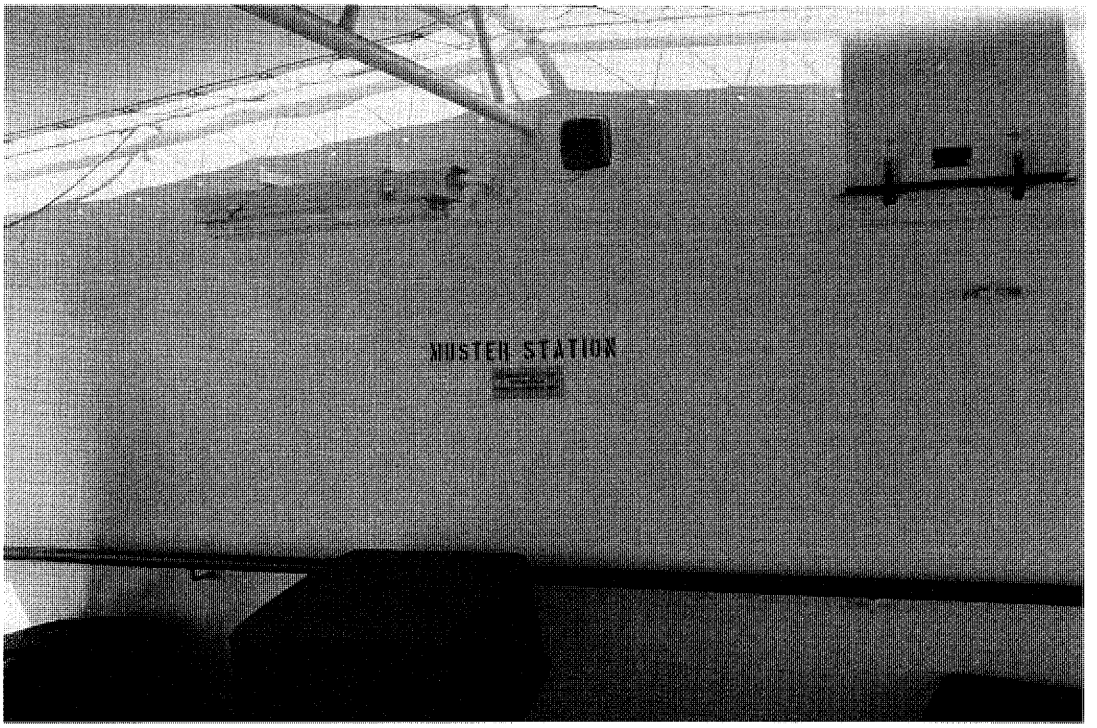
Since parts of the ship were burned out, only areas where the signposting was partly or wholly intact are described below. During the

Photograph 1



Photograph 2

Photograph 3



Photograph 4

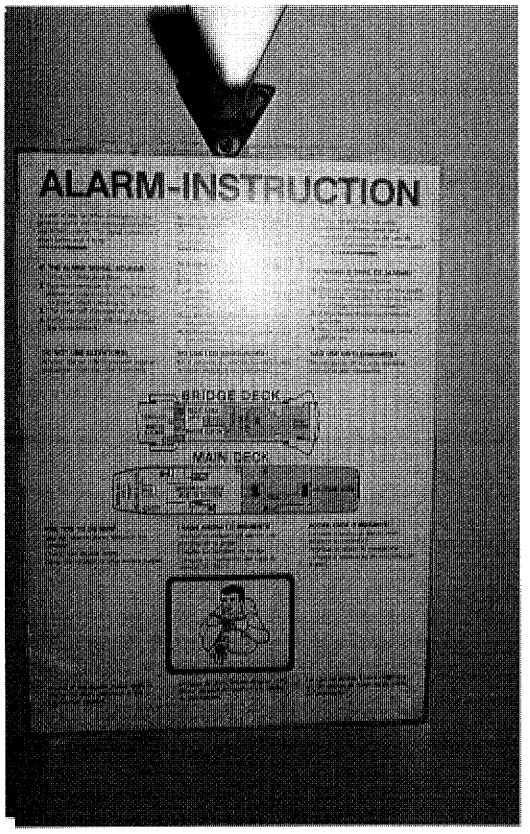
Photograph 5

Photograph 6

Photograph 7

Photograph 8

Photograph 9



Photograph 10

photographing, it became obvious that some of the signs had been taken down and/or removed. This must have been done after the fire because smoke deposits from the fire clearly showed where the signs had been. The places where signs had been removed were also photographed. On decks 9 (Sun Deck), 8 (Bridge Deck), and 7 (Sunset Deck), photographs were only taken of the starboard side, with one exception, since, with this exception, the signs on the port side were the same.

Photograph 1 shows the type of notice that was used throughout the ship to indicate the way to muster stations. Four muster stations are indicated, each with a different colour. The arrow indicates the direction to the muster station.

Two types of arrows are used:

A horizontal arrow means that the passengers should keep to the same deck and follow the direction of the arrow, and a diagonal arrow means that passengers should go upwards or downwards.

These standard notices were used all over the ship.

When the two different types of arrow were shown together, this indicated that an escape route led to a muster station and to the lifeboats.

In *photograph 2* the arrows point in different directions, one indicating the way to the muster station and the other the way to the lifeboats.

Photograph 3 shows how a muster station was signposted.

Photographs 4 and 5 show how the fire doors were signposted.

Photograph 6 shows the notice on a fire door that under normal circumstances was only to be used by the crew. This type of signposting was used consistently in areas of the ship reserved for the crew or where it was considered best that passengers should not enter during normal operation.

Photographs 7 and 8 show two types of notice at ceiling height, showing the position of an emergency exit in a longitudinal corridor. These emergency exits cannot be seen immediately, however, by a person standing in the same corridor. The fire doors that served as emergency exits were the same colour as the adjoining bulkheads, which meant that they were difficult to locate. Notices at ceiling height like this cannot be seen when the corridor is full of smoke.

Photograph 9 shows an instruction of the type posted all over the ship, concerning what to do in an emergency.

Photograph 10 shows an example of the notice posted on the doors of the passenger cabins. The notice refers to a "card", meaning the boarding card that should have been given to each passenger on arrival on board.

4.3.4.3 *Conclusions concerning the signposting on board the* Scandinavian Star

The fact that boarding cards were not dealt out meant that the passengers were unable to follow the colour codes, and were consequently unevenly distributed between the muster stations. At the maritime inquiry it became clear that the passengers had been highly confused when escaping to the open deck and during the distribution of life jackets. This deserves criticism, although a certain amount of confusion must be considered normal under the circumstances.

Some of the signs are confusing because they indicate two different means of escape from one place.

Following the usual practice, the signs and notices were at eye level. This made it impossible to see them when the corridors were full of smoke.

The signs and notices were *not* luminous, nor is this a requirement. The emergency lighting functioned all through the fire, but the fixtures caused the light to shine downwards. The signs ought to have been luminous, even though this would not have been of much help in the smoke-filled corridors.

The notices were in English, Spanish, and Portuguese. A few were in French. There were no notices in a Scandinavian language. This is not in compliance with SOLAS, which requires the use of "appropriate languages", which on the *Scandinavian Star* would have been Danish or Norwegian.

In their evacuation study, A/S Quasar Consultants concluded that the principles behind the signposting system on the *Scandinavian Star* were good, but that the ideas were not carried through.

In summary, the Committee concludes that it was censurable to put the ship into service between Denmark and Norway without posting emergency notices in a Scandinavian language and without issuing boarding cards. The fire also showed that notices should be placed at ankle height, and that they should give off

light and sound of a quality and strength that would enable them to be identified even in smoke-filled spaces.

4.3.5 Other precautions: Watertight doors

The watertight doors between the engine rooms were class 3 doors. The remote control system that controlled them was operated from the wheelhouse on the bridge and was completely destroyed by the fire.

These arrangements comply with the requirements of SOLAS 1960 and the Danish regulations, apart from the Danish provision concerning childproof mechanisms on watertight doors.

4.4 FAULTS AND DEFECTS IN THE SHIP AND ITS EQUIPMENT ON 7 APRIL 1990

When the ship was examined after the fire, a number of faults and defects were found which had been present at the time the fire broke out.

Workshops and stores on the car deck

From statements made by representatives of the ship's command, it seems that the previous owner had set up workshops and stores on the car deck, deck 3. The workshops were not recent. As soon as the ship had come under new management, removal of the workshops and clearing of the car deck were begun. A temporary carpenter's shop had also been set up on the forward part of the car deck on the starboard side. This had been done during the journey to Europe for rebuilding and alteration purposes. The workshops had not been completely removed before the outbreak of the fire on 7 April 1990.

Pressure bottles on the car deck, deck 3, and the poop deck, deck 5

In the aftermost room (the hydraulic room) on the starboard side of the car deck, pressure bottles containing various gases, including oxygen, nitrogen, freon and acetylene, had been stowed. The full bottles had valve caps and were standing upright, but were only fastened by ropes. Various empty bottles lay loose on the deck.

On the poop deck on deck 5 there were one bottle of oxygen and one of acetylene, secured only by rope. These two bottles had not been touched by the fire, but represented a potential hazard during the fire. Because the fire developed as it did, the bottles in the room on the car deck did not constitute a hazard.

The sprinkler system on the car deck

The ship was equipped with an open sprinkler system on the car deck, deck 3. This was divided into seven sections and supplied with water from a separate pump or from the ship's fire pumps. After the fire on 7 April, it was noted that the sprinkler system did not seem to have been tested for a long time, since many of the heads were blocked with rust. When the two sprinkler sections furthest aft were tested before the ship left Copenhagen after the fire, at least half the sprinkler heads were found to be blocked.

Fire doors

After the fire on 7 April 1990, it was found that the door frame on the saloon deck, deck 6, aft on the starboard side, which should have been equipped with a fire door, only had a glazed door. It has been established that the missing fire door had not been installed at any previous time, among other things because the door frame was not built to take such a door.

The self-closing fire door furthest aft on the port side of the car deck, deck 3, did not function properly during the fire on 7 April 1990. This meant that the door stood open during the whole course of the fire.

Main fire alarm system

Three of the alarms marked on the fire and safety plan were missing. The missing alarms should have been installed by the purser's information desk, deck 5, by the lavatory section on the main deck, deck 6, and by the air conditioning room, deck 7. When these places were inspected, no traces were found of electric wiring, fixtures, or any other indications that the missing alarms had been installed prior to the fire.

The sound level of the alarms installed in the accommodation areas was measured after the fire without the normal background noise. The results varied from about 30 to 80 dB. In about 90 of the cabins the sound level was below 58 dB (see 4.8.4).

As regards the main alarm system, see 4.3.1.17 for further details.

Motorized lifeboats

The technical standard of the lifeboats is described under 4.3.2.3.

The boats appeared in general to be in a poor state of repair, especially since patches of rot had been covered by fresh paint. Corrosion on hooks and attachments had also been painted over.

The Committee was informed that a number of items of equipment, such as compasses, fire extinguishers, etc. had been removed by unauthorized persons immediately after the fire. The missing starting handles for boats 8 and 10 may also have been removed unlawfully.

Signposting

The text of the emergency notices should have been in a Scandinavian language. Boarding cards should have been used. Some of the notices had symbols, but most of them simply consisted of written instructions. The positions of some of the notices meant that the information they conveyed was misleading. See under 4.3.4.3 for further details.

4.5 THE SHIP'S CERTIFICATES

4.5.1 SOLAS

SOLAS Passenger Ship Safety Certificate issued by Lloyd's Register on 5 February 1990, valid until 18 January 1991.

Service Certificate (issued by the firm that had carried out the inspection) for inspection of the CO_2 plant for the engine room, portable CO_2 extinguishers, the halon 1301 plant for the paint room and the halon 1301 plant for the galley, issued on 5 March 1990 by High Seas Trading, Inc., Miami.

Service Certificate (issued by inspecting firm) for inspection of 159 portable fire extinguishers and extinguishers in lifeboats, issued on 5 March 1990 by High Seas Safety, Inc., Miami.

RFD Certificates of Service and Testing of an Inflatable Liferaft (issued by inspecting firm) issued between 22 February and 7 March 1990 by Datrex, Inc., Miami.

Viking Certificates of Reinspection (issued by inspecting firm) for inflatable liferaft issued between 25 February and 3 February 1990 by High Seas Safety of America, Inc., Miami.

4.5.2 ILLC, 1966

A full-term International Load Line Certificate was issued by Lloyd's Register on 5 April 1990 on the basis of previously satisfactory surveys. The certificate was valid until 22 February 1995.

4.5.3 MARPOL

International Oil Prevention Certificate issued by Lloyd's Register on 23 November 1988, valid until 20 January 1993, latest periodic survey by Lloyd's Register on 2 February 1990.

4.5.4 Class

Lloyd's Register class 100 A1 *Passenger/Ro-Ro Cargo/Ferry, LMC*, with accompanying certification.

4.5.5 National certification

Passenger Ship Certificate of Inspection issued by the Commonwealth of the Bahamas on 16 January 1990.

Control Verification for Foreign Vessels issued by the US Coast Guard on 6 February 1990.

4.6 THE LAST SURVEYS BEFORE THE FIRE

4.6.1 Conduct of the surveys

4.6.1.1 Surveys conducted by Lloyd's Register as part of flag state control

The ship was surveyed by Lloyd's Register (the Miami office in Florida) during the period from 2 January up to and including 5 January 1990 on behalf of the flag state of the Bahamas.

The inspection comprised among other things the periodical survey stipulated in SOLAS Regulation 7 (b) (ii) for the renewal of a Passenger Ship Safety Certificate (Regulation 12 (a)). The survey was carried out by a single surveyor, who according to the maritime inquiry spent about half his working hours on board from 2 to 5 January 1990 on this SOLAS survey. The rest of the time was spent on the load line survey and the class surveys.

On the basis of the survey findings, Lloyd's Register issued the ship with a new certificate.

4.6.1.2 Survey by the nautical inspector of the Bahamas

According to Bahamian law, passenger ships registered under the Bahamas flag are subject to an annual inspection. See under 10.4.2.2.1 and 10.4.2.2.2 for further details.

The most recent annual survey was completed on 16 January 1990. The inspection was carried out by a single nautical inspector for the purpose of issuing a *Passenger Ship Certificate of Inspection* on behalf of the Bahamas. Such a certificate was issued on 16 January 1990.

4.6.1.3 Lloyd's Register's surveys for maintenance of the ship's class

The most recent periodical surveys for classing purposes were undertaken in February and March 1990.

At the end of March the ship was found to have maintained its status in class 100 A1 *Passenger/Ro-Ro Cargo/Ferry, LMC*. There were no further conditions to be fulfilled.

Since the fire no criticism has been made of the actual classification survey of the ship or the way in which the classification was followed up.

4.6.1.4 Inspection by the US Coast Guard

The US Coast Guard inspected the *Scandinavian Star* on 17 January 1990 for purposes of port state control and issued a certificate on 6 February which was valid until 18 January

1991. For more general information concerning this type of control, see 10.4.3.2.6.

4.6.2 Faults and defects in the ship and its equipment as of January 1990

More general information may be found under 10.4.2.2.2 and 10.4.2.2.6 regarding the flag state control exercised by and on behalf of the Bahamas. Here, under 4.6, the Committee will consider whether the surveys carried out by Lloyd's Register and by the Bahamas' nautical inspector in January 1990 were sufficiently critical in relation to the faults and defects that were present at the time. In order to undertake such an evaluation, it has to be established which faults and defects were actually present in the ship and its equipment in January 1990. The quality of the surveys is evaluated below under 4.6.3.

Under 4.4 above are listed the faults and defects noted in the ship and its equipment on 7 April 1990. Here the question of whether these faults and defects were present in January 1990 will be considered. In theory it is possible that there were faults present in January 1990 that had been corrected before 7 April 1990. However, the Committee has no information suggesting that this was the case.

In January 1990 there were workshops and stores on the forward part of the car deck. Even though the ship was at that time engaged in one-day cruise traffic, it did occasionally transport vehicles to and from the Bahamas. Workshops like this on the car deck are not in accordance with the SOLAS provisions concerning the protection of special-category cargo spaces.

The Committee has no evidence that the incorrectly stored and secured pressure bottles described under 4.4 on the car deck, deck 3, and the poop deck, on deck 5, were in this state in January 1990.

As mentioned under 4.4, many of the sprinkler heads in the car deck sprinkler system were blocked with rust. The system does not appear to have been tested for a long time. However, in the Committee's view this does not prove that the sprinkler heads were already blocked in January 1990.

There should have been a fire door on the saloon deck, deck 6, aft on the starboard side. The door frame was filled by a glazed door. This fire door was missing in January 1990.

The self-closing fire door furthest aft on the port side of the car deck did not function during the fire. It is not impossible that the door functioned satisfactorily, and that it was therefore in working order, in January 1990.

It is a reasonable assumption that the three alarm klaxons that should have been in position according to the fire and safety plan, see 4.4, were also missing in January.

The condition of the motorized lifeboats in January 1990 was by and large the same as it was after the fire. The description given under 4.3.2.3 thus also applies to their condition in January. However, as pointed out under 4.4, equipment may have been removed from the boats after the fire, and therefore this equipment may have been present in the boats in January.

The signposting of escape routes, etc. was the same in January as in April. However, many of the faults noted in this respect were related to the fact that the notices were not in a Scandinavian language, and that boarding cards were not used. These criticisms did not apply in January. However, the positions of some of the signs and notices made them misleading.

4.6.3 Evaluation of the surveys

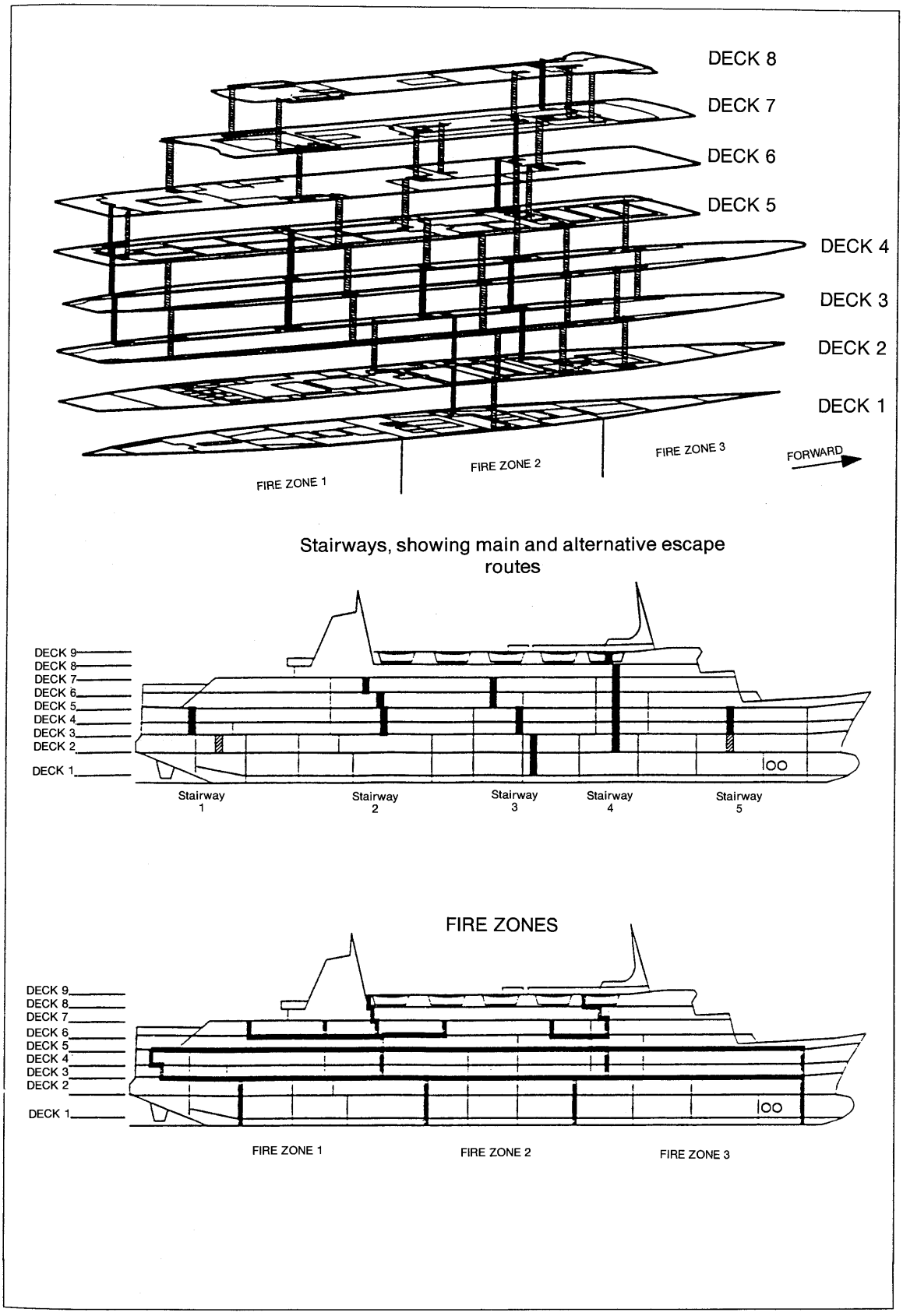
4.6.3.1 Survey by Lloyd's Register

The presence of workshops and stores on the car deck should have been noticed by Lloyd's Register's surveyor in January, and he should have given orders to have them removed.

The missing fire door on deck 6 had never been installed. It was meant to be installed in connection with certain alterations that were made before Lloyd's Register took over the classification of the ship. Lloyd's Register had not received any copies of plans showing these alterations, nor, according to its statement, did the previous classification society, Bureau Veritas, receive any such plans. Owing, among other things, to the lack of documentation, the Committee has, with reservations, decided that Lloyd's Register's surveyor cannot be criticized for not having noticed the missing fire door during his survey in January. However, in view of what happened, it is to be hoped that Lloyd's Register and the other classification societies will take steps to ensure that their documentation is more reliable in future (see under 13.3.1.2 for further details).

Three of the alarm klaxons marked on the fire and safety plan were missing. It must be assumed that these three alarms were also missing in January 1990. As mentioned above, no trace has been found of wiring, fixtures, or other indications that these klaxons had ever been installed. The alarm system is an important safety measure, and the Committee considers that Lloyd's Register's surveyor should have noticed that one or more of the alarms was missing when he surveyed the ship in January. He should also have noted and drawn

Fig. 4.7.1 *Ship profile, showing main escape routes and fire zones*



attention to the faintness of the alarms in parts of the accommodation areas.

The condition of the lifeboats is decisive for the safety of passengers and crew. Lloyd's Register's surveyor should have noted their poor state of repair during his survey in January, and given orders to correct it.

The positions of many of the signs, etc. in January were the same as during the fire, i.e. they were misleading and difficult to follow. Attention should have been drawn to this during the survey. As mentioned above, the language used in the notices could not have been criticized in January 1990, and at this time boarding cards were being used.

4.6.3.2 Survey by the nautical inspector for the Bahamas

The purpose of such surveys is to act as a check on the flag state control exercised by the classification society on behalf of the Bahamas. The inspection by the nautical inspectors is not expected to be as thorough as Lloyd's Register's survey on behalf of the Bahamas.

The Bahamas' nautical inspector should have drawn attention to the workshops on the car deck and ordered the deck to be cleared.

The Committee finds no grounds for censuring the Bahamas' nautical inspector for not noticing the missing fire door. Nor does the Committee consider that blame can be attached to him for not noticing that three alarm klaxons were missing, or that the sound of the alarms was too faint in parts of the accommodation areas.

The Bahamas' nautical inspector should have noted the defective condition of the lifeboats. In this connection the Committee wishes to emphasize the crucial importance of the lifeboats for safety on board.

The Bahamas' nautical inspector should have noted the misleading positions of many of the notices.

4.7 ESCAPE ROUTES

4.7.1 Introduction

The possibilities of escape are of crucial importance for the safety of passengers and crew in an emergency. The majority of passengers and crew have to be able to escape from dangerous situations without help. The use of specially trained crew, such as smoke divers, to rescue passengers is too time-consuming to be practicable for more than a limited number of people.

This conclusion, and the following presentation, are based partly on an evacuation study carried out at the request of the Committee by a Norwegian firm, A/S Quasar Consultants, and partly on the results of investigations and experiments that the Committee commissioned from the Danish National Institute for Testing and Verification (Dantest) and SINTEF NBL – Norwegian Fire Research Laboratory.

In the following, the escape possibilities are examined from the point of view of what the Committee considers can be learnt from the disaster, without direct reference to the SOLAS requirements for exits and emergency exits. This means that the Committee's conclusions are more critical than they would have been on the basis of the SOLAS rules.

The Committee wishes to point out that the arrangement of corridors, exits, emergency exits, and escape routes on the *Scandinavian Star* was with one exception in accordance with the provisions of SOLAS, and that generally speaking the arrangements were of the same standard as those of similar passenger ships. The exception was a corridor with a blind end that was too long.

The reason why the Committee has wished to base its conclusions on other grounds than the SOLAS requirements, is that it considers it necessary to examine whether the rules in SOLAS do ensure satisfactory escape possibilities for passengers and crew in the event of a fire.

For the calculation of times for escape and evacuation, see 4.7.4.

4.7.2 Principles of escape and evacuation from passenger ships

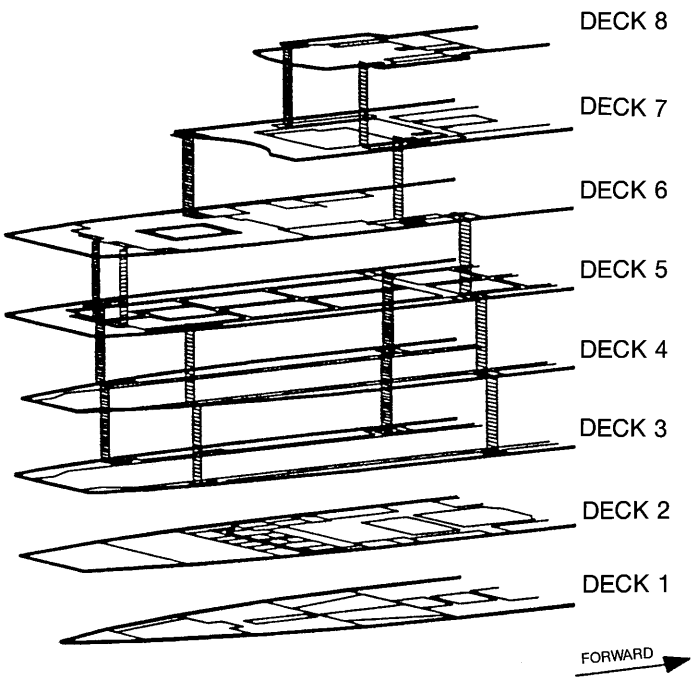
Passenger ships have to be divided into fire zones by means of transverse fireproof bulkheads. In an emergency passengers and crew should be able to escape from wherever they happen to be to special muster stations and from there to lifeboat stations, without having to go through a fireproof bulkhead. Escape is supposed to take place along main escape routes, and there should be alternative routes for cases where a main escape route is blocked. At the muster stations the passengers should be given life jackets to put on and should be conducted by a crew member from the muster stations to a lifeboat station.

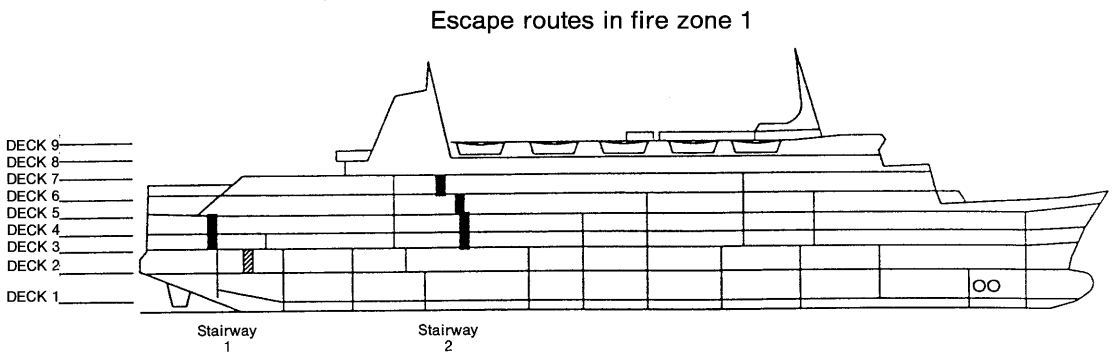
The main escape routes should be enclosed by fireproof bulkheads, but this is not required for the alternative routes.

The escape routes to the muster stations should be easy to follow. This means that the signposting must comply with certain requirements. On the *Scandinavian Star* the marking of escape routes was defective in some respects, as described under 4.3.4.

Openings in fireproof bulkheads should be closed by fireproof doors. During a fire, the doors should be released from the bridge so

Fig. 4.7.2 *Profile showing stairways used as escape routes in fire zone 1*





that they close, but they must be able to be opened by passengers or crew for purposes of escape. Escape routes through fireproof doors into another fire zone are possible as alternative routes.

4.7.3 Escape arrangements on the *Scandinavian Star*

The *Scandinavian Star* was divided into three fire zones. The arrangement of each deck is described in detail under 4.1.

4.7.3.1 Main and alternative escape routes

As far as can be seen from the undamaged or partly damaged signs on board, three main stairway systems were designated as the main escape routes. These stairways run with one or more interruptions from the lowest to one of the upper decks. The only exception observed was that of deck 5 (Gulf Deck), where an escape route has been planned to run aft along the deck, around the swimming pool tank and out onto the open deck (see 4.7.3.2.5). From the open deck there were stairs leading to the upper decks.

Four muster stations were indicated on the fire and safety plan: two on deck 6 (Main Deck) in fire zone 1, and two on deck 8 (Bridge Deck) in fire zones 1 and 2.

The review of the escape possibilities takes into consideration the position of escape routes and muster stations in relation to each other.

4.7.3.1.1 Fire zone 1

Both the main and the alternative escape routes in this fire zone are poor, but they comply with the requirements applicable to the ship. The main escape routes lie at the forward end of the fire zone.

The main escape routes for this zone, fire zone 1, run from deck 2 (D Deck, for the crew) up a stairway on the port side, into a longitudinal corridor, forward to the end of the corridor, and up a flight of stairs. On the starboard side there is only an emergency escape route in the form of a ladder from deck 2 up to deck 3, and after that the route corresponds to that on the port side. From deck 3 (C Deck) and upwards, these escape routes are intended for both passengers and crew.

The stairs on the port side end on deck 5 (Gulf Deck). On the starboard side there are stairways leading, with various interruptions, to deck 8 (Bridge Deck). There is an exit from the starboard stairway to deck 6 (Main Deck), where there are two muster stations. There are also two muster stations on deck 8 at the end of the stairways.

There is an alternative escape route from deck 2 that runs down into the engine room. From deck 3 there are alternative escape routes up stairways on the port and starboard sides at the after ends of the longitudinal corridors. On deck 5 there are exits from the stairways to the open deck on both sides, but these are through weathertight steel doors. From the deck there are external stairs up to deck 6 and the two above-mentioned muster stations.

At the forward ends of the corridors on decks 4 and 5 there are exits through fire doors to fire zone 2. These can be used as escape routes.

Evaluation of the escape routes

Adequate lighting is essential for satisfactory escape routes. The following evaluation of the suitability of escape routes is based on the assumption that the routes are properly lit.

The main shortcomings of the main escape routes in fire zone 1 are that the stairways are not continuous, and that the fireproof boundary of the stairways forming the main escape route includes a transverse corridor on deck 5. Further, a total of 16 fire doors have to be closed if this main escape route is to be effectively closed off in case of fire.

Persons escaping from decks 2, 3, 4, and 5 on the port side, especially from the stern of the ship, have to find their way down very long corridors, and they also have to cross over to the starboard side on deck 5 where the port stairway ends. This means a long and often confusing escape route. There may also be bottlenecks at the point where the port and starboard escape routes join up at the starboard stairway on deck 5.

A through stairway on the port side would have improved the situation considerably.

On deck 6 (Main Deck) the stairway is also interrupted, which makes it easy to lose sight of the direction of escape, but in this case those who take the wrong turning will find themselves in the lounge on deck 6, and thus in a muster station.

Both the port and starboard stairways and the transverse corridor between them on deck 5 had the same continuous fireproof boundary. This means that any smoke and flames that entered the starboard stairway, spread across to the port stairway and rapidly on from there. This made it difficult to escape along this route.

Getting from the lower decks up to the muster stations required considerable physical stamina, and persons in poor physical condition would have found it difficult.

The main escape routes in fire zone 1 may have been adequate for evacuation in a good light and with no smoke under organized conditions, but they were inadequate in darkness

Fig. 4.7.3 *Profile showing stairways used as escape routes in fire zone 2*

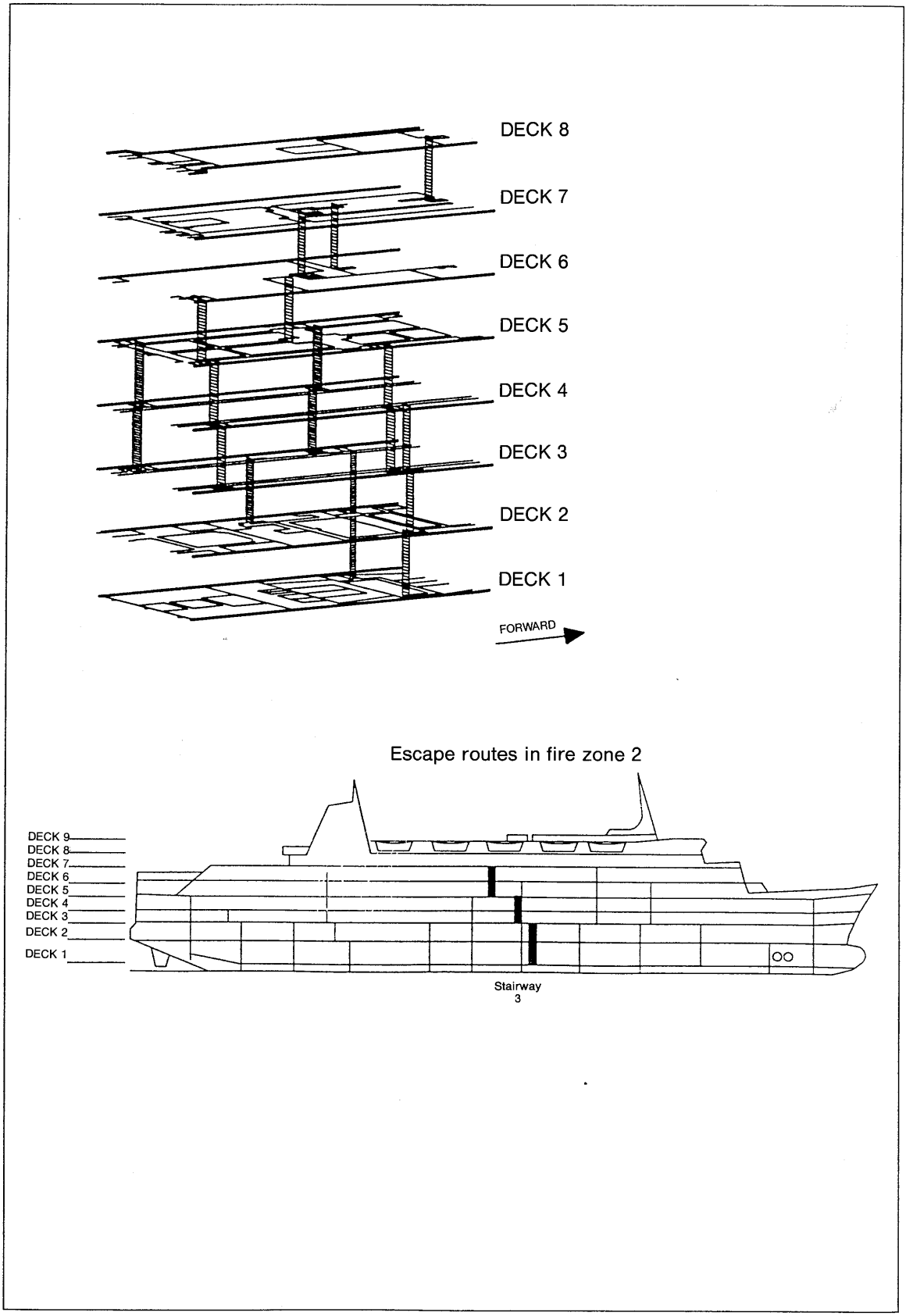
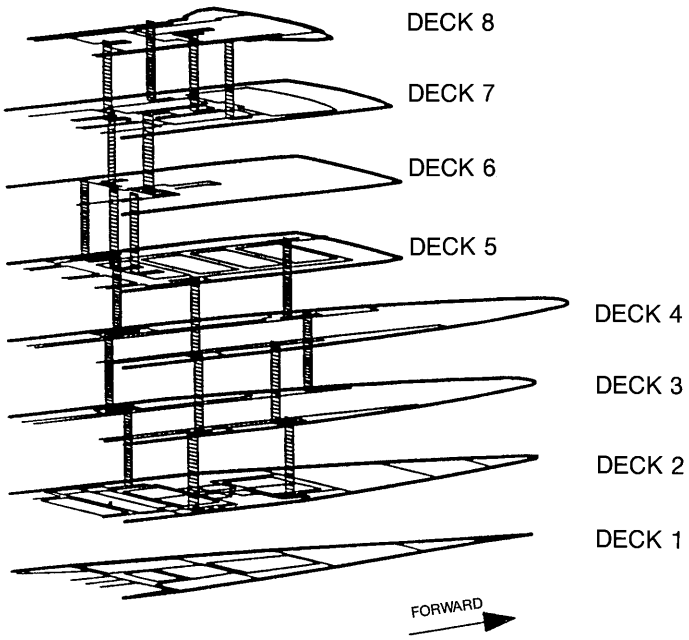
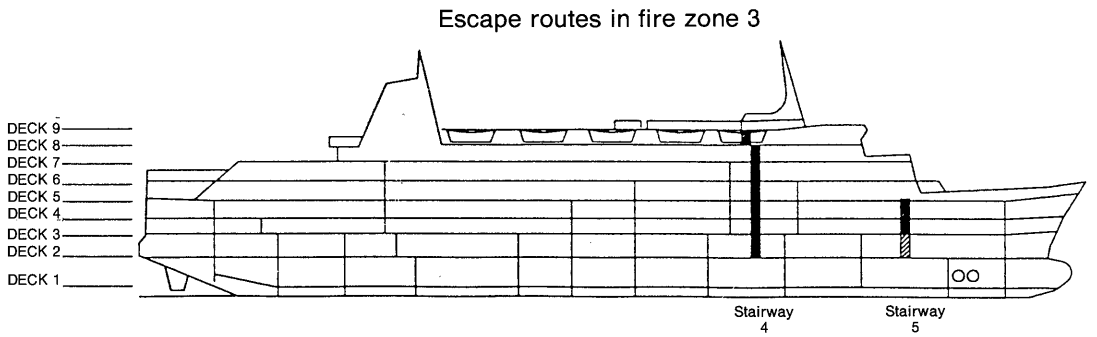


Fig. 4.7.4 *Profile showing stairways used as escape routes in fire zone 3*





and smoke and were not suitable for hurried evacuation under stress.

The *alternative escape routes* lay towards the after ends of the longitudinal corridors. On deck 5 these corridors ended aft in blind ends. There were exits in the side walls of the corridors about 2 to 3 metres from the blind ends, in the form of fire doors opening into stairways. The fire doors were not marked as escape routes. Several of the deceased were found in these corridors. Smoke made it difficult to find the way but even without smoke these blind ends made the corridors unsuitable as escape routes.

Under any circumstances, directions from the crew were necessary wherever the escape routes changed direction and the stairways were interrupted.

4.7.3.1.2 Fire zone 2

The main escape routes in this zone also had shortcomings. The stairways began at the sides of the ship and continued amidships on deck 5, and the fireproof boundary includes a wide transverse corridor connecting port and starboard stairways on deck 5.

In this zone the accommodation spaces start on deck 1 (E Deck), i.e. one deck lower than in zone 1. The main escape route runs from deck [1] up the port and starboard stairways to deck 5 (Gulf Deck), where they both end and continue as a single midship stairway. The route from the port or starboard stairway to the midship stairway goes through a fire door.

The stairways are also interrupted on deck 3, but the distance between the stairways is not as great as on deck 5. Here, too, the route goes through a fire door. The fire doors limit the spread of fire but make it difficult for persons escaping.

The escape routes from deck 1 to deck 3 are for the use of the crew. From deck 3 and upwards they are intended for both crew and passengers.

The midship stairway has an exit on deck 6, where there are two muster stations, and continues up to deck 7. The muster stations on deck 8 can only be reached by an exit at the end of a transverse corridor or through a lounge and out onto the open deck. The stairway leading to deck 8 is far away from the exits.

The main escape routes are situated, longitudinally speaking, towards the middle of the fire zone.

Alternative escape routes from decks 3, 4, and 5 are through fire doors at the forward and after ends of the longitudinal port and starboard corridors and into the adjoining fire zones. On decks 6 and 7 there are doors, restaurants, and lounges opening onto the open deck.

Evaluation of escape routes

The weaknesses of the escape routes are that the stairways are not continuous, being interrupted on decks 3 and 5, and that the main escape routes do not lead directly up to the muster stations on deck 8.

Access to the alternative escape routes is through doors that are supposed to be shut during a fire, and is therefore complicated.

In a good light and without smoke or flames, the main escape routes in zone 2 were adequate for evacuation under organized conditions, but they were not satisfactory with low visibility due to smoke. For passengers who were not strong physically it would have been difficult to get from the lowest passenger deck up to the muster stations.

In any event, rapid evacuation would have required crew members stationed at relevant points to direct passengers to new stairways and at every change of direction of the escape route.

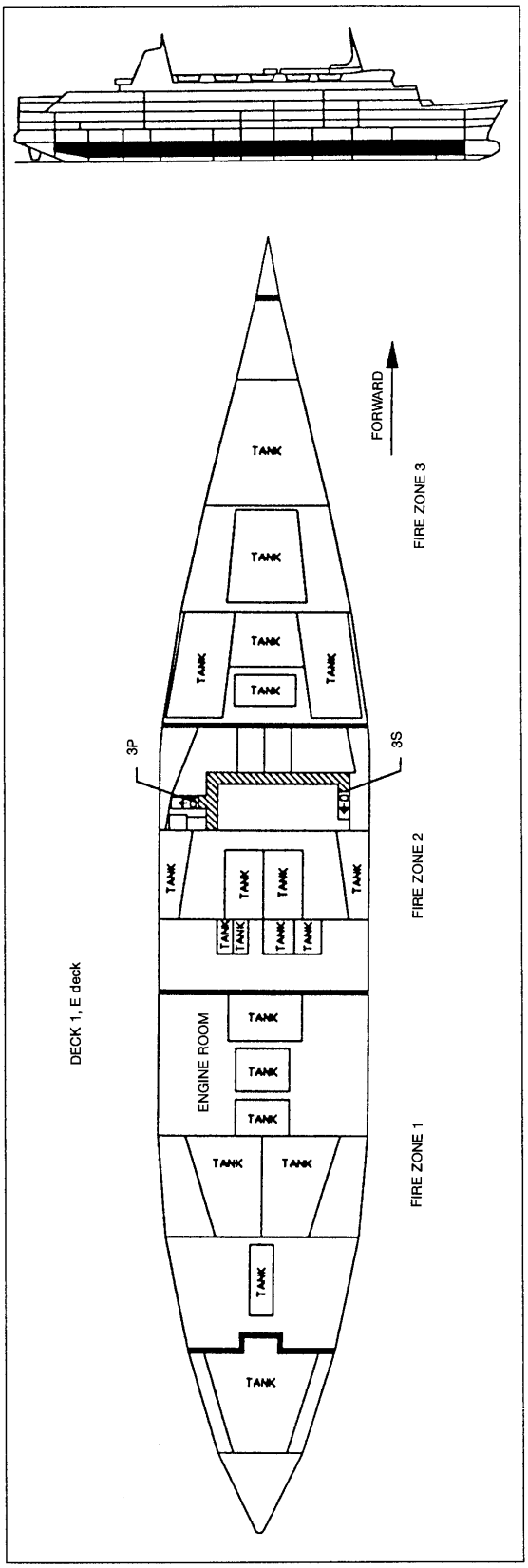
4.7.3.1.3 Fire zone 3

The main escape route in fire zone 3 was not satisfactory. Like the other main escape routes, it involved a change of stairway on deck 5 (Gulf Deck), and also a wide transverse corridor which is only partly separated from the stairway by fire doors. This escape route was situated at the after end of the zone. The lowest accommodation space in this zone is the crew accommodation on deck 2 (D Deck). The main port and starboard escape routes are stairways running continuously up to deck 5. They end in a broad transverse corridor and the route continues up two stairways near the centre of the ship. From deck 5 a continuous stairway leads up to deck 7 (Sunset Deck), where there is an exit via a transverse corridor to the open deck on both the port and the starboard side. Across the transverse corridor there is a stairway up to deck 8 (Bridge Deck). There is no fireproof partition between the broad transverse corridor on deck 5 and the stairway leading upwards.

The exits on deck 7 lead to the embarkation stations for lifeboats, but not directly to a muster station. A muster station can only be reached by going up a flight of stairs to deck 8 and aft to the restaurant and lounge areas. There are, however, chests containing life jackets on deck 7 at the embarkation stations, so that in practice there is little need to proceed further to a muster station.

The *alternative escape route on the starboard side* is up a flight of stairs slightly for-

Fig. 4.7.5 *Layout of deck 1 (E Deck), with hatched areas showing escape routes*



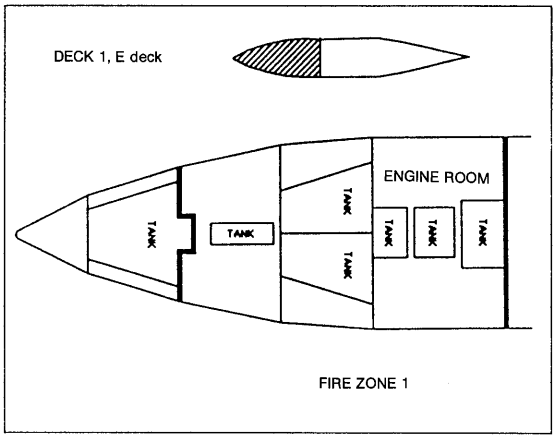
ward of the middle part of the accommodation area between decks 2 and 3, and then aft to the main starboard escape route.

Evaluation of escape routes

The *main escape route* has the same weaknesses as those in the other two zones, involving as it does a change of stairway on deck 5.

Since there are two parallel stairways from deck 5 to deck 7 (Sunset Deck), the escape capacity is greater in zone 3 than in the other fire zones, but from deck 6 and upwards the stairways also have to accommodate the diners from the large restaurant at the forward end of the deck (the Ocean View Dining Room). If the restaurant is full, the stairways may become crowded.

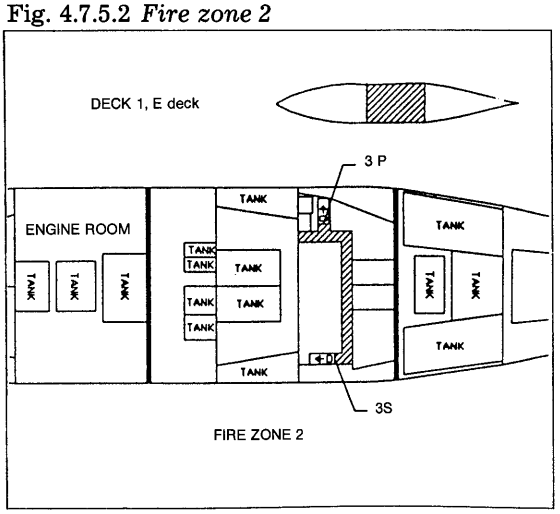
Fig. 4.7.5.1 *Fire zone 1*



Smoke and flames on deck 5 would be able to spread unhindered up the stairway because it is not closed off by a fireproof partition on deck 5.

The fact that this escape route does not lead directly to a muster station may be a shortcoming. (There are notices recommending passen-

Fig. 4.7.5.2 *Fire zone 2*



gers when they hear an emergency signal to proceed directly to a muster station, where life jackets will be distributed by the crew.) However, as mentioned above, there are stores of life jackets at the embarkation stations for the lifeboats, so that it might not be necessary to proceed from here to the muster stations.

There are two muster stations on the after part of deck 6, but the exit to this deck is inadequate and access aft through the restaurant and shopping area is complicated. Escaping from one of the lower decks to the lifeboat stations would be a great physical strain, and proceeding to a muster station on decks 6 or 8 would be even more so. Passengers would require a considerable amount of guidance from the crew in order to reach the lifeboats or the muster stations.

The alternative escape route on the port side is adequate in that it leads to an exit to the open deck on deck 5, but the exit has a weathertight steel door that may be difficult for passengers to open. If the door cannot be opened, the alternative is to proceed aft to a broad transverse corridor and then turn left. Before reaching the broad transverse corridor passengers have to pass four narrower corridors that all turn left. In an atmosphere obscured by smoke it would be easy to make a mistake.

The alternative escape route on the port side may be adequate if properly illuminated, but it is not adequate in darkness and smoke. Passengers would need assistance from crew members to make use of it.

The alternative escape route on the starboard side only runs from deck 2 to deck 3. It cannot therefore be regarded as an alternative escape route for fire zone 3.

4.7.3.2 Escape routes on each deck

The layout of each deck is described under 4.1. In the following only the escape routes for

Fig. 4.7.5.3 *Fire zone 3*

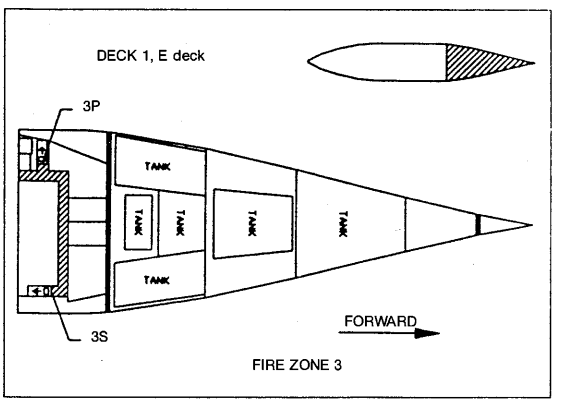


Fig. 4.7.6 *Layout of deck 2 (D Deck), with hatched areas showing escape routes*

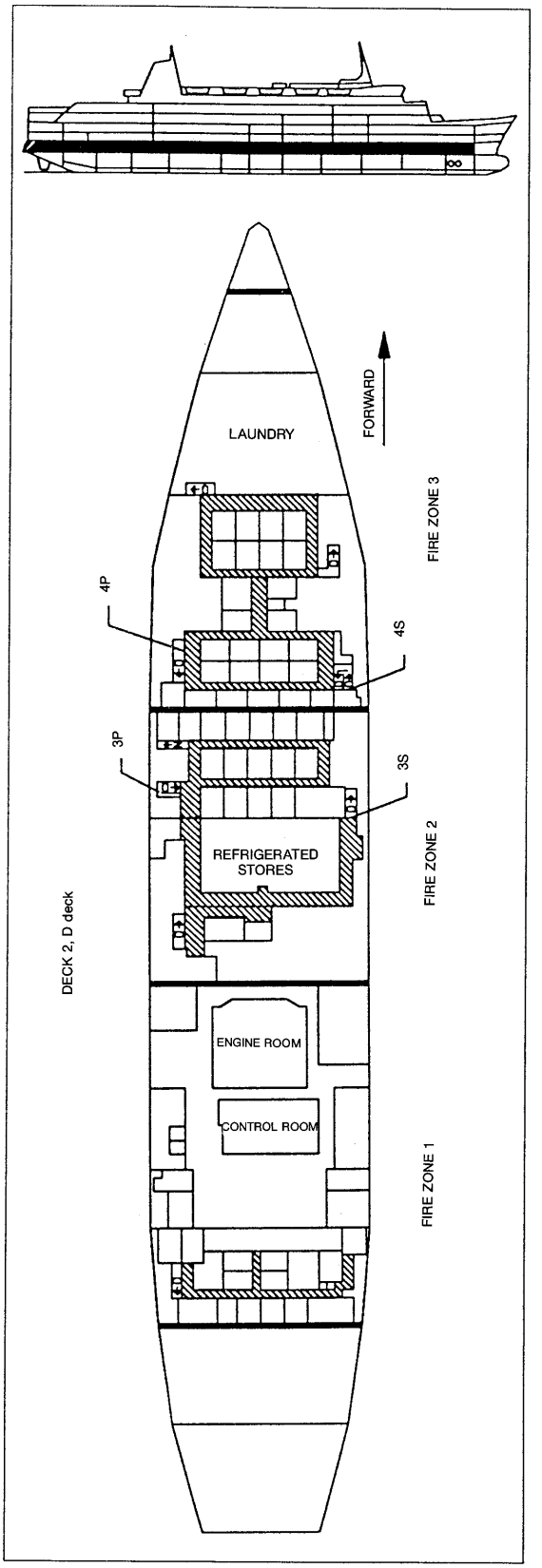


Fig. 4.7.6.1 *Fire zone 1*

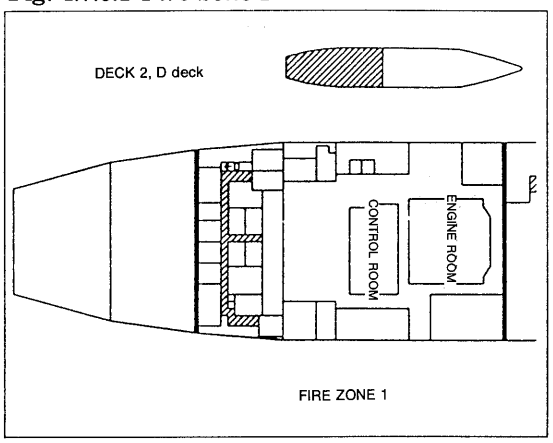
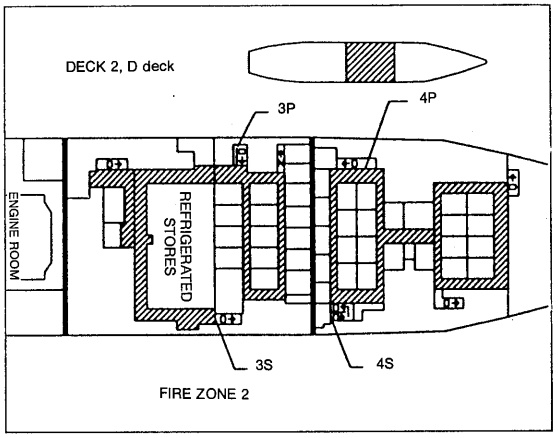


Fig. 4.7.6.2 *Fire zone 2*



each fire zone on each deck that lead to the main escape route will be evaluated. In many parts of the ship there are lifts, but these have not been included in the escape routes.

4.7.3.2.1 Deck 1 (E Deck)
Fire zone 1

The first room at the stern end is the *sewage tank room*. Under normal circumstances there is seldom anyone in this room, and anyone present there would be a member of the crew. The escape routes, up an emergency ladder or through a watertight door, are fairly good for these conditions, but would be difficult in smoke or darkness and in a hurry. Forward of the sewage tank room is the *auxiliary engine room*. This, too, would normally only contain crew members, and there would in any case be few of them. Anyone in the room would have to have a detailed knowledge of the escape possibilities. Assuming that they did, the escape routes, up a ladder to the diesel generator room above, or through the watertight doors fore or aft, are reasonably good for such a room. But they would be difficult to find in a hurry and in smoky conditions.

The main engine room is situated forward of the auxiliary engine room. The floor is level with deck 1. There may be crew members here at all times, but they will often be higher up in the engine room or in the control room. There is a fire pump in this room that may require supervision during a fire.

The escape routes, on both sides up a ladder to a higher level, or out through watertight doors fore and aft, are reasonably good for crew members who are familiar with the ship. The forward escape route through a watertight door involves the use of one of two emergency exits in order to proceed further, which again requires a good knowledge of the ship. In case of a hurried exit through smoke it might be difficult to find.

Any crew members who were in the engine room during a fire would have had to know the escape routes.

Fire zone 2

Forward of the engine room is a room containing *pumps and compressors*, including two fire pumps. The escape routes are aft through a watertight door into the main engine room or up through one of two emergency exits. The fire pumps might need supervision during a fire. In the event of a fire in the engine room the only escape routes from this room would be through one of the emergency exits, and this would require a good knowledge of the ship.

Thus the escape routes are not very good, and in smoke they would be difficult to find.

Forward of the pump and compressor room lie *mess and common rooms* for the crew. These rooms lie off a transverse corridor. On both sides are stairways leading to the deck above. The escape route from the corridor changes direction at right angles twice before reaching the port stairway, and once before reaching the starboard stairway. The distances are short, however, and in practice it would be impossible to mistake the route. These rooms

Fig. 4.7.6.3 *Fire zone 3*

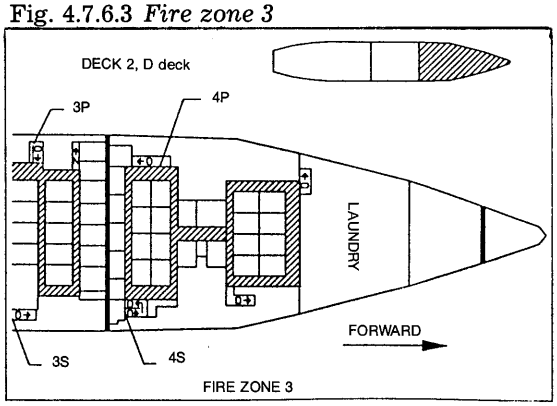
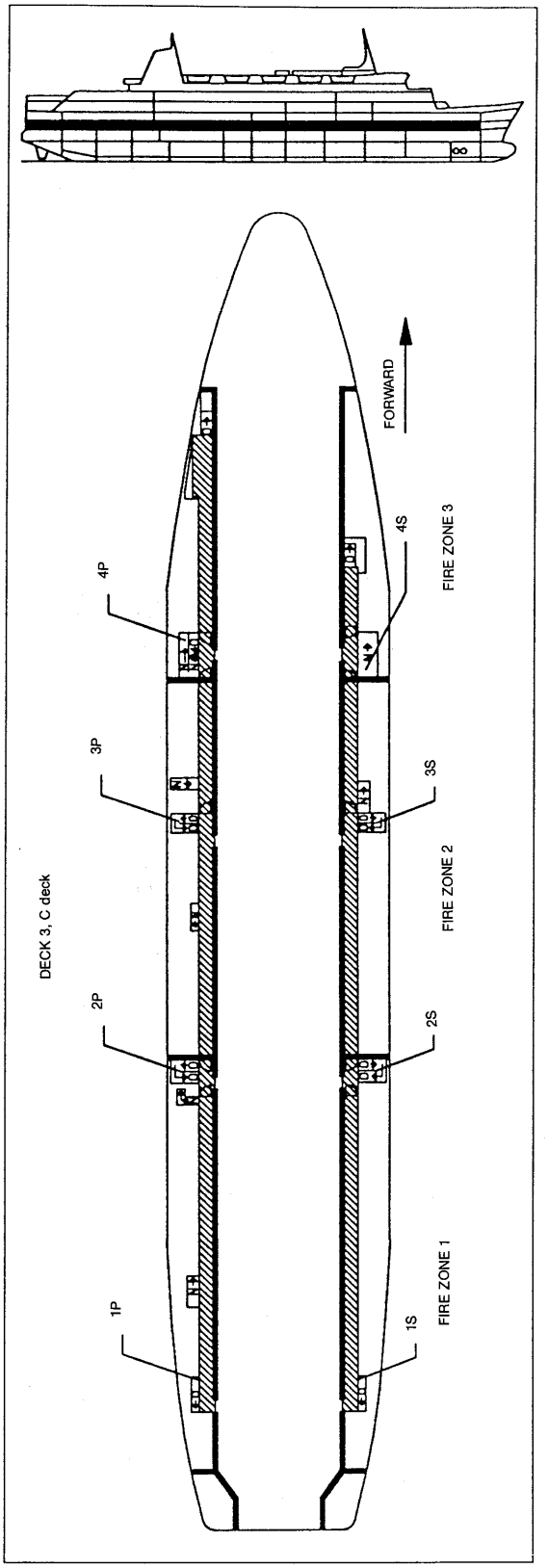


Fig. 4.7.7 *Layout of deck 3 (C Deck), with hatched areas showing escape routes*



are used regularly by the crew down there. There is no sleeping accommodation.

Thus the escape possibilities are fairly good. It is possible to find the way even in very reduced visibility.

Fire zone 3

The aftermost room in this zone contains *sewage and fuel tanks.* Access and escape are by means of a vertical ladder. For the limited traffic to this room the escape route is adequate.

The foremost room in this zone contains the *bow thruster machinery.* The room is two decks high and will be considered under deck 2.

4.7.3.2.2 Deck 2 (D Deck)
Fire zone 1

The aftermost part of the zone contains a *cabin section* for up to 37 crew members. The escape routes from this section are up a stairway on the port side or up through an emergency exit on the starboard side. These two routes lie on either side of the transverse corridor off which the cabins open. There is also an emergency escape route from the shower and lavatory section down to the sewage tank room.

Considering that this section is intended for the use of people who are familiar with the ship, the escape routes are adequate as long as they are not obscured by darkness or smoke.

From the *diesel generator room* forward of the cabin section there are stairs up through the starboard engine-room casing to the open deck. On the port side there is an exit through a watertight door to the engine room and stairs leading upwards from there. The escape routes are adequate as long as they are not full of smoke.

Fig. 4.7.7.1 *Fire zone 1*

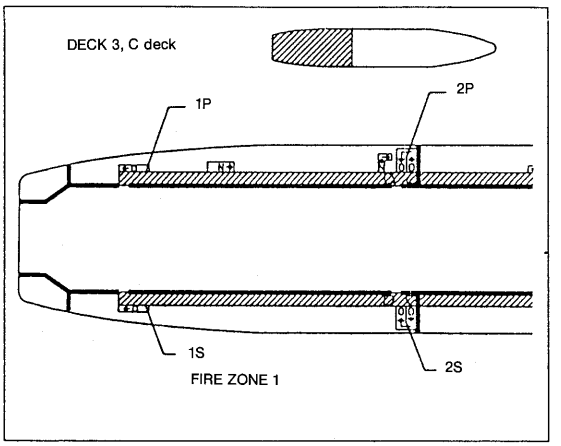
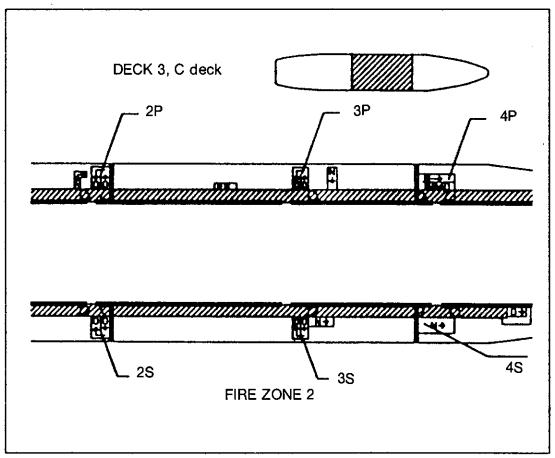


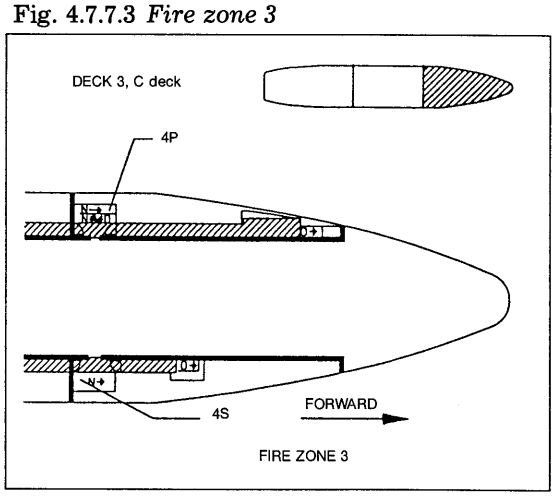
Fig. 4.7.7.2 *Fire zone 2*



The control room for the engines lies between the diesel generator room and the main engine room. It has an exit on both sides to the main engine room and an emergency exit up to the car deck and out. The escape routes from the control room are adequate.

The *main engine room*, which is situated at the foremost end of the zone, has only one

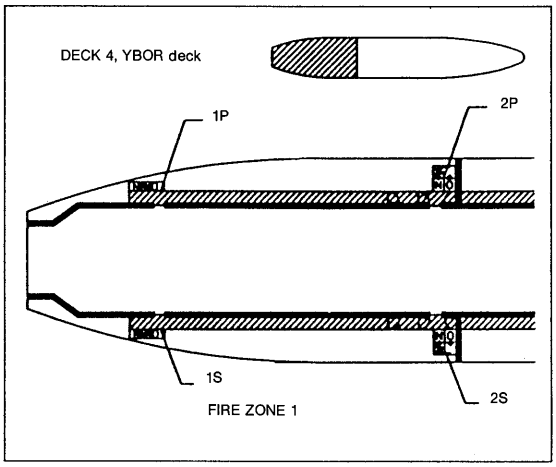
Fig. 4.7.7.3 *Fire zone 3*



escape route to a higher deck: up the stairs in the engine-room casing on the port side and out into the accommodation corridor on deck 3. Alternative escape routes on the port and starboard sides go down to deck 1 and out through watertight doors fore and aft.

The fact that the engine room only has an escape route to an upper deck on one side is a shortcoming. The escape routes may be adequate for trained crew members who are familiar with the ship and not confused by smoke or darkness.

Fig. 4.7.8.1 *Fire zone 1*

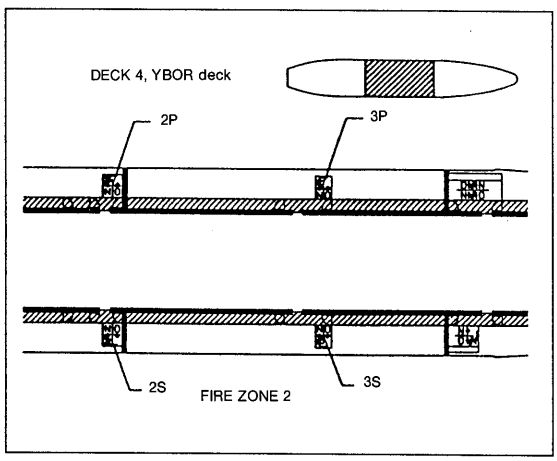


Fire zone 2

The aftermost room in this zone is the *dry stores room*. The escape routes are up a stairway or through a watertight door on the port side. Considering that only a limited number of crew would be present in this room at any time and that they would be awake, the escape routes are adequate.

The *refrigerated stores room*, the next one forward, has a starboard emergency exit to the deck above and an exit through watertight doors fore and aft on the port side. If the

Fig. 4.7.8.2 *Fire zone 2*



watertight doors are closed there is only the emergency exit. This is not adequate.

The cabin section at the forward end of the zone has stairs up to the deck above at both ends of the after transverse corridor. The starboard stairwell is in the same space as a shower and lavatory section. The whole section is separated from the cabin corridor by a door. Considering that the cabins are for crew, the escape routes are adequate, but smoke

Fig. 4.7.8 *Layout of deck 4 (Ybor Deck), with hatched areas showing escape routes*

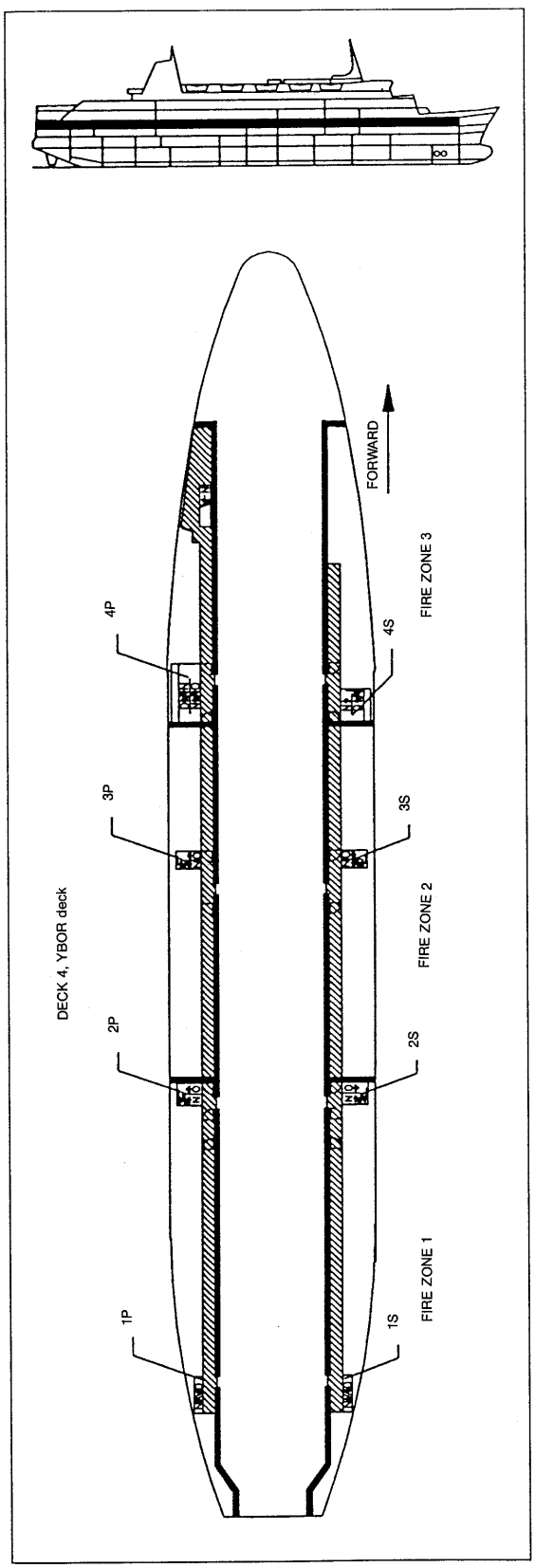
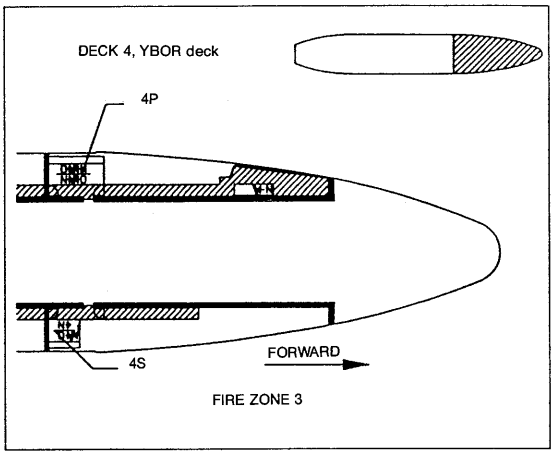


Fig. 4.7.8.3 *Fire zone 3*



might make it difficult to find the way out from the foremost transverse corridor.

Fire zone 3

The *aftermost cabin section* has accommodation for 36 crew members and direct access to the main starboard escape route. The alternative escape routes are forward through watertight doors into the laundry, and aft into the after section. The escape routes are adequate as long as they are not obscured by smoke, otherwise they are poor.

The laundry has an exit aft through the watertight door into the cabin section, and an emergency exit on the port side up a stairway to the deck above. The escape routes are adequate.

The bow thruster room has an exit up ladders that change from the starboard to the port side and that terminate to port at the forward end of deck 3, the car deck. Considering that there is seldom anyone in the bow thruster room under normal circumstances, the escape routes are adequate.

4.7.3.2.3 Deck 3 (C Deck)

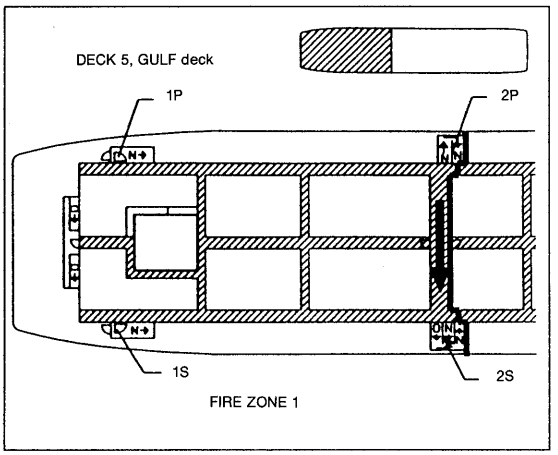
Fire zone 1

The few cabins lie along the longitudinal corridors without any changes of direction and with access to stairways at both ends. The escape routes are adequate.

Fire zone 2

Here, too, the cabins open off the longitudinal corridors without any changes of direction. The escape routes are up stairways about halfway along the corridors or out through fire doors fore and aft. For the limited number of persons with cabins in this zone the escape routes are adequate.

Fig. 4.7.9.1 *Fire zone 1*



Fire zone 3

The few cabins lie along the longitudinal corridors without any changes of direction. The escape routes are at the forward and after ends of the port corridor and at the after end of the starboard corridor. The escape routes are adequate for the limited number of people with cabins here.

4.7.3.2.4 Deck 4 (Ybor Deck)

Fire zone 1

The cabins, corridors, and escape routes follow the same pattern as on deck 3, but there is more cabin space than on the lower deck. Even though the number of persons is larger, the escape routes are in principle adequate. However, 19 bodies were found in the starboard cabins. This is probably because toxic smoke penetrated the corridor before the passengers became alarmed. Under the circumstances of this fire, therefore, the passengers in fact had no possibilities of escape.

Two bodies were found in the corridor.

Fire zone 2

In this section, too, the arrangement of cabins, corridors, and escape routes is the same as on deck 3, and this, too, caters for a larger number of persons. The escape possibilities must therefore also be said to be adequate, but 14 bodies were found. The reason is assumed to be the same as for fire zone 1 above.

Fire zone 3

The layout of corridors and cabins is roughly the same as on the deck below. The port corridor has exits at both ends, and the escape possibilities are in principle adequate. The starboard corridor is 15.2 m long and has an exit at one end only. This is not adequate.

Fig. 4.7.9 *Layout of deck 5 (Gulf Deck), with hatched areas showing escape routes*

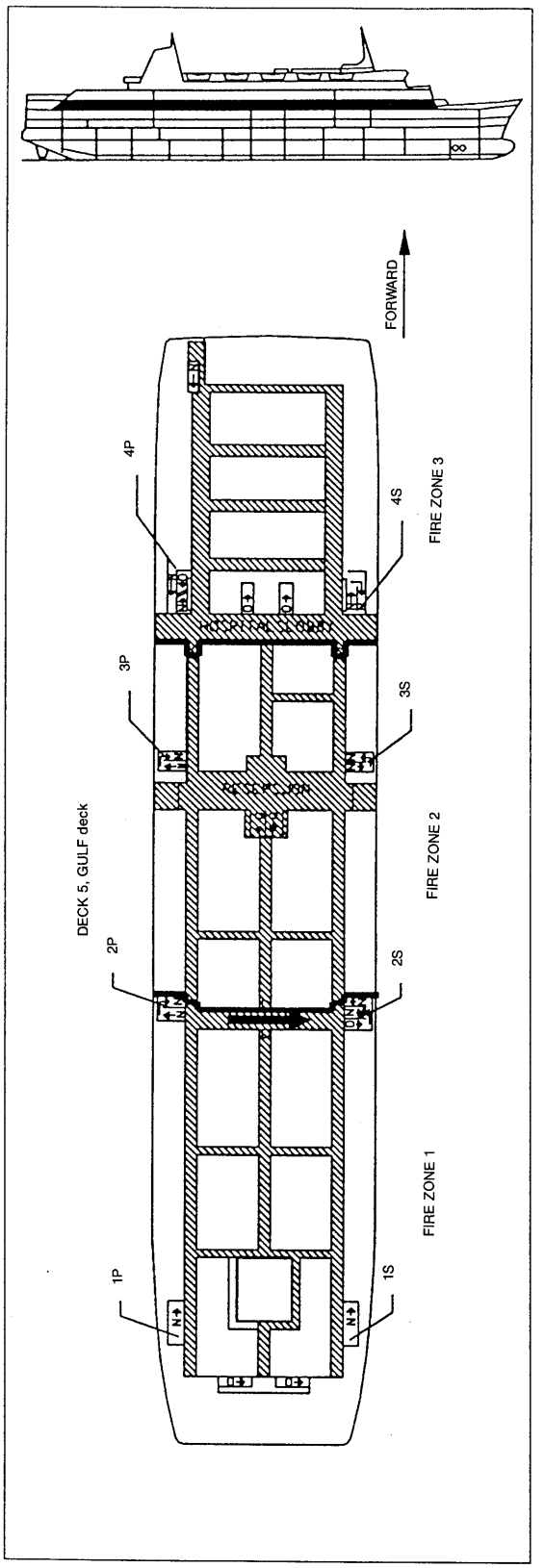


Fig. 4.7.9.2 *Fire zone 2*

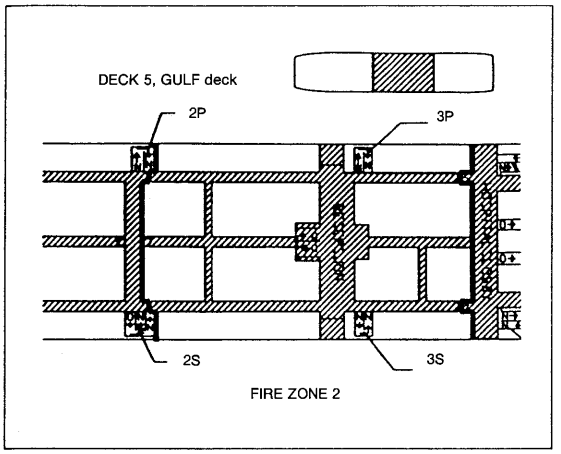
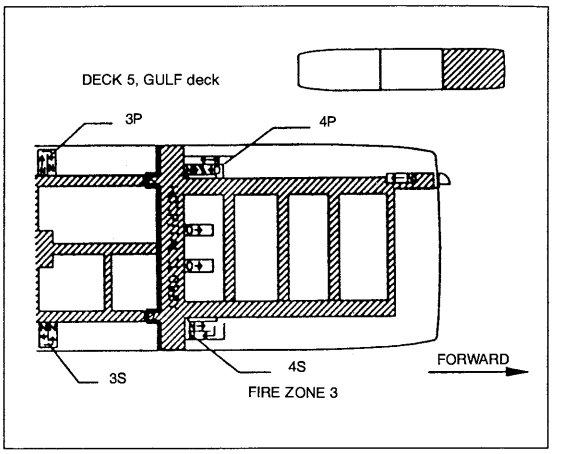


Fig. 4.7.9.3 *Fire zone 3*



4.7.3.2.5 Deck 5 (Gulf Deck)
Fire zone 1

The cabin section has three longitudinal and three transverse corridors. The cabins open into the longitudinal corridors, which are the escape routes.

The escape possibilities are not adequate because the port and starboard corridors have blind ends aft, and because the centre longitudinal corridor has too many changes of direction. Furthermore, persons escaping along the forward end of the port corridor have to cross right over to the starboard side in order to proceed further.

The port and starboard corridors end aft in fire cabinets. The corridor exits are located in the side walls, about 2 m short of the blind ends, but may be difficult to see.

The centre longitudinal corridor has four changes of direction before reaching the after exit. The exit has a weathertight steel door.

It might be difficult for people in poor physical condition to escape forward from the cabins in the port corridor.

It might be difficult to find the right escape route even in an organized evacuation with good visibility, and in conditions of poor visibility, like smoke, it would be very difficult. In any circumstances, directions from the crew would be necessary for rapid evacuation. Eighty bodies were found in this zone.

Fire zone 2

The stairway representing the main escape route is situated in the middle of the fire zone. The cabin section *aft* of this has three longitudinal corridors and one transverse corridor, with cabins opening off the longitudinal corridors.

The centre longitudinal corridor has a blind end, but the other two corridors open into broad transverse corridors. The openings are closed off by fire doors.

The escape possibilities are not satisfactory because the centre corridor has a blind forward end and because persons escaping aft on the port side have to cross over to the other side when they have left the corridor. Escaping passengers meeting closed fire doors may regard them as impediments.

There is a considerable risk of passengers' losing their way while escaping, and a safe large-scale evacuation would require help from the crew. The escape possibilities were not adequate during the present fire. A total of 38 bodies were found in this zone.

Forward of the main escape route are three longitudinal corridors and a transverse corridor. They are relatively short.

The port corridor has exits at both ends and provides adequate means of escape.

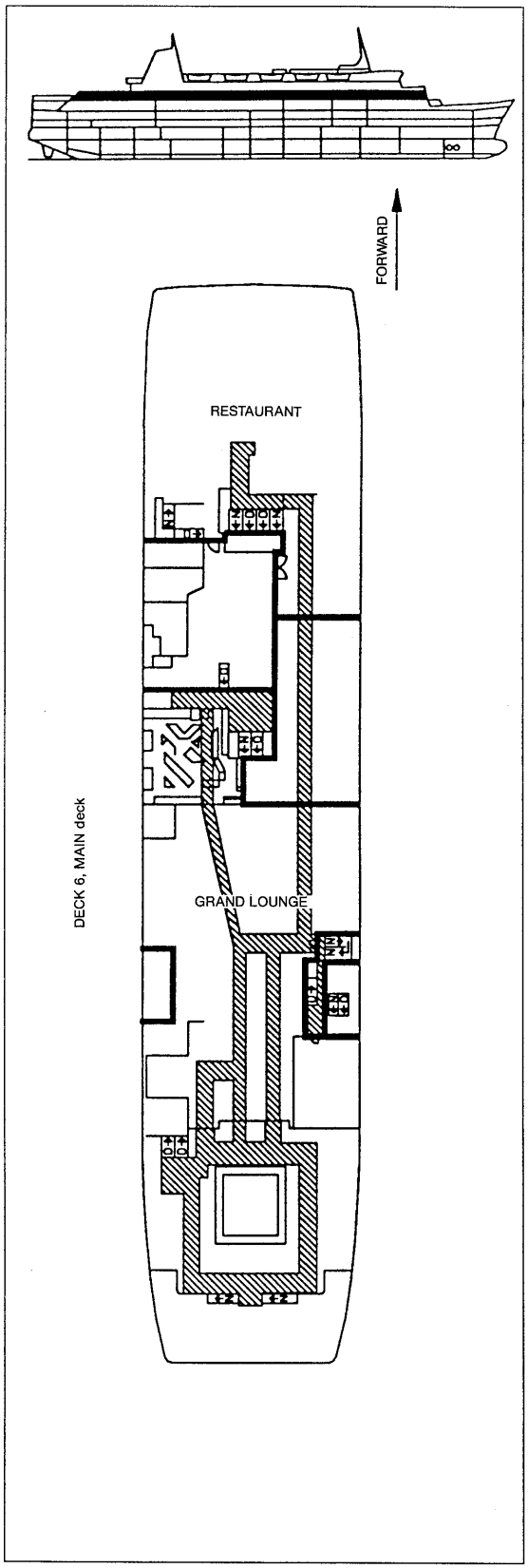
The centre corridor has two blind ends and an exit halfway along, but only to starboard. This is not adequate. The starboard corridor has exits at both ends and is thus adequate in this sense, but in darkness and smoke passengers can lose their way by going into the transverse corridor and from there into the blind centre corridor.

On the whole the means of escape from this zone are not satisfactory. Directions from the crew would be required in the centre and starboard corridors.

Fire zone 3

The cabin section lies above the main escape route and is divided up by two longitudinal and four transverse corridors. There are cabins opening into all the corridors. There are six corridor intersections, some with 90° changes of direction, and two additional 90° changes of direction. The escape routes are aft to the

Fig. 4.7.10 *Layout of deck 6 (Main Deck), with hatched areas showing escape routes*



hospital lobby or out from the forward end of the port corridor.

As long as it is easy to see signs, the escape routes from the cabin area are adequate, but because of the many possibilities of error under stress, they are not satisfactory in poor visibility such as smoke.

Escape through the lobby is liable to be hindered by the presence of video game machines. This is not satisfactory.

4.7.3.2.6 Deck 6 (Main Deck)
Fire zone 1

Most of this fire zone consists of a lounge containing two muster stations. The escape routes to these muster stations are ideal.

Further escape to the lifeboats on the embarkation deck above is up external stairways aft of the lounge on the port side or up the main starboard escape route in a separate stairwell about halfway along the starboard side of the lounge. An alternative escape route is through fire doors into fire zone 2.

Since, according to the ship's emergency plan, the passengers at the muster stations are supposed to be directed to the lifeboats by the crew, the escape routes from here to the lifeboats are adequate.

Fire zone 2

Fire zone 2 has a port and a starboard section. From the starboard section it is possible to escape aft through a fire door into zone 1 or forward through a fire door into zone 3. The exit to the main escape route is through a fire door in the middle of the zone.

From the port section there is an escape exit up two stairways to the deck above or through a fire door into zone 1.

The means of escape from zone 2 are good.

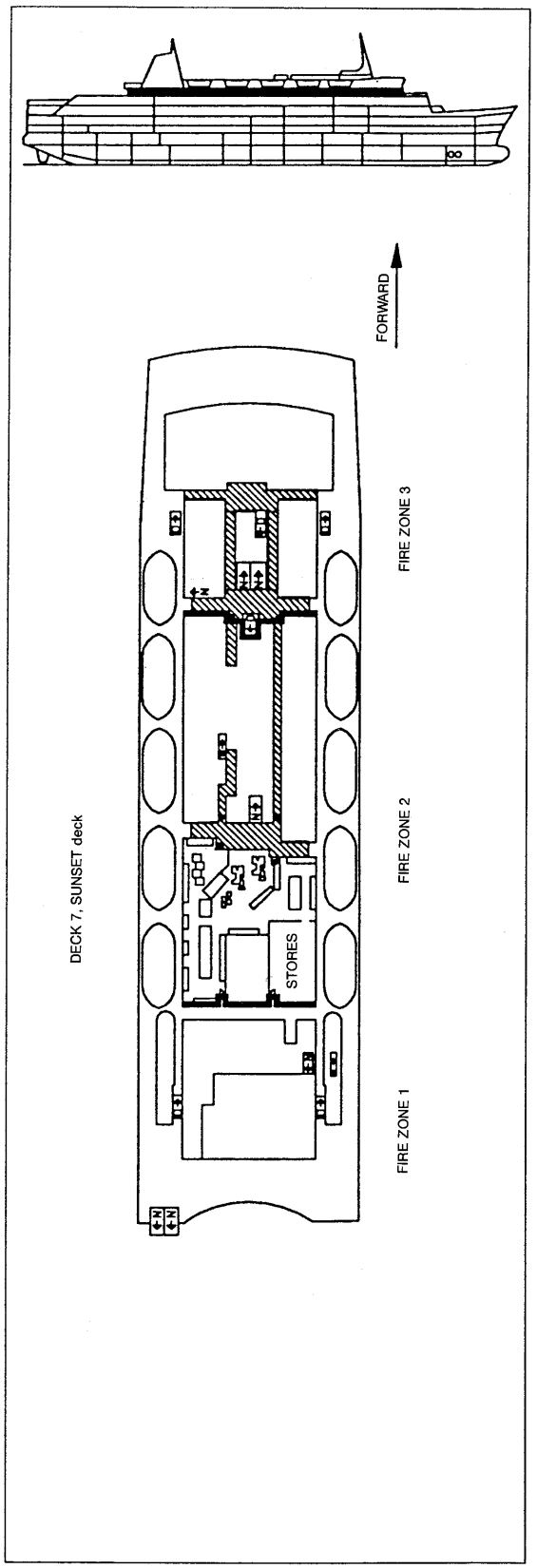
Fire zone 3

This zone contains a large restaurant with accompanying service space. The main way of escape from the restaurant is up a stairway and out to the lifeboats on the deck above. The service spaces have access via another stairway to the deck above.

The alternative escape route is through the fire door aft to zone 2.

If the restaurant is full the escape route may be crowded, but since there would always be crew in the restaurant whenever there are passengers there, the crew would be able to direct and control an evacuation. Under these circumstances the escape possibilities are adequate.

Fig. 4.7.11 *Layout of deck 7 (Sunset Deck), with hatched areas showing escape routes*



4.7.3.2.7 Deck 7 (Sunset Deck)
Fire zone 1

The large lounge in this zone has exits directly onto the open deck or into a corridor which is open at both ends. The liferaft and lifeboat stations are on this deck.

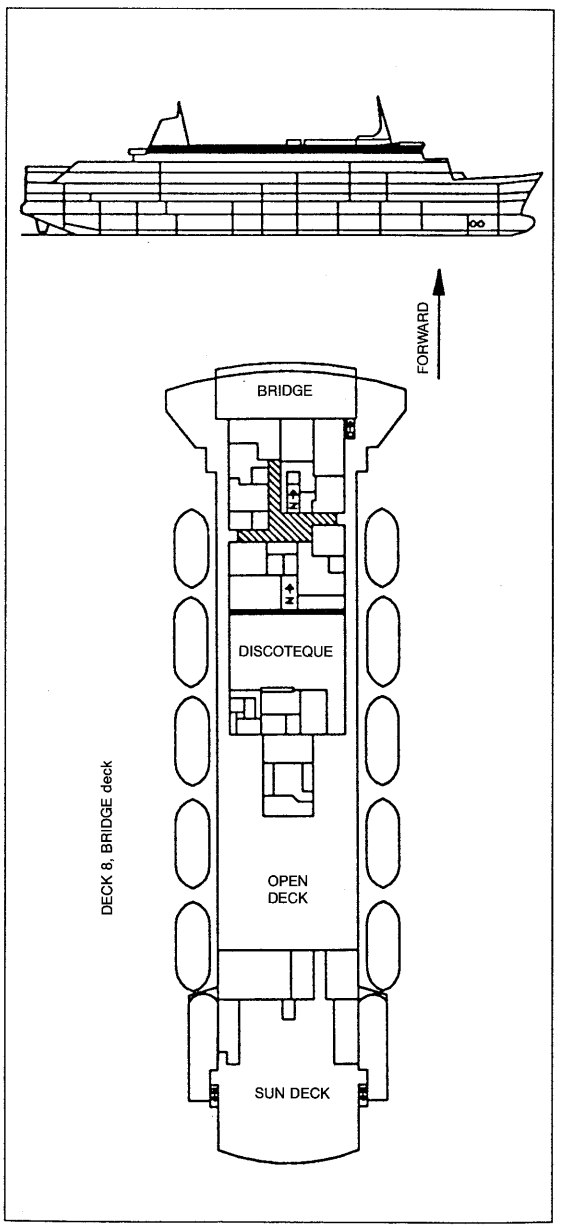
The escape possibilities are good.

Fire zone 2

Fire zone 2 is a deck house containing lounges and shops for passengers, rooms for the crew, and the accompanying service space. It has several exits to the open deck and stairs to the decks above and below.

The escape possibilities are good.

Fig. 4.7.12 *Layout of deck 8 (Bridge Deck), with hatched areas showing escape routes*



Fire zone 3

Fire zone 3 contains officers' cabins, stairways, and corridors. There are port and starboard exits to the open deck in the after and middle parts of the zone.

For the category of crew who have cabins in this zone the escape possibilities are good.

4.7.3.2.8 Deck 8 (Bridge Deck)
Fire zones 1, 2, and 3

This deck is mainly open. The deck houses contain the wheelhouse, other operations rooms, officers' cabins, the CO_2 room, and a ventilation room. There is one muster station on the after part between the funnels, and one approximately amidships. Both are on the open deck.

Passengers on this deck will be at the muster stations. For the limited number of crew members who happen to be on the bridge or in other operations rooms there is good access aft to the muster stations and down the stairs to the deck below, where the lifeboat and raft stations are situated. In this respect the escape routes are good.

Outside access from the muster stations down to the lifeboats is restricted to two single companionways at the after end of the deck. An alternative way down is forward through the discoteque and down a single stairway amidships and out to the port and starboard lifeboat stations.

In case of rapid evacuation of large numbers of passengers on the sun deck, the escape routes to the lifeboats might easily be too narrow and difficult. But as long as the crew are there to direct passengers, as laid down in the emergency plan, the escape routes are adequate.

4.7.3.2.9 Deck 9

This is the roof of the deck houses on the deck below. There is a ventilation room, and chests containing lifebelts and four "buoyancy apparatuses". The only exit is a stairway forward on the starboard side. Normally there is no one on this deck. The single exit downwards therefore represents an adequate escape route.

4.7.4 Calculated time of evacuation from passenger areas to muster stations

A/S Quasar Consultants has made estimates for the Committee of the time it would take to evacuate passengers from the accommodation areas to the muster stations. The calculations are based on the conditions prevailing on the *Scandinavian Star* during the fire, and on escape routes that are not impeded by smoke. It was found that without smoke, escape could take place within the times prescribed by SOLAS.

The estimates are based on the assumption that the crew direct the passengers during the escape and evacuation to muster stations. Very little of this kind of assistance was provided during the *Scandinavian Star* disaster.

There are two sets of calculations, one based on the number of passengers that were present on the *Scandinavian Star* at the time of the disaster and one on a full complement of passengers. The actual or possible whereabouts of passengers when there is a full complement of passengers are shown in Tables 4.7.1 and 4.7.2 below. The time of escape with a full complement is influenced by the fact that since there are not enough cabins for all the passengers, a large number would have to remain in the public rooms.

The most time-consuming part of an evacuation is rescuing passengers who remain in their cabins. Experience has shown that about 50 per cent of those already in their cabins at the time of the disaster will remain there. Events on the *Scandinavian Star* confirmed this. Fifty-nine persons died while trying to escape and 37 managed to escape from cabin areas that rapidly filled with smoke. This means that there were altogether 96 who tried to escape. The number found in the cabins was a little higher, being 99.

Table 4.7.1 *Overview of the whereabouts of the passengers when the fire broke out*

Deck	Cabins	Public rooms, corridors	Total
3, C Deck		1	1
4, Ybor	94	2	96
5, Gulf	211	13	224
6, Main		58	58
7, Sunset		6	6
Total	305	80	385

With the limited number of smoke-divers' outfits that were on board according to the fire and safety plan – seven complete outfits and two breathing apparatuses – it would have been very time-consuming to have searched all the cabins to rescue the passengers. This is shown by Table 4.7.3, which shows the estimated times from the sounding of the alarm until the passengers were assembled at the muster stations.

The calculation of the escape and evacuation times assumes a walking speed of 1 m/sec

in the corridors and public rooms, and a speed of 0.35 m/sec vertically up stairs.

Table 4.7.2 *Estimated distribution of passengers with full complement*

Deck	Cabins	Public rooms, corridors	Total
3, C Deck	52		52
4, Ybor	130		130
5, Gulf	427		427
6, Main		378	378
7, Sunset		65	65
Total	609	443	1052

Table 4.7.3 *Estimated time of evacuation of passengers from accommodation/ public spaces to muster station*

% of passengers to arrive at muster stations	Passenger complement during fire		Full passenger complement	
	Intact escape routes	Smoke-filled escape routes*	Intact escape routes	Smoke-filled escape routes*
30	2.7 min	2.8 min	2.7 min	3.4 min
60	4.4 min	5.0 min	4.8 min	7.0 min
90	13.0 min	8.5 *hrs*	8.4 min	6.6 *hrs*
100	24.0 min	11.0 *hrs*+	29.0 min	13.6 *hrs*+

* As during the fire.
+ The hours are incorrectly given as minutes in the Norwegian report.

It is assumed that 45 per cent of passengers will remain in their cabins when the alarm is sounded.

The time taken to mobilize the smoke-diving team is also included.

When there is no smoke or flames, the searching of cabins for passengers is calculated to take half a minute per cabin, plus an additional four minutes per team for rousing sleeping passengers. Eleven search teams are considered adequate when there is no need for smoke divers. This means that searching the cabins could be done fast enough as long as there was no smoke or flames.

When smoke and flames *are* present, however, the search would take considerably longer. This is because the number of smoke-diving teams that can be mobilized is limited and because it takes longer to search each cabin under these circumstances. The calculations assume that it takes five minutes to search each cabin and five minutes for each person found in a cabin to be led or carried or out.

Smoke-diving teams may have two different tasks: fire fighting and searching cabins. The evacuation times given in Table 4.7.3 are based on only two cabin-searching teams of smoke divers. They assume a continuous search, with reliefs to replace exhausted team members, and replacement of air cylinders as needed.

If there were four teams instead of two, this would halve the time needed to evacuate 90 per cent and 100 per cent of the passengers. It would not shorten the time needed to evacuate passengers in public rooms or passengers who had left their cabins on their own initiative. A smoke-diving team consists of two smoke divers. As already mentioned, the *Scandinavian Star* had complete outfits for seven smoke divers, which is more than is required under SOLAS.

Since experience has shown that just over half the number of passengers escape from their cabins without prompting from the crew, it is estimated that it would take a relatively short time to evacuate the first 60 per cent or so of the passengers, even with a full complement. What takes a long time is rescuing the passengers who remain in their cabins.

Table 4.7.3 shows that the estimated evacuation time for a full complement of passengers is not much greater than for the number that were actually on the *Scandinavian Star*. One of the reasons for this is that with a full complement there are not enough cabins for everyone, so that a number of passengers would always be in public places that are relatively easy to escape from.

Furthermore, *all* the cabins have to be searched whether or not the ship is carrying a full complement. The only difference in the time it takes to evacuate a full complement and a partial complement is therefore due to the difference in the estimated number of passengers who have to be taken out of their cabins.

The time taken to embark in lifeboats and liferafts is not included in these estimates. These times will increase proportionately more than any increases in the number of passengers.

The Committee has not evaluated the accuracy of the time estimates calculated by the experts. The Committee agrees entirely with their main conclusion, that it takes a very long time to evacuate passengers when the cabin areas are full of smoke. On this basis the Committee concludes that searching cabins and rescuing passengers takes so long that an evacuation plan must be based as far as possi-

ble on passengers escaping on their own. In order to reduce the number of cabins to be searched, care should be taken when selling the tickets to fill cabins section by section, so that unused cabins are grouped together. In an emergency these sections would then not need to be searched. Unused cabin sections should also be patrolled, however, to prevent attempts at arson. Unused cabins should be kept locked.

4.8 WARNING THE PASSENGERS

In the event of a fire like the one on the *Scandinavian Star*, it is important that passengers and crew receive warning of the emergency as soon as possible. Early warning is essential so that the cabins can be evacuated before the corridors become filled with toxic smoke gases.

An effective warning system requires alarm signals that are loud enough to be heard all over the ship, even by sleepers. The alarms must also be sufficiently fireproof so that they can go on sounding for a sufficiently long period.

4.8.1 Standards of fire alarms and public address systems on board ship

SOLAS 1960 stipulates a main alarm system on board ship. In an amendment to SOLAS 1974, which applies to existing ships (including the *Scandinavian Star*), there is a further requirement concerning a separate warning system for the crew and a public address system or other effective method of communication.

SOLAS 1974 with amendments stipulates that there must be a main alarm system that can be heard in all public rooms and in the normal working quarters of the crew.

SOLAS does *not* stipulate the strength of the sound level of the warning system.

Ships registered in Norway used to be required to have a warning system with a sound level of 80 dB in accommodation spaces. This requirement has been abolished in the interests of harmonization with international rules.

4.8.2 Description of the fire alarm and public address systems on board the *Scandinavian Star*

The *Scandinavian Star* had a manual fire alarm system. According to the fire and safety plan it consisted of 53 alarms distributed about the ship. It has since been established that at least three of these alarms had not been installed.

The system was manually operated. The alarm was sounded by pressing buttons on the bridge. The buttons had to be held in for the alarm to be sounded. The system had two separate circuits, one for warning the crew and one for the passengers.

The installation of the system was satisfactory and provided sufficient protection against fire.

There was also a public address system on board that could be used to give instructions to the passengers.

The public address system could be operated from the bridge and from the information desk in the reception lobby on deck 5.

The loudspeakers were installed in the corridors, on the car deck, and on open areas of deck. There were no loudspeakers in the cabins.

The public address system was not protected from fire, and was destroyed during the fire.

4.8.3 The significance of the sound level of the warning system

For adequate warning of passengers, alarms must be loud and they must last for a certain period of time.

It has been estimated that an alarm needs a sound level of about 75 dB to wake 90 per cent of sleepers, assuming this value to be 10 to 15 dB above background noise (Danish fire protection authority, Dansk Brandværn Komité).

Seventy-five decibels is not enough to wake sleepers in the deepest phases of sleep immediately. It is therefore essential that the alarm should have a certain duration and should be repeated several times.

A satisfactory sound level of the alarms on the *Scandinavian Star* would depend on the level and nature of the background noise. If this noise is assumed to be less than 60 dB, and without any peaks at the level of the most important frequencies of the alarm sound, the sound level can be divided into the following four classes as regards its efficiency in warning passengers (Danish fire protection authority):

$\geqslant$ 68 dB: ..... probably sufficient
58-67 dB: ..... possibly sufficient
48-57 dB: ..... probably insufficient
$\leqslant$ 47 dB: ..... insufficient

4.8.4 Sound level of the alarm system on the *Scandinavian Star*

After the fire, the Danish fire protection authority assessed the probable sound level in all the cabins on board the *Scandinavian Star*. The results showed values of between 30 and 80 dB. Out of a total of 264 cabins, 97 (37 per cent) had a sound level of over 68 dB, or "probably sufficient". In 86 to 94 (33-36 per cent) of the cabins, depending on whether the

fire doors were open or closed, the sound level was less than 58 dB, or "probably insufficient". Table 4.8.1 shows the distribution of cabins according to sound level.

Table 4.8.1 *Cabins with different sound levels, with open and closed fire doors*

Sound level (dB)	No. of cabins near open fire doors	No. of cabins near closed fire doors
⩽ 47	8	23
48-57	78	71
58-67	81	73
⩾ 68	97	97

After the fire a comparison was made between the sound level in the various cabins and the cabins where bodies were found. The purpose was to see whether the strength of the alarm might have influenced whether or not the passengers left their cabins. The investigation was made in the cabins in the after part of deck 5 (Fig. 4.8.1), since the time taken for the development of smoke gases was about the same for the whole of this area. A large number of bodies were also found in the starboard cabins on deck 4, but here the development of smoke gases followed a different course, and so these cabins could not be included in the comparison. Only cabins that had passengers in them when the alarm sounded are included. The sound levels for these cabins are shown in Fig. 4.8.1.

Table 4.8.2 *Comparison between whereabouts of bodies and sound level*

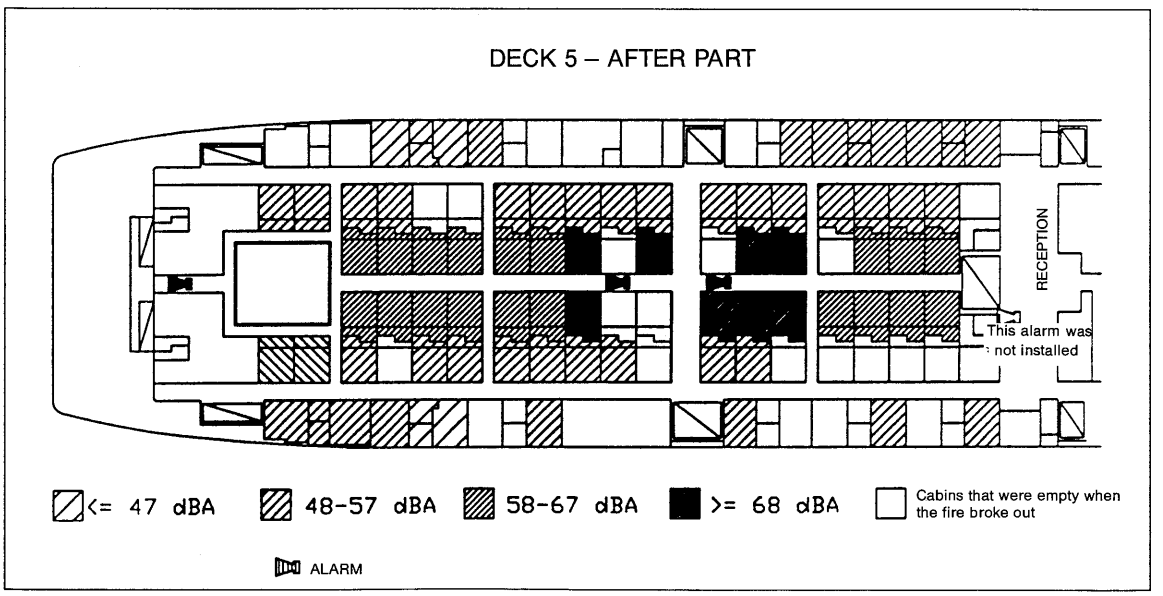
Sound level (dB)	No. of cabins	No. of cabins with bodies	Per cent of cabins with bodies
⩽ 47	3	1	(33)
48-57	40	26	65
58-67	19	9	47
⩾ 68	8	2	25

Table 4.8.2 shows the distribution of cabins where bodies were found according to sound levels.

The figures show that there was less evacuation from the cabins with low sound levels than from those with high sound levels. No other features, like smoke spread or heat development, have been found that could account for the differences. The sound level of the alarms therefore seems to have influenced whether or not the passengers left their cabins. The hypothesis is statistically significant, with a probability of error of 10.8 per cent.

Bodies were found in most of the starboard cabins on deck 4, even though the sound level of the alarms here was high (over 668 dB). This may have been because smoke began seeping into this corridor at a very early stage, probably only one minute after the start of the fire, and before any alarm was sounded at all.

Fig. 4.8.1 *After part of deck 5 with hatched areas indicating sound levels*



Since the public address system was completely destroyed by the fire, it has not been possible to measure the sound levels. However, it is reasonable to suppose that the level was considerably lower than that of the alarms.

4.9 CONCLUSIONS REGARDING THE TECHNICAL STANDARD OF THE SHIP AND ITS EQUIPMENT

4.9.1 Introduction

This evaluation is concerned with those parts of the ship's construction and equipment that had or that might have had an influence on the fire on board.

The Committee has measured the standard of the ship in certain areas against national requirements and in these cases has chosen Danish legislation as a basis for comparison.

In principle the ship complies with those requirements in SOLAS 1960 and SOLAS 1974 that an existing ship built in 1971 is supposed to comply with. The inadequacies mentioned under 4.9.2 are related to maintenance, and the missing fire door described under 4.9.3 must be regarded as a construction fault that arose in connection with the rebuilding that was done in the area where the fire door ought to have been.

4.9.2 Faults and defects in maintenance

At the time of the fire there were a number of deficiencies in the ship and its equipment: workshops and stores had been set up on the car deck, some of the heads in the sprinkler system on the car deck were blocked with rust, pressure bottles were stored incorrectly, there was a defective fire door on the port side of the car deck, and the motorized lifeboats were generally in poor repair (see 4.4 for details).

4.9.3 Faults of construction

A fire door was missing on the saloon deck, deck 6, aft on the starboard side. The door opening was filled by a glazed door. Three alarm bells were missing in relation to the fire and safety plan. The sound level of the alarms was faint in parts of the accommodation area.

4.9.4 The question of which faults and defects should have been noticed and corrected

For a discussion of the faults and defects that must have been present during the surveys in January and of whether they should have been noted during the surveys, see 4.6.2 and 4.6.3. For a discussion of whether the ship's commanding officers should have noticed the deficiencies that were present on 7 April, see 7.7.3.2 and 7.8.

4.9.5 The general technical condition and standard of equipment of the ship

Apart from the faults and defects mentioned under 4.9.2 and 4.9.3, the technical condition and standard of equipment of the ship was good. Fixtures and safety equipment, including the fire-fighting equipment, seemed to be well maintained.

The engine room also appeared to have a high standard of equipment and maintenance.

The items of technical equipment and fixtures that in the Committee's opinion had a significant effect on the extent of the disaster were the defective fire door on deck 3, the weak sound level in parts of the alarm system, and the corridors with a confusing layout. A factor that may have aggravated the disaster was the misleading or incomprehensible signposting.

Chapter 5. The Shipowners. The Transfer of Ownership

5.1 THE VR DANO GROUP. CONDITIONS OF OWNERSHIP

The following description concerns the conditions of ownership of the *Scandinavian Star* as they would have been when the VR DaNo Group took it over. The Committee has not committed itself on the question of whether or not ownership had actually been transferred on 7 April 1990, cf. 5.3.

The *Scandinavian Star* was owned and run by companies in the VR DaNo Group. This group is not a legal entity, but a group of companies that work closely together and are all owned and controlled by Henrik Johansen and members of his family. Many of the same people are to be found on the boards and acting as managing directors of the companies in the group.

The Committee has based its review of the question of ownership mainly on the information revealed at the maritime inquiry, the documents of the inquiry, statements to the police, and information from the VR DaNo Group. When the Committee refers in this chapter to information from the shipowners, this means information provided by the lawyer representing the VR DaNo Group.

The *Scandinavian Star* was owned by the company K/S Scandinavian Star.

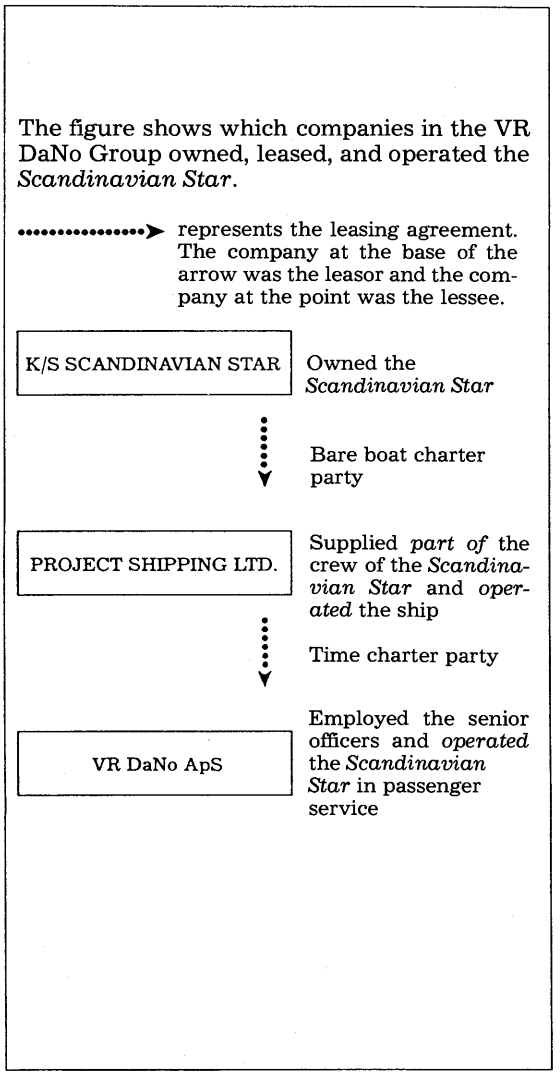
K/S Scandinavian Star leased the ship to Project Shipping Ltd. It was leased as a bare boat charter party (based on the standard contract Barecon A). This means that the ship was leased without a crew but ready for service. The leasing agreement was entered into in Paris on 1 March, at a rate of USD 12,500 per day.

Project Shipping, in its turn, leased the ship to VR DaNo ApS as a time charter party (based on the standard contract Baltime 1983). This means that the ship was leased with a crew. This agreement was entered into on 2 March 1990 in Fredrikshavn, and the rate was USD 22,500 per day.

Managing Director Ole B. Hansen stated at the maritime inquiry that this was only partly a time charter party, because Project Shipping was only providing part of the crew. The officers who had previously sailed on the *Holger Danske* were employed by DaNo Ferry A/S.

The VR DaNo Group has several parts. In the context of the *Scandinavian Star* there are two that are of interest: the part of the group that owned the ship and the part that operated it. The companies that owned the ship were K/S Scandinavian Star, Sea Lion Ltd., Superflex Shipping ApS., and Matrikkel nr. 4 bh ApS.

Fig. 5.1



K/S Scandinavian Star, which owns the *Scandinavian Star*, is a Danish limited partnership. K/S Scandinavian Star is owned by Sea Lion, as the general partner, and Superflex Shipping, a limited partner. Limited partnerships must always be owned by a general partner and one or more limited partners. The general partner is fully responsible for the

limited partnership's liabilities, and the limited partners are only responsible to the extent of their financial investment. Henrik Johansen is managing director of K/S Scandinavian Star. The company has no board of directors.

The shipowners have informed the Committee that the reason for having a Danish limited partnership as owner was so that depreciation could be written off in Denmark.

Sea Lion Ltd. is registered in the Bahamas. It is the general partner in K/S Scandinavian Star and is itself owned by Superflex Shipping ApS. Mr. Henrik Johansen is managing director and Mr. Ole B. Hansen is secretary of Sea Lion. The company has no board of directors. According to information from the shipowners, Sea Lion's function was to be general partner in K/S Scandinavian Star.

Superflex Shipping ApS is registered in Denmark and is a limited partner in K/S Scandinavian Star. It is also the owner of Sea Lion. Thus K/S Scandinavian Star, and therefore the *Scandinavian Star*, are in fact entirely owned by Superflex Shipping. Superflex Shipping is owned by Matrikkel nr. 4 bh ApS. Mr. Henrik Johansen is managing director in Superflex Shipping. The board of directors consists of Mr. Johansen, Mr. Ole B. Hansen, and Mr. Jørgen Søtofte.

The shipowners have explained that the reason why Superflex was not the sole, direct owner was that this might have entailed registering the ship in Denmark.

Matrikkel nr. 4 bh ApS owns Superflex Shipping. This company is wholly owned by Mr. Henrik Johansen's children, and Mr. Johansen is managing director in the company, which has no board of directors.

The ship was operated by a different part of the group, consisting of Project Shipping, Ltd., VR DaNo ApS, DaNo Ferry A/S, and VR Holding ApS.

Project Shipping is registered in Monrovia, Liberia. This was the company that leased the *Scandinavian Star* from K/S Scandinavian Star. Project Shipping leased the ship with crew to VR DaNo ApS, which owned Project Shipping.

The shipowners have explained why Project Shipping was involved. The company did not wish the *Scandinavian Star* to be owned and operated by the same company. It therefore had to be leased. The shipowners wanted VR DaNo ApS to operate the ship. Since they wished to employ a number of non-Nordic crew, and since they assumed that the Danish and Norwegian unions would demand Danish or Norwegian working agreements for the non-Nordic crew members if they were to be employed by a Scandinavian company, a company from outside Scandinavia was brought in. Thus the *Scandinavian Star* was leased, without crew, to Project Shipping, and the crew, apart from the officers from the *Holger Danske*, were employed by Project Shipping. Project Shipping then leased the ship to VR DaNo ApS.

Project Shipping was bought by the VR DaNo Group in connection with the purchase of the *Scandinavian Star*. The company had no previous activities of any significance.

According to information from the shipowners, Mr. Athanassi Yannaulatos was managing director in Project Shipping. He became involved in his capacity as shipping broker, since he had received a commission on the sale of the *Scandinavian Star*, and offered after the sale to help in connection with the insurance and crewing. The insurance was not, however, arranged through him. As part of the assistance he provided, he organized the purchase of Project Shipping on behalf of VR DaNo ApS, and he also organized the administration of Project Shipping.

VR DaNo ApS is registered in Denmark. The company leased the *Scandinavian Star* on a time charter party basis from Project Shipping. It was VR DaNo ApS that had the right to a berth in Fredrikshavn. It appears to the Committee that VR DaNo ApS was the main company involved in the operation of the *Scandinavian Star*, and it was this company that entered into the purchase agreement for the ship on 23 January 1990. VR Holding ApS owns VR DaNo ApS, which owns Project Shipping and DaNo Ferry. The shipowners have informed the Committee that VR DaNo ApS had sold about 30 per cent of the tickets for the voyage on the night of the disaster. Mr. Ole B. Hansen is the managing director of this company, and the board consists of Mr. Henrik Johansen, Mr. Hansen, and Mr. Jørgen Søtofte.

DaNo Ferry A/S is registered in Norway. On 8 January 1990 the assets of DaNo-Linjen A/S were transferred to DaNo Ferry, which also took over all the employees except one. DaNo-Linjen belonged to shipowner Jens C. Hagen, and was the owner of the *Holger Danske*. DaNo Ferry was owned by VR DaNo ApS, and was responsible for much of the operation of the *Scandinavian Star*. The officers on the *Scandinavian Star* who had sailed with the *Holger Danske* were employed by DaNo Ferry. The shipowners have informed the Committee that about 70 per cent of the tickets for the disaster voyage were sold by DaNo Ferry. Mr. Ole B. Hansen is the managing director of this company, and the board consisted of Mr. Henrik

Johansen, Mr. R. Hagen, and the recently deceased shipowner Mr. Jens C. Hagen.

VR Holding ApS is registered in Denmark. This company owns all the companies involved in operating the *Scandinavian Star*. Thus it owns VR DaNo ApS, and through this latter company it owns Project Shipping and DaNo Ferry. VR Holding also owns VR København-Helsingborg ApS and Vognmandsruten Nyborg-Korsør ApS. Through Vognmandsruten Nyborg-Korsør, VR Holding owns Vognmandsruternes Ejendoms- og Havneanlegg ApS. The Committee has been informed that VR Holding is directly owned by Henrik Johansen's wife. Mr. Henrik Johansen and Mr. Ole B. Hansen are directors in the company. The board consists of Mr. Henrik Johansen, Mr. Ole B. Hansen, and Mr. Jørgen Søtofte.

Several companies in the group have been involved in the present case, but not apparently in any significant way. These are VR København-Helsingborg ApS, Vognmandsruten Nyborg-Korsør ApS, Vognmandsruternes Ejendoms- og Havneanlegg ApS, Miflemca ApS, Molarco Shipping A/S, and Molarco Finans ApS.

VR København-Helsingborg ApS runs a ferry route between Copenhagen (Tuborg dock) and Helsingborg, Sweden. The company is owned by VR Holding. The company was set up and began running the ferries in January 1990. Mr. Ole B. Hansen is managing director in the company. The board consists of Mr. Henrik Johansen, Mr. Ole B. Hansen, and Mr. Jørgen Søtofte.

Vognmandsruten Nyborg-Korsør ApS is also owned by VR Holding, and the former, in its turn, owns Vognmandsruternes Ejendoms- og Havneanlegg ApS. Vognmandsruten Nyborg-Korsør provided a guarantee for VR DaNo ApS's liabilities under the purchase agreement for the *Scandinavian Star*. Mr. Ole B. Hansen is managing director of the company. The board consists of Mr. Henrik Johansen, Mr. Ole B. Hansen, and Mr. Jørgen Søtofte.

Vognmandsruternes Ejendoms- og Havneanlegg ApS is owned by Vognmandsruten Nyborg-Korsør. Vognmandsruternes Ejendoms- og Havneanlegg provided a guarantee for VR DaNo ApS's liabilities under the purchase agreement for the *Scandinavian Star*. Mr. Ole B. Hansen is managing director of the company. The board consists of Mr. Henrik Johansen, Mr. Ole B. Hansen, and Mr. Jørgen Søtofte.

VR Shipping ApS is owned by Miflemca ApS. At the maritime inquiry on 2 October, Hans Bergmann stated that he was employed by VR Shipping. The survey carried out by Mr. Hans Jürgen Cierpinski at the end of March 1990 had been commissioned by VR Shipping. Mr. Henrik Johansen is managing director of the company. The board consists of Mr. Henrik Johansen, Mr. Ole B. Hansen, and Mr. Jørgen Søtofte.

Miflemca ApS is owned by Henrik Johansen's wife. This company owns VR Shipping. Mr. Henrik Johansen is managing director of Miflemca. There is no board of directors.

Molarco Shipping A/S owned Vognmandsruten's ferries in Storebælt, Denmark. This ferry line was sold in the spring of 1990 to Difco LXXI K/S for DKK 362 million. Difco LXXI K/S is owned by Danish limited partners, and does not belong to Mr. Henrik Johansen's group of companies. Part of the money from the sale was used to finance the purchase of the *Scandinavian Star*. Molarco Shipping provided a guarantee for VR DaNo ApS's liabilities under the purchase agreement for the *Scandinavian Star*. Mr. Henrik Johansen is managing director of the company. The board consists of Mr. Henrik Johansen, Mr. Ole B. Hansen, and Mr. Jørgen Søtofte.

Molarco Finans ApS owns Molarco Shipping and Henrik Johansen's children own 72 per cent of Molarco Finans. As regards the remaining 28 per cent, the shipowners have provided the following information:

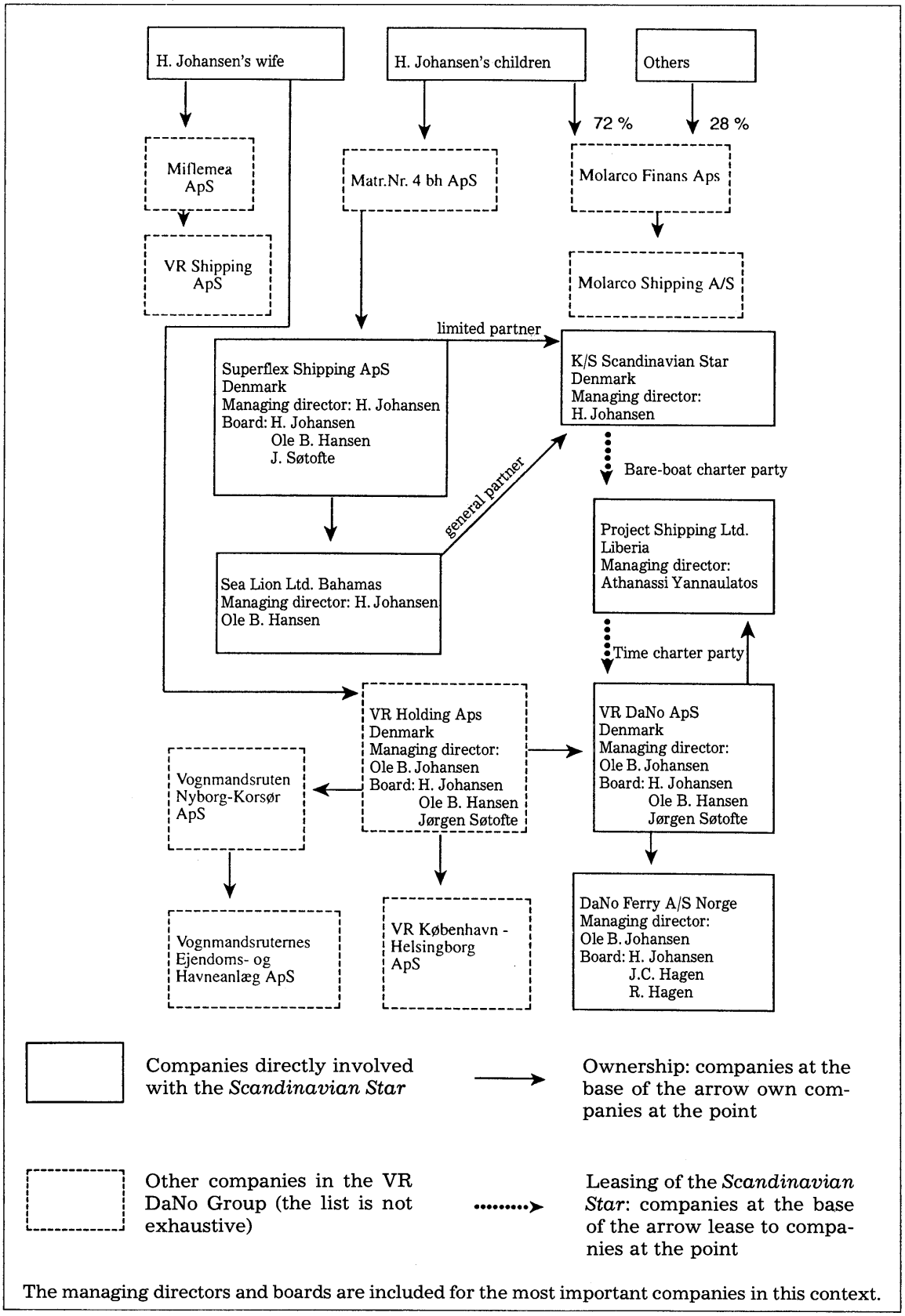
"The remaining 28 per cent is owned by persons who are not Henrik Johansen or Ole B. Hansen or their wives or families."

Mr. Jørgen Søtofte is managing director of the company. The board consists of Mr. Henrik Johansen, Mr. J. Johansen, and Mr. Jørgen Søtofte.

Anderson Cavendish Inc and Polycos Shipping Inc are London companies. The shipowners have stated that these two companies do not belong to Mr. Henrik Johansen's group. These two companies acted as middlemen between Project Shipping and Wallem Shipmanagement in connection with the hiring of the crew. Mr. Yannaulatos must have been employed by, or closely associated with, both companies. He was probably also managing director of Project Shipping, which was part of Mr. Henrik Johansen's group of companies. There must have been close links between Polycos Shipping and Anderson Cavendish. This is indicated by among other things a letter dated 15 February 1990 to Wallem Shipmanagement, written on Anderson Cavendish stationery and signed by hand with the name "Polycos".

The VR DaNo Group has a relatively complicated structure, presumably to spread the

Fig. 5.2 *Overview of the companies in the VR DaNo Group*



economic risks and to facilitate financing, among other reasons.

If the insurance had not been adequate, the compensation claims would have had to be met by the companies associated with the *Scandinavian Star*. Section 12.2 of this Report deals in more detail with the provisions of the Maritime Act relating to liability. The provisions relating to liability for damages are concerned with negligence. According to the Maritime Act, liability rests with the *shipowner*, cf. section 233, the *carrier*, cf. section 188, and the *person who performs the carriage*, cf. section 196, second paragraph. The question of which of the companies involved in the *Scandinavian Star* would be liable for settling claims therefore depends on which of them filled these roles.

The following presentation is based on the assumption that the ownership of the ship had been transferred to the VR DaNo Group as represented by K/S Scandinavian Star. As already mentioned, the Committee has not taken any stand on the question of whether ownership had actually been transferred, cf. 5.3. The presentation below is based on the situation as described in the previous paragraphs.

The shipowner is the person who employs the crew and equips and operates the ship. In principle this is the owner of the ship, but these functions and their attendant liabilities may be transferred to others by agreement. Normally the function of shipowner is assumed to have been transferred in the event of a bare boat charter party, but not of a time charter party. This means that in general Project Shipping, as bare boat carrier, fulfils the function of shipowner, with the liability that accompanies this function.

The agreement between Project Shipping and VR DaNo ApS diverged in several respects from normal time charter party agreements. VR DaNo ApS was to carry out certain functions normally performed by bare boat carriers; for example, VR DaNo ApS was to provide some of the crew. This makes it rather unclear as to whether Project Shipping was the shipowner or whether this function had been transferred to VR DaNo ApS. The Committee has no need to take a stand on this subject.

The *carrier's* liability rests with the person who has assumed responsibility for the transport, cf. section 171 of the Maritime Act. Obviously the company that issued tickets on its own behalf is responsible for the transport. DaNo Ferry issued tickets without making any reservation that this was done on behalf of another company, and must assume the carrier's liability. The shipowners have informed the Committee that VR DaNo ApS in Fredrikshavn also sold tickets. The Committee does not know whether this was done on the company's own behalf or on behalf of DaNo Ferry.

The liability attached to the *shipowner who performed the carriage* rests with the company that operated the ferry. It is not clear which of the companies really operated the ferry. When the operating functions are as split up as was the case here, it is most natural to go back to the general definition of a shipowner as given above. Thus the person with shipowner's liability also bears the liability of the person performing the carriage.

Thus only three of the companies in the VR DaNo Group appear to be liable for damages under the normal provisions of maritime law, DaNo Ferry A/S, VR DaNo ApS, and Project Shipping Ltd. The Committee wishes to point out that these only represent a very small proportion of the companies in the group.

5.2 THE SHIPOWNERS' LAND-BASED ORGANIZATION

The following presentation is based on the maritime inquiry, statements to the police, and information from the shipowners. The Committee wishes to point out that the fact that its members were not given the opportunity to meet and put further questions to the shipowners has made it difficult for the Committee to establish the details of this land-based organization.

The land-based administration of the *Scandinavian Star* was primarily carried out from offices in Oslo and Fredrikshavn, which had been taken over from DaNo-Linjen A/S. The Fredrikshavn office had seven employees, and was headed by Mr. Jens Bille Jacobsen. The Oslo office had eight employees, and was headed by Mr. Thor Bøhnsdal. Three employees in the accounts department at the group's headquarters in Copenhagen also dealt with the *Scandinavian Star*. DaNo Ferry and VR DaNo ApS were allowed to make use of employees from the other companies in the group, but this does not seem to have been done to any great extent.

The whole VR DaNo Group is headed and controlled by the managing director Mr. Ole B. Hansen, who seems to occupy a very strong central position. The Committee has the impression that he is personally involved in most of the important decisions, at any rate all those involving expenditure above a certain amount.

Booking of the tickets was taken care of by the shipping offices in Oslo and Fredrikshavn. According to information from the shipowners, 70 per cent of the tickets for the disaster voy-

age were sold in Oslo and the rest in Fredrikshavn. These two offices also arranged some of the purchasing of supplies for the ship.

The Committee has been informed that Mr. Bøhnsdal was personnel manager for the crew who were taken over from the *Holger Danske*. Apart from this the Committee has not been informed of any personnel manager or other person in charge of personnel in the shipping company. Some of the hiring was done by Mr. Ole B. Hansen from the headquarters in Copenhagen. This applied primarily to the captain, the engineering crew, and the Portuguese crew.

The shipping offices in Oslo and Fredrikshavn had previous experience from running the *Holger Danske*, but the Committee's impression is that they had been primarily concerned with the commercial side of the operation. These offices seem to have had little or no involvement in the safety aspects of making ready the *Scandinavian Star*.

The maritime inquiry revealed that Mr. Hans Bergmann was nautical adviser in the VR DaNo Group. He is permanently employed by the group but has no fixed area of responsibility, being assigned to different projects according to need. The Committee has been informed that the group had engaged a Mr. Jørgen Kongstad to take care of matters connected with the buying, selling, and leasing of the group's ships. The Committee has no information indicating that Mr. Kongstad had any special technical expertise. The Committee has no other information concerning technical expertise in the shipping company. Information from the maritime inquiry and from the shipowners indicates that when the shipowners required technical advice they often consulted outside experts.

The shipowners have informed the Committee that the responsibility for safety on board the *Scandinavian Star* lay primarily with the captain. Mr. Hans Bergmann, in his capacity as inspector, stated at the maritime inquiry that no one in the land-based organization had been given responsibility for safety on board. When operating ferries in the Storebælt, the shipowners had left all responsibility for safety to the captain, and they continued this policy with regard to the *Scandinavian Star*. The shipowners have since informed the Committee that the captain was supposed to refer directly to Mr. Ole B. Hansen on questions of safety. It is the Committee's impression that Mr. Ole B. Hansen did not pay sufficient attention to safety issues during the preparation of the *Scandinavian Star* for service.

The Committee concludes that the lack of a senior person in the shipping company with responsibility for the safety aspects of the preparation of the *Scandinavian Star* was a serious shortcoming. The safe operation of a passenger ship of this size requires that continual attention be paid to the safety aspects, not only by the crew, but also by the management of the shipping company. The Committee will return to this question under 7.8 and 13.2.4.2.

5.3 TRANSFER OF THE SHIP

The Committee has based its presentation mainly on two sources. One is the maritime inquiry and the accompanying documents. The second is a report from a firm of solicitors in the UK called Holman, Fenwick & Willan, dated 10 May 1990. This firm represents SeaEscape Cruises Ltd. (SeaEscape), and it also represented SeaEscape during the transfer of ownership of the ship to K/S Scandinavian Star. The first owner of the *Scandinavian Star* was the Compagnie Maritime des Chargeurs Réunies. The ship was then called the *Masalia*. In January 1984 it was sold to Stena Cargo Line Ltd., which renamed it the *Stena Baltica*. In July 1984 it was renamed the *Island Fiesta* and a few months later it became the *Scandinavian Star*.

Stena Cargo Line leased the ship bare boat charter to Stena Cruise Line AB, and it was further leased to SeaEscape. This latter company is registered in the Bahamas. Both SeaEscape and Stena Cruise Line had an option to purchase the *Scandinavian Star* in their contracts.

On the basis of this option to buy, a purchase agreement was concluded between SeaEscape and VR DaNo ApS on 23 January, for the sum of USD 21,700,000. A deposit was to be paid on 16 February. VR DaNo ApS had the right to transfer the purchase agreements to a second party, by designating another buyer. The transfer of ownership was to take place at the end of March, and the provisional delivery date was 20-25 March. During this period the ship was to be handed over in exchange for the documents, provided that both ship and documents were in order. Each party had the right to cancel the agreement if the other was not able to fulfil its obligations by 25 March, which was the date of cancellation.

The Committee assumes that VR DaNo ApS intended to use at least part of the money from the sale of the Storebælt ferries to finance the purchase.

The Committee will not go into detail concerning the financing of the purchase, but the main point was that SeaEscape was to lend money to the buyer against the ship as security. VR DaNo ApS was to take of the paper-

work as regards the security and the loan.

The deposit was not paid on 16 February, and the deadline was extended to 23 February. In this agreement SeaEscape stipulated payment of DKK 10 million by June 1990. Other companies in the VR DaNo Group, Vognmandsruten Nyborg-Korsør, Vognmandsruternes Ejendoms- og Havenanlæg, and Molarco Shipping, guaranteed the purchase sum, using their claims to a share of the money from the sale of the Storebælt ferries to Difco LX-XI K/S as security.

The *Scandinavian Star* arrived in Cuxhaven on 23 March 1990, and was approved by VR DaNo ApS as being technically ready for delivery. According to the original agreement the transfer should have taken place by 25 March. The transfer and the cancellation date were postponed, however, first to 27 and then to 28 and 30 March.

On 28 March VR DaNo ApS gave notification that K/S Scandinavian Star would be the formal purchaser of the ship. However, the papers dealing with the payment, loan, and security were not ready by 30 March.

On 29 March SeaEscape and VR DaNo ApS agreed that the *Scandinavian Star* could sail to Fredrikshavn, and that VR DaNo would bear all the expenses in this connection. On 30 March the *Scandinavian Star* was taken over by the purchasers. Technically this occurred at 1702 hours, when the ship was transferred from Stena Cruise Line to SeaEscape. The former acted as *disponent owners* for Stena Cargo Line. This transfer of ownership was registered in the ship register of the Bahamas.

The ship was then immediately taken over by the company K/S Scandinavian Star. This meant that the purchasers acquired de facto possession of the ship, and were considered by the parties to be the owners. The sellers, however, still had a certain security: If the payment and documentation were not in order by Friday 6 April, the ship was to be returned to SeaEscape. It was also agreed that SeaEscape should continue to be registered as the owner in the ship register. This transfer to K/S Scandinavian Star took place at 1820 hours.

However, the payment settlement and the new entry in the ship register were not made on 6 April. An agreement was concluded between SeaEscape and K/S Scandinavian Star that payment and registration of the transfer should be postponed until Monday 9 April.

The ship caught fire on Saturday 7 April. The parties were still willing to register the transfer on Monday 9 April, but the ship register refused, since it was not clear on this date whether the ship was so badly damaged that it would have to be struck off the ship register.

During the summer of 1990, the ship's name was changed to *Candi*. The sale of the ship to K/S Scandinavian Star was registered in the ship register on 30 August.

The circumstances of the transfer of ownership of the *Scandinavian Star* to VR DaNo are relatively complicated and difficult to establish with complete certainty. However, the Committee feels that it has succeeded in acquiring a sufficient overview.

As regards the seller, SeaEscape, and the buyer, the VR DaNo Group as represented by K/S Scandinavian Star, the situation was that the ship had been transferred de facto, but not fully paid for. The transfer had not been registered, and the ship still represented a form of security for SeaEscape.

The question of which company is to be regarded as the owner has mainly economic implications and concerns the rights of private individuals. This question is therefore clearly outside the mandate of the Committee.

The question has been raised of whether the survivors and bereaved families can claim compensation from SeaEscape. This, too, is a matter concerning private individuals and economic considerations, and as such the Committee cannot make recommendations with respect to the question of compensation.

6. Manning the Ship

6.1 GENERAL REMARKS

When the *Scandinavian Star* left Oslo on 6 April there were 99 crew members on board. The crew came from nine different countries altogether. They fall into three groups on the basis of the way they were recruited. One group consisted of crew who had previously served on the *Holger Danske* and included the captain, several deck officers, and some of the catering officers. The second group consisted of crew who had been taken over from SeaEscape. This group included the chief engineer and many of the engineering officers. The third, and by far the largest group, was recruited by the shipping company through the firm Wallem Shipmanagement Ltd., of the Isle of Man. The crew members recruited through Wallem came from Portugal.

6.2 FURTHER DETAILS OF RECRUITMENT

6.2.1 The crew members taken over from SeaEscape

The shipping company decided to buy the *Scandinavian Star* at the end of January 1990, but even before this date the managing director, Mr. Ole B. Hansen, had already started negotiations concerning crew. During a visit to the ship on 16-18 January, Mr. Ole B. Hansen had had a meeting on board with Chief Engineer Steinhauser, at which it was agreed that Mr. Steinhauser would continue in his position if VR DaNo purchased the *Scandinavian Star*. It was also agreed that he would make a list of those of the engineering crew he considered suitable to accompany him in the event of a transfer of ownership. The shipping company's reason for wishing to retain many of the engineers was that this would ensure the safe operation of the ship.

At the end of February Mr. Ole B. Hansen made a fresh visit to the *Scandinavian Star*, during which he made an agreement with SeaEscape that VR DaNo would take over a carpenter and two able seamen. These three had sailed on the *Scandinavian Star* for a long time, and the two able seamen had sometimes acted as fire patrols. One of the reasons for hiring them was that the three men were to carry out renovation work on deck 3 in cabin section 200 during the voyage to Europe; a further reason was that the two able seamen could train new seamen to act as fire patrols.

On this trip Mr. Ole B. Hansen had a further meeting with Mr. Steinhauser, at which it was agreed that five more of the engineering crew would be given berths on the *Scandinavian Star* under the new owners.

6.2.2 The crew members already employed by VR DaNo

After the sale of the *Holger Danske* in November 1989, 10 of the crew were kept on by VR DaNo. They were two first officers, a radio officer, two chief pursers, and five ratings from the catering section.

After the sale of the *Holger Danske* and up until 1 April, VR DaNo chartered the *Sardinia Nova*. The radio officer was on holiday all this time, but the other nine crew members sailed on the *Sardinia Nova*. During this period the chief steward and bar manager were given berths on the *Sardinia Nova*. They both went on to serve on the *Scandinavian Star*.

Mr. Ole B. Hansen has explained that these particular crew members were selected partly because they were still in the company's employ and partly because they knew one another after having sailed together for so long.

6.2.3 Recruitment of Captain Larsen and Chief Officer Finstad

Captain Hugo Larsen and Chief Officer Oddvar Finstad were dismissed when the *Holger Danske* was sold. They had both sailed on this ship for a long time. From the statement made by Mr. Ole B. Hansen to the Maritime and Commercial Court, the Committee understands that these two officers were re-hired because they knew the other deck officers from their time on board the *Holger Danske*. Captain Larsen was also chosen because he was familiar with passenger ships and with conditions in the Oslofjord, which would save the company the expense of pilot fees.

6.2.4 The crew members from Portugal

Mr. Ole B. Hansen explained to the Maritime and Commercial Court that approaches were made to several ship management firms as regards the hiring of the remainder of the crew. One of these, Wallem Shipmanagement, Ltd., of the Isle of Man, hereafter referred to as Wallem, was finally given the commission, and

it was this firm, together with the crewing agent D.A. Knudsen & Co. Ltd. of Lisbon, Portugal, that recruited the Portuguese crew.

Contact with Wallem was mainly effected through the intermediary of the firm of Polycos (cf. 5.1) in London, which acted on behalf of Project Shipping, Ltd. Another firm, Anderson Cavendish, Inc., was also involved. It is not clear to the Committee exactly which functions were performed by Polycos and which by Anderson Cavendish, but there is no doubt that the main contact person between the VR DaNo Group and Wallem was Mr. Athanassi Yannaulatos. According to Mr. Ole B. Hansen's statement to the Maritime and Commercial Court, Mr. Yannaulatos was managing director of Project Shipping. This company was wholly owned by VR DaNo Aps, and Mr. Yannaulatos thus acted as VR DaNo's agent in the group's contacts with Wallem.

After a description of Wallem and D.A. Knudsen, hereafter referred to as Knudsen, details will be given of the practical steps taken to recruit the crew from Portugal.

6.2.4.1 Wallem

Wallem's headquarters are on the Isle of Man. The firm is at present a management company administering about 130 ships. In this connection the company sometimes acts as a crewing agent.

The Committee has not been able to discover exactly when Polycos or Anderson Cavendish first approached Wallem, but on 15 February Anderson forwarded a request for 73 crew members, stipulating that the crew should be Portuguese and that as many as possible should speak English. Wallem had no direct possibility of hiring a Portuguese crew, and therefore approached Knudsen in Lisbon. Thus Wallem acted as an intermediate agent in relation to Knudsen.

Wallem had been informed that the *Scandinavian Star* was to be put into service on 10 April, but on 14 March they were notified that the crew needed to be signed on by 27 March. Wallem immediately passed on the message to Knudsen.

Wallem addressed several requests to Polycos for more information about the crew's qualification requirements, but without success. The information concerning the crew's qualifications that Wallem gave Knudsen was thus based on Wallem's own judgment of what was required, in the light of previous experience and of the information available about the ship and the type of service. Wallem did not directly stipulate how many of the crew should have smoke-diving certificates, but specified that as many as possible should have attended safety training courses.

Wallem had a representative, a Mr. Goodall, on board the *Scandinavian Star* while it was docked in Fredrikshavn. On his return to headquarters, Mr. Goodall delivered a critical report to the management (Mr. J.G. Dorey, Mr. C. Goy, and Mr. D.G. Alland) concerning the hasty preparations being made to put the ship into service before it was completely ready. On this basis a decision was made by the board on 2 April not to enter into a manning agreement with the shipping company.

6.2.4.2 Knudsen

Knudsen has been a crewing agent and recruited crews for cargo and passenger ships for 20 years. Today the firm is involved in several fields connected with shipping and one of their tasks is to act as agent for the firm Assuranseforeningen Skuld. Knudsen has about 100 employees, of whom about 12 work with crewing.

The crewing department obtains crew for about six passenger ships a year, usually small groups of about 10 to 12 persons.

On 15 February Wallem contacted Knudsen with a request to obtain a crew of 73, enclosing a list of positions that had to be filled. The list did not stipulate that any of the crew were required to have had safety training, but it did specify that as many as possible should be able to speak English. Knudsen had no previous experience of hiring such a large crew, but considered that the information at their disposal was sufficient for them to begin arrangements for hiring the crew. Knudsen therefore began advertising and going through their records and came up with about 700 persons who were called in for preliminary interviews. By this means about 200 were selected for further interviews. A representative of Wallem, Mr. Skinner, was present during this second round of interviews, during which the final selection was made. The selection process took three days, and preference was given to persons with previous experience of passenger ships.

The first group of Portuguese crew came on board the *Scandinavian Star* in Cuxhaven on 28 March. It consisted of 29 persons for the engineering, deck, and catering crews, 18 of whom were catering personnel. The group was accompanied by Knudsen's representative Mr. Geraldes, who remained on board for about a week.

On 30 March, after the ship had arrived in Fredrikshavn, the next group of 30 Portuguese crew members arrived on board. The composition was about the same as that of the previ-

ous group, consisting mainly of catering personnel and some deck and engineering crew. This group was accompanied by Mr. Martins of Knudsen. Later a further five Portuguese crew members came on board.

Wallem and Knudsen had divided the practical arrangements between them. Wallem was to take care of the agreements and contracts with the ITF and obtain the necessary certificates from the Bahamas, while Knudsen was to take care of the plane tickets to Cuxhaven and Fredrikshavn.

Knudsen has told the Committee that most of the crew they hired could speak English, with the exception of about 10 or 12. This is discussed in more detail under 6.4.

6.2.5 Evaluation of the hiring procedures

The manning of the *Scandinavian Star* was done with the same haste that characterized the whole project of making the ship ready for service on 1 April. Chief Officer Finstad's appointment was not confirmed until the day before he was to board the ship. Some of the questions involving crew from the *Sardinia Nova* who went over to the *Scandinavian Star* were only settled just before 1 April.

The manning agreement between Polycos and Wallem was finally ready for consideration on 15 March. After this Wallem and Knudsen had about 13 days to organize employment contracts with the crew members from Portugal. Wallem has informed the Committee that manning a ship like the *Scandinavian Star* would normally take about one to two months, and they told Polycos on several occasions that the time limit was very short. However, Wallem considers it unlikely that a more qualified crew would have been found if the time limits had been more generous, because of Knudsen's great experience in this field. The Committee has noted that Knudsen had never before had to obtain a crew of this size.

Polycos provided Wallem and Knudsen with little information about the ship and crew requirements. The correspondence made available to the Committee shows that Polycos had only provided information regarding the ship's size and its trade, and had only described the crew in terms of the positions they were to occupy. No form of safety training was stipulated as a requirement. An example of the type of information that Wallem and Knudsen had to work on is given below. It is taken from a telex from Wallem to Knudsen on 15 February.

Information regarding the ship:

"10,000 grt passenger ferry operating in Scandinavia on an overnight (about 10 hours) international service."

An example of crew specifications:

"Bosun
Assistant/carpenter
A/B seamen X 6
Deckboys X 2".

Requirements:
"1) As many as possible of the crew should be English speaking.
2) Several of the stewards/messboys must be qualified barmen/assistants.
3) Crew will be required between 26 and 31st March 1990."

6.3 FURTHER DETAILS OF THE CREW'S QUALIFICATIONS, ETC.

6.3.1 General remarks

The Committee's mandate was to investigate whether the composition of the crew was satisfactory and in accordance with national and international rules. In the following the Committee will briefly describe the crew's qualifications. The senior officers are described individually, and those of the other groups are summarized.

6.3.2 Formal qualification requirements for crews

There are conventions with provisions that regulate the size, composition, and qualifications of ship's crews, and there are similar requirements pursuant to the Bahamas Merchant Shipping Act. These rules are dealt with in more detail under 10.3.1 and 10.3.2.1. It should be noted that the *Scandinavian Star* had not been issued with a safe manning certificate.

The question of whether the crew of the *Scandinavian Star* met the requirements stipulated in conventions and national legslation is dealt with under 6.4.

6.3.3 The deck officers

As mentioned above under 6.2.2 and 6.2.3, all the deck officers had sailed on the *Holger Danske*. They were all Norwegian.

Captain Hugo Larsen was born in 1934. He had sailed on the *Holger Danske* on the regular route between Fredrikshavn and Oslo since November 1985. Captain Larsen signed his employment contract in Oslo on 22 March, after an oral agreement made at the end of February or beginning of March. He came on board the *Scandinavian Star* in Cuxhaven on 23 March.

Captain Larsen has a master's certificate dated 24 June 1968. During the mid-1970s he attended a one-week fire-fighting and smoke-diving course.

Staff Captain Karsten Hansen was born in

1934. He had sailed on the *Holger Danske* from 1973 to 1989, with a single break of three years when he worked for Scandinavian Airlines System. After the *Holger Danske* had been sold he sailed as supervisor on the *Sardinia Nova*. He came on board the *Scandinavian Star* in Fredrikshavn on 1 April.

Staff Captain Hansen has a master's certificate dated 27 June 1983.

Chief Officer Oddvar Finstad was born in 1933. He had sailed on VR DaNo's ferry routes from Fredrikshavn to Oslo for 13 1/2 years. He came on board the *Scandinavian Star* in Cuxhaven on 28 March. His employment contract had been finalized the day before.

Chief Officer Finstad has a mate's certificate first class dated 29 June 1957. He has no safety training and no smoke diver's certificate.

First Officer Sverre Aashildrød was born in 1941. He had sailed on VR DaNo's ferry route from Fredrikshavn to Oslo since 1971. At the maritime inquiry he declared that he had been safety officer on the *Holger Danske*. According to Chapter III Regulation 53, subsection 3, of SOLAS, this means that he was the officer responsible for ensuring that life-saving and fire appliances were in good condition and ready for use. After the sale of the *Holger Danske* he worked as supervisor on the *Sardinia Nova*. He came on board the *Scandinavian Star* in Cuxhaven on 23 March.

First Officer Aashildrød has a mate's certificate second class dated 23 June 1972. He has attended three one-week courses in fire fighting and smoke diving, the most recent of which was in 1975.

The deck officers possessed the required certificates and had many years' experience of sailing on passenger ships. The Committee considers that on a ship like the *Scandinavian Star* the deck officers ought to have attended safety courses at regular intervals in order to keep up their knowledge in this area. The Committee draws attention to the fact that several of the navigation officers had not attended safety courses since the mid-1970s. It should be noted that this does not contravene the existing rules with respect to qualifications.

6.3.4 The remaining deck crew

The deck crew of the *Scandinavian Star* came from four different countries and their ages ranged from 18 to 59. The crew consisted of a boatswain, a carpenter, a carpenter's assistant, seven able seamen and two deckboys.

The boatswain was Portuguese and had been hired by Knudsen in Lisbon. He had a discharge book and a seaman's certificate, and a certificate that he had attended a basic fire-fighting course in August 1989. The boatswain had several years' experience. According to Knudsen's records he had the requisite command of English.

The carpenter was from the Dominican Republic. He had sailed on the *Scandinavian Star* before it was taken over by VR DaNo. In his statement to the police he said that he had attended courses in fire fighting and smoke diving. He spoke English.

The carpenter's assistant was Portuguese, hired by Knudsen in Lisbon. He had no discharge book. According to Knudsen's records he did not speak English.

Two of the *able seamen* had sailed on the *Scandinavian Star* before VR DaNo took it over. At the time of the transfer of ownership, one had sailed for four years and one for four months on the *Scandinavian Star*. One was from Costa Rica and the other from the Philippines. Both spoke English. The remaining five able seamen were Portuguese and had been hired by Knudsen in Lisbon. They all had several years' experience and had discharge books and seaman's certificates. Two of them also had certificates in fire fighting. According to Knudsen's records three of them spoke English, one spoke sufficient English, and one knew some English.

The two *deckboys* were Portuguese and had been hired by Knudsen in Lisbon. Both of them had seaman's certificates and one had a basic course in fire fighting which was as recent as February 1990. According to Knudsen's records the deckboys spoke English.

The deck crew of the *Scandinavian Star* had the necessary seaman's certificates and the necessary experience to carry out their duties as seamen. As regards their safety training, Knudsen have explained that they were hired because they had discharge books, which according to Knudsen are evidence that they had undergone the prescribed safety training with regard to fire fighting and handling life-saving equipment. According to information from the Portuguese maritime authorities, the deck crew did have the above-mentioned certificates for fire fighting courses. As regards evidence of their ability to handle lifeboats and liferafts, cf. RVI/1 of the STCW Convention, cf. Chapter III Regulation 10, subsections 3 and 4, see 6.4.

Knudsen's records concerning the boatswain's knowledge of English are not borne out by the facts. According to witnesses, the boatswain's lack of English created considerable working difficulties. It should be noted that, according to witnesses and other sources, there were in addition to the boatswain four

more subordinate deck crew who spoke either no English or very little.

6.3.5 Engineering officers

The engineering officers on board the *Scandinavian Star* came from four different countries. Three of them had been hired by Knudsen in Lisbon and the remainder had sailed on the *Scandinavian Star* before it was taken over by VR DaNo.

Chief Engineer Heinz Steinhauser is German and was born in 1956. He joined the *Scandinavian Star* as chief engineer in 1988. He had been sailing on similar ships since 1979. In addition to being a qualified chief engineer, Mr. Steinhauser had a smoke diver's certificate. He was recruited by Mr. Ole B. Hansen.

There were five *engineers* on board the *Scandinavian Star*. The first and one of the third engineers had been on board since SeaEscape's time. The first engineer was from the Philippines and had sailed on the *Scandinavian Star* since 1988. He had an engineer's certificate, had attended fire fighting and smoke diving courses, and had a certificate of competence for handling lifeboats and liferafts. The first engineer had had an oral agreemeent with Chief Engineer Steinhauser to continue his employment after the transfer of ownership. As mentioned above, three of the engineers had been hired by Knudsen. They were all Portuguese. One was the second engineer and the other two were third engineers. All three had engineer's certificates. According to the records of the Portuguese authorities, one of them had a basic course in fire fighting. According to Knudsen's records two of them spoke English, while the third had the comment (+/-) English against his name.

The chief electrician was Danish. He was a qualified electrician and had sailed for two and a half years on the *Scandinavian Star* when VR DaNo took it over.

The engineers on the *Scandinavian Star* had the necessary qualifications. But there were considerable problems of communication between the Portuguese engineers and the others. The first engineer was particularly dissatisfied with the standard of English of the Portuguese crew. At a hearing at the Consulate in Miami the first engineer stated that a third person often had to be used to interpret.

6.3.6 The remaining engineering crew

The remaining engineering crew of the *Scandinavian Star* consisted of a plumber, an electrician's assistant, two repairmen, and five motormen.

The plumber, who was one of the four third engineers on the crew list, had no experience of ships. He was Portuguese and had been hired by Knudsen in Lisbon on 28 March. On the same day he flew to Cuxhaven, where he went aboard the *Scandinavian Star*. According to Knudsen's records, his knowledge of English was poor.

The electrician's assistant was Portuguese and had been hired by Knudsen in Lisbon. He came on board the *Scandinavian Star* on 30 March in Fredrikshavn. He had several years' experience as a ship's electrician. According to Knudsen's records, he spoke no English.

Both *repairmen* came from the Philippines and had sailed on the *Scandinavian Star* before VR DaNo took it over.

The motormen were Portuguese. They were hired by Knudsen in Lisbon and came on board the *Scandinavian Star* in Cuxhaven on 28 March. All of them had motorman's certificates. According to Knudsen's records, one spoke English, one had a very limited knowledge of English, one had the comment (+/-) English, and one spoke no English.

Apart from their poor standard of English, this section of the crew possessed the necessary qualifications. For certificates of competence for lifeboats and liferafts, see 6.4. Cooperation with the motormen, as with the Portuguese engineer, was difficult because of the language problems.

6.3.7 The senior catering officers

The senior catering officers on board the *Scandinavian Star* came from three different countries. They also had very different backgrounds.

Chief Purser Josef Bezzina was Maltese and was born in 1945. He had sailed on VR DaNo's ships between Oslo and Fredrikshavn for 17 years, five of them as purser. He came on board the *Scandinavian Star* on 23 March in Cuxhaven. He spoke Norwegian and English.

Purser Grete Forslund was Norwegian and was born in 1959. She had sailed on the *Holger Danske* for three years. She came on board the *Scandinavian Star* in Cuxhaven on 1 April.

She had never attended a safety training course.

Chief Steward Bent Christensen was born in 1955. He was Danish and joined VR DaNo in January 1990. His only experience of ships was in 1975-76, when he had done his military service in the Navy. Before joining VR DaNo, he had worked in a restaurant on shore.

Chief Steward Christensen had no safety training apart from what he had learned in the Navy.

6.3.8 The remaining catering crew

The remainder of the catering crew on the

Scandinavian Star consisted of about 52 persons, who came from five different countries. As mentioned above, several of them were already employed by VR DaNo when they took over the *Scandinavian Star*. These were the bar manager, the shop manager, two receptionists, and two shopgirls. One of the shopgirls was Danish and the others were Norwegian.

The remainder of the catering crew, about 46 persons, had been hired by Knudsen in Lisbon. They included two assistant chief pursers, two assistant chief stewards, 12 stewards, an assistant provision master, a pastry chef, an assistant pastry chef, three peelers, two caterers/porters, two bakers, four cooks, one assistant cook, four messgirls, and 11 messboys.

One of the two *assistant chief pursers* on the *Scandinavian Star* was Portuguese and had sailed on the *Kronprins Harald* on the Oslo-Kiel route. The other was Brazilian and had no experience of ships. According to Knudsen's records they both spoke English.

The two *assistant chief stewards* and the 12 *stewards* on the *Scandinavian Star* were all Portuguese. One of the assistant chief stewards had experience of passenger ships while the other had no experience of ships at all. According to Knudsen's records they both spoke English.

Of the 12 *stewards*, one had no experience of ships, and six had worked on passenger ships, one of whom had sailed on the *Scandinavian Star* in 1986. Four of them had sailed on merchant ships and one on a naval vessel. Five stewards had discharge books. According to Knudsen's records 11 of them spoke English and one understood but did not speak it.

According to Knudsen's records, five of the remaining catering personnel had discharge books. Five had previous experience of passenger ships and four of merchant ships. This left about 21 with no previous experience of working on ships. As regards their knowledge of English, Knudsen's records show that 18 spoke English, four spoke a little English, one had a very poor knowledge of English, three spoke no English, and for four of them there is no record of their knowledge of English.

However, statements from witnesses indicate that the number of crew with a poor knowledge of English must have been higher than this.

6.4 CONCLUSIONS

The safe manning figure for the *Scandinavian Star* was 90 persons. This figure met the national requirements for the Bahamas and those laid down in international conventions, cf. 10.3.1 and 10.3.2.1.

The Committee considers the actual number of crew selected by the shipping company for the safe manning of the ship to be sufficient. For purposes of comparison, it may be noted that the maritime authorities in Denmark and Norway would have accepted this size of crew for a ship of a similar size.

The crew of the *Scandinavian Star* also possessed the prescribed certificates and qualifications to operate the ship. As regards safety on board, however, the Committee is critical of the fact that so many of the deck officers either had no safety training or had not attended courses in safety training for a long time. The Committee assumes, on the basis of the information provided by the Portuguese authorities at the maritime inquiry and in police interrogations, that the fire fighting training of the lower ranks of crew in general met the requirements laid down by conventions such as the STCW Convention.

As regards the crew's training in the handling of life-saving equipment, the ship's safety certificate stipulated that 48 of the crew had to be certificated lifeboatmen (certificates of competence in the handling of lifeboats and liferafts), cf. Chapter VI, Regulation VI/1 of the STCW Convention, cf. Chapter II, Regulation 10, subsections 3 and 4 of SOLAS. No such certificates were registered for the Portuguese crew, since it was assumed that the possession of a Portuguese discharge book was evidence of the prescribed safety training. However, the information given to the Committee by the Portuguese maritime authorities indicates that the possession of a Portuguese discharge book is not in itself evidence that the holder possesses a certificate of competence in handling lifeboats and liferafts.

The Committee sent the Portuguese maritime authorities a list of 23 persons who are registered as having discharge books, most of them deck and engineering crew, and some catering crew, asking for information as to which of these persons had certificates in handling lifeboats and liferafts. The authorities replied that only one of the people on the list had a certificate of this kind issued by the Portuguese authorities. The authorities also informed the Committee that none of these people were allowed to serve on foreign ships, since under Portuguese law this requires a licence.

On this basis it must be concluded that the *Scandinavian Star* did not have the prescribed number of crew members with certificates in the handling of lifeboats and liferafts on board.

The Committee wishes to add the following.

It has been claimed in many quarters that the possession of a discharge book means that the holder has a certain level of safety training. Knudsen, for example, has sent the Committee a statement from a Portuguese seaman's union containing the following statement (in translation):

"For the appropriate purposes, it is declared that in order to obtain a Portuguese maritime certificate the following documentation is necessary:

"Thus:
- Portuguese nationality,
- training at a maritime school,
- training certificate/ curriculum vitae/ language certificate,
- certificate of proficiency in swimming and rowing,
- certificate of proficiency in damage control,
- fire protection certificate,
- first aid certificate.

"In the case of officers, the fire and first aid certificates would be more advanced/comprehensive."

This information was confirmed in another quarter.
Wallem maintained:

"The STCW Regulations 1978 have been adopted by Portugal, and Resolution 19 states that all seafarers should undergo some training in personal survival. Where a person has a higher position within the crew then more intense training is a requirement, and all seamen grade 1 (AB) would have done a course in Lifeboat and Firefighting training before they were issued with a certificate to sail in that rank."

The Committee's comment is that it is not possible now to establish whether the Portuguese crew of the *Scandinavian Star* had safety training and if so what type of training. The Committee has no grounds for disputing the above information. But what the Committee does have grounds for maintaining is that on the basis of information from the Portuguese authorities, the requirement in the passenger ship safety certificate that 48 crew members had to be certificated lifeboatmen had not been met.

The standard of English of the crew hired by Knudsen was strongly criticized by the senior officers of the *Scandinavian Star*. For example, the chief officer, first engineer, and one of the pursers complained about the communication problems on board. These complaints were not unfounded; as mentioned above, a considerable number of crew had an insufficient command of English or none at all.

According to the provisions of Bahamian legislation, either the crew must speak English or it must be possible to give orders in a language understood by the non-English-speaking members of the crew (see 10.3.2.1). The Committee does not see that this provision was complied with on the *Scandinavian Star*.

With regard to safety functions, the Committee does not consider that it was justifiable to sail with a crew consisting of so many persons with a poor command of English. The *Scandinavian Star*'s emergency plan was in English, and since no fire and abandon ship drills had been held, many of the crew were unable to make themselves familiar with the emergency plan.

7. Preparing the Ship for Service, etc.

7.1 GENERAL

Chapter 7 deals with the preparations involved in making the *Scandinavian Star* ready for service. The chapter starts with a chronological survey, under 7.2, followed by a description of the work done by the shipping company and the crew, respectively, to prepare the ship for service. Summaries and conclusions are given under 7.6.

7.2 CHRONOLOGY

After the *Holger Danske* had been sold, the *Sardinia Nova* was chartered by the VR DaNo Group on about 20 November 1989. At about the same time VR DaNo began investigating the possibility of buying a suitable ship for the Fredrikshavn-Oslo run. The company appointed Mr. Jørgen Kongstad to carry out the task.

By the beginning of January 1990, Mr. Kongstad had found the *Scandinavian Star*. VR DaNo sent its inspector, Captain Bergmann, to Florida to examine the ship, and after a thorough inspection he sent an unconditionally positive report back to VR DaNo.

During 2 to 5 January 1990 the ship underwent an ordinary *Passenger Ship Safety Survey* carried out by Lloyd's Register. On 12 January 1990 Lloyd's Register issued, on behalf of the flag state of the Bahamas, a *Passenger Ship Safety Certificate*. VR DaNo was informed of Lloyd's survey and the issue of the certificate.

On 16 January 1990 Mr. Ole B. Hansen, managing director of VR DaNo, and Mr. Kongstad travelled to Florida to look over the *Scandinavian Star*. They remained on board for several days and accompanied the ship to Mobile, where it was docked.

During his sojourn on board, Mr. Ole B. Hansen had a meeting with the chief engineer, Mr. Steinhauser, at which they agreed that he would continue on board the *Scandinavian Star* if VR DaNo took over the ship. It was also agreed that Mr. Steinhauser would make a list of the engineering crew that he thought should remain with the ship if it was sold to VR DaNo.

VR DaNo also had a technical survey made of the ship.

The sales agreement for the ship was concluded in January 1990. It was a condition of the sale that all the ship's certificates should be clean and that the ship should have undergone a five-year periodical survey. Such a survey was carried out in February.

After Mr. Ole B. Hansen had returned to Denmark, the decision was made to use the officers from the *Holger Danske*, cf. 6.2.2 and 6.2.3.

Those of the crew who had not previously served on the *Holger Danske* or the *Scandinavian Star* were to be recruited through a crewing agent. The shipping company approached several companies, and it was decided to recruit a Portuguese crew through Wallem Shipmanagement of the Isle of Man, cf. 6.2.4.

Around 23 and 24 February Mr. Ole B. Hansen again visited the *Scandinavian Star*. The purpose of the visit was to go over the ship once again and to confer with Captain Bergmann, who was still on board. They were to plan the work to be done on board while the ship was sailing to Europe. An agreement was made that a carpenter and two able seamen were to accompany the ship when VR DaNo took it over. They had had a long period of service on the *Scandinavian Star*, and the able seamen had also served as fire patrols. On the journey to Europe these three were to carry out renovations in section 200.

On this trip Mr. Ole B. Hansen also had a further meeting with Chief Engineer Steinhauser, and it was agreed that a total of six of the engineering crew should be engaged by the new owner after the sale of the *Scandinavian Star*.

On 12 March the *Scandinavian Star* set sail from Port Canaveral in Florida. The first port of call in Europe was to be Lisbon. On 18 March, off the Azores, abandon ship and fire drills were held, and the fire alarm system was tested.

The ship's destination in Europe was altered because of delays in the recruitment of the new crew. The *Scandinavian Star* arrived in Cuxhaven on 23 March at 0900 hours. On the same day Captain Larsen, First Officer Aashildrød, Chief Purser Bezzina, and Chief Steward Christensen all came on board.

The shipping company had the ship surveyed by a technical expert in Cuxhaven.

While the ship was in Cuxhaven a number of minor alterations, installation work, etc. were

begun. These were necessary to adapt the ship from service as a cruise ship to service as a passenger ferry between Fredrikshavn and Oslo. Among other things, shops for selling cosmetics and other duty-free goods were to be fitted out. Mr. Ole B. Hansen arrived on board in Cuxhaven on 23 March to plan this work.

After arriving on board, Captain Larsen and First Officer Aashildrød made themselves acquainted with the ship and went over some of the technical equipment. After discussing the question with Mr. Ole B. Hansen, Captain Bergmann, and Captain Schaab, Captain Larsen decided to retain the *Scandinavian Star*'s previous emergency plan. First Officer Aashildrød, who had been appointed safety officer, was given the task of converting the plan to take account of the new crew.

Chief Purser Bezzina and Chief Steward Christensen had several conversations with Mr. Ole B. Hansen after coming on board. They discussed the fitting out of the shops, marketing, sales policy, etc.

Mr. Ole B. Hansen returned to Cuxhaven on 27 March and stayed until 29 March to see that the work was being carried out satisfactorily.

On 28 March the first group of crew members from Portugal arrived in Cuxhaven. These included deck and engineering crew and 18 of the catering crew, and totalled 29 persons. Chief Officer Finstad and Radio Officer Rasmussen also arrived on board on 28 March. Chief Officer Finstad began making himself familiar with the ship and Radio Officer Rasmussen verified the radio equipment. She assisted First Officer Aashildrød with the adaptation of the emergency plan.

Able Seaman Reis was appointed to the fire patrol after he had arrived on board.

The Portuguese crew were accompanied, as mentioned under 6.2.4.2, by Mr. Geraldes of Knudsen. In Cuxhaven Mr. Geraldes had meetings with Captain Larsen, the chief purser, the chief steward, and Mr. Ole B. Hansen. Mr. Geraldes has told the Committee that the crew's cabins were not ready for them when they arrived on board the ship, and many of them had to be given quarters in passenger cabins.

At 1950 hours on 29 March the *Scandinavian Star* sailed from Cuxhaven. During this voyage Mr. Geraldes made two safety announcements over the public address system at the request of Captain Larsen. The announcements were in Portuguese and contained information about the alarm signals, safety procedures, and positions of life jackets and lifeboats.

The ship arrived in Fredrikshavn at 1445 hours on 30 March. Here the second large group of crew from Portugal came on board. This group consisted of 30 persons, and contained more deck and engineering crew, but the majority were catering crew. This group was accompanied by Mr. Martins of Knudsen. A further five Portuguese crew members came on board later.

At 1820 hours Captain Larsen took over command of the *Scandinavian Star* from Captain Schaab.

On 31 March the whole day was spent in making the ship ready.

On 31 March the chief purser asked Mr. Geraldes and Mr. Martins to make a detailed list of the Portuguese crew. The list was finished by the evening of the same day, and contained the names, positions, passport numbers, and birth dates of the members of the crew.

On 1 April a meeting was called on board by Mr. Skinner and Mr. Ole B. Hansen, at which the distribution of work and the need for more crew were discussed.

On 1 April Staff Captain Hansen, Purser Forslund, and seven Scandinavian crew who were to be part of the catering staff came on board. They came straight from the *Sardinia Nova*. On the same day the crew members from SeaEscape's ownership period who were not re-employed by VR DaNo signed off, with the exception of Captain Schaab, who remained on board until 5 April in order to advise Captain Larsen and the other deck officers. It should be noted that it was originally intended that Captain Schaab should remain longer on board, but he himself expressed a desire to leave on 5 April and Captain Larsen considered it unnecessary for him to remain any longer.

From the time VR DaNo took over the ship until it started its new service on the evening of 1 April, hectic preparations were carried out on board. The work of preparation continued all the following week after the ship had been put into service.

Before the ship was in service and while it was berthed in Fredrikshavn, the engines from lifeboats nos. 1 and 3 were taken on shore. At this point they had been overhauled and were ready to be reinstalled in the lifeboats. The relevant lifeboats were supposed to be lowered so that the engines could be installed. This was not done, but two other lifeboats were lowered. The way this was done and the reason for it are dealt with in detail under 7.7.3.2.

Mr. Ole B. Hansen came on board the ship again at 1030 hours on 1 April. Apart from attending meetings on shore in Oslo on Monday, he remained on board until Tuesday morning. The purpose of his visit, according to

the statement he made to the Danish Maritime and Commercial Court, was to verify that the work on the shops was finished and that the ship was ready to sail with passengers.

The *Scandinavian Star* sailed from Fredrikshavn at 2305 hours on 1 April 1990 and arrived in Oslo the following day at 0815 hours.

After the ship had been put into service, Mr. Martins, the second engineer, and Mr. Galinho, one of the motormen, checked the engines in two of the lifeboats, and found that they would not start. They reported this to the chief engineer, Mr. Steinhauser, who made a note of it. He thought that the starting problems were due to cold.

The *Scandinavian Star* left Oslo at 1920 hours on 2 April and arrived in Fredrikshavn at 0750 hours on 3 April. It left Fredrikshavn again at 2010 hours on 3 April, and arrived in Oslo at 0810 hours on 4 April, leaving again at 1955 hours that evening and arriving in Fredrikshavn at 0655 hours on 5 April. At about 0800 hours on 5 April Captain Schaab left the *Scandinavian Star*, which departed for Oslo at 0908 hours, arriving there at 1800 hours.

On 5 April a meeting was held on board, attended by Captain Larsen, Staff Captain Hansen, Chief Officer Finstad, Chief Engineer Steinhauser, Chief Electrician Rytter, Chief Steward Christensen, Purser Forslund, and Chief Purser Bezzina. Various questions concerning the running of the ship were discussed, and it was decided to hold an abandon ship and fire drill in Fredrikshavn on Sunday 8 April.

The *Scandinavian Star* left Oslo at 2128 hours on 5 April and arrived in Fredrikshavn at 0750 hours on 6 April. It left again at 1003 hours and arrived in Oslo at 1900 hours that evening.

While the *Scandinavian Star* was in port in Oslo, Radio Officer Rasmussen paid the crew their wages and at the same time she asked them if they knew their emr numbers (emergency plan numbers, for details, see 7.7.2.2). Ms. Rasmussen noted that many of them did not know their emr numbers. She asked them to write these down and told them that it was their duty to know their own emr number. For further details, see 7.6.

The *Scandinavian Star* left Oslo at 2145 hours on 6 April 1990. For the further course of events, see Chapter 8.

7.3 INVESTIGATIONS AND PURCHASE OF THE SHIP BY THE SHIPPING COMPANY

As mentioned under 7.2, the company started looking for a ship suitable for the Fredrikshavn-Oslo run at the end of 1989. The *Sardinia Nova* had been chartered until the end of March 1990, and the company needed a ship to replace her. The task of finding it was assigned to Mr. Jørgen Kongstad of VR DaNo, who had previously worked for the company Vognmandsruten for about four years, where his duties had included buying and selling ships. According to Mr. Ole B. Hansen's statement to the Danish Maritime and Commercial Court, Mr. Kongstad had previously worked in the same field for Stena Line, where he had been employed for 10 to 12 years. Mr. Kongstad found the *Scandinavian Star* at the beginning of January 1990. He was familiar with the ship from his employment with Stena Line and thought it highly suitable for this service.

The shipping company then sent Captain Bergmann over to inspect the ship. Captain Bergmann was employed by the company as an inspector. He had experience as a navigator and had also run a small company dealing with coastal tankers. Captain Bergmann went over to look at the *Scandinavian Star* at the beginning of January, and remained on board the ship, apart from a brief absence, until it arrived in Cuxhaven on 23 March.

As mentioned under 7.2, Mr. Ole B. Hansen visited the ship twice while it was in the USA. On one of these occasions he was accompanied by Mr. Kongstad. The ship was inspected by Mr. Ole B. Hansen, Captain Bergmann, and Mr. Kongstad. The shipping company also had a technical survey carried out. Lloyd's Register also surveyed the ship, as mentioned under 7.2.

The agreement to purchase the ship was concluded at the end of January 1990.

7.4 MANNING

Before the shipping company took over the ship on 30 March, it had engaged a new crew. The manning of the ship is dealt with in Chapter 6.

7.5 PREPARATION OF THE SHIP BY THE SHIPPING COMPANY

The *Scandinavian Star* had been used for one-day cruises from Miami. This meant that a large number of cabins had not been used for a long time. They had to be cleaned and some of them renovated before they could be used. The transformation from cruise to regular ferry traffic also involved the installation of shops, etc.

Before the ship left the USA, the VR DaNo Group hired a carpenter and two able seamen from SeaEscape. They were to carry out renovations in section 200 on the voyage over to

Europe. Section 200 was not completely ready when the ship was put into service.

Two tax-free shops were installed. Mr. Ole B. Hansen was responsible for the planning, and engaged a paint firm and a firm to take measurements and fit out the shop interiors.

The work of converting the casino on deck 7 (Sunset Deck) to a tax-free shop was begun while the *Scandinavian Star* was berthed in Cuxhaven. The work consisted of painting and putting up shelves and counters.

A perfume and cosmetics shop was installed in place of the "Casino Slots" on the port side of deck 6 (Main Deck). Shelves were put up in fornt of a door leading to the "Grand Lounge". Apart from this, no other structural changes were made. The rest of the work consisted of putting up shelves, counters, etc.

A computer network was also to be installed. The work on this began in Cuxhaven and continued in Fredrikshavn. The network had not yet been completely installed at the time of the disaster.

Mr. Ole B. Hansen was responsible for planning and initiating the work, arriving in Cuxhaven on 23 March to get the work started. He engaged a team of painters from Korsør, Denmark. They arrived on board around 24-25 March, and painted among other things the reception area and the new shops. After this they began painting the crew's quarters on deck 2.

Mr. Ole B. Hansen followed up the building and renovation work. He returned to the ship on 27 March and remained on board until 29 March. He returned again on 1 April and stayed until 3 April. The purpose of these visits was among other things to supervise the progress of the work and in general to make sure that the ship was being made ready to receive passengers.

Through Mr. Ole B. Hansen the shipping company also took part in the preparations on the catering side. Mr. Ole B. Hansen had direct contact with the chief purser, Mr. Bezzina, and the chief steward, Mr. Christensen, with respect to this aspect of the running of the ship.

The company does not appear to have been directly involved in the work of the deck or engineering crew.

The work on the emergency plan is an exception to this. Mr. Ole B. Hansen recommended to Captain Larsen that he take over the emergency plan used under SeaEscape's ownership. Both Captain Bergmann and Captain Schaab had agreed that this plan should continue to be used, and this, we are informed, was why he recommended the use of the plan to Captain Larsen.

7.6 THE PREPARATION OF THE SHIP BY THE CREW. THEIR KNOWLEDGE OF THE SHIP AND THE EMERGENCY PLAN

7.6.1 Overview

The first group of crew members signed on in Cuxhaven on 23 March. The next group came on board on 28 March. VR DaNo did not take over the ship until 1820 hours on 30 March, and until this time the crew on board should formally, and to a great extent in practice, be considered as passengers. The new crew were able to settle in on board. They were able to get to know the ship, and the then captain, Captain Schaab, gave them some opportunities to do some of the clearing up and cleaning. But the major part of the preparations under the management of VR DaNo did not begin seriously until the takeover on 30 March.

The Committee describes below the preparations made by the crew up until the disaster. Each of the three main groups of crew are dealt with: the deck crew, the engineering crew, and the catering crew. Senior officers are dealt with separately. The Committee reviews the various tasks that were carried out, particularly those connected with safety. The working hours of the various groups are commented on. The extent of the crew's knowledge of the ship, the emergency plan, and their roles in the emergency plan are commented on. In this connection the Committee points out that one of the most important factors in preparing a ship with a new crew must be to see that the crew is familiar with the ship and with the handling and functions of important ship's equipment, especially safety equipment.

When considering the preparation work done by the crew, it is important to see the work as a whole. For example, the work of the deck officers is described, but whether or not this work was satisfactory cannot be judged for each officer in isolation. It must be seen in context, and although individual tasks may have been performed satisfactorily by a particular officer, the total result may be defective if important preparatory work is not done or not done properly. Such work requires organization and planning. The Committee will return to this point under 7.7 and 7.8.

The company has pointed out to the Committee that the crew had help from shore in the preparation work; for example a group of cleaners from Fredrikshavn were sent on board. The Committee is aware of this and has naturally taken account of it in its comments on the workload, etc. of the various groups of crew.

7.6.2 Deck crew

Captain Hugo Larsen

Captain Larsen came on board the *Scandinavian Star* in Cuxhaven on 23 March. Before this date he had seen plans of the ship, but he had never been on board before.

Captain Larsen spent the time in Cuxhaven in getting to know the ship, and in going over some of the equipment. According to his own statements Captain Larsen inspected the ship several times, sometimes on his own and sometimes with Captain Schaab, Captain Bergmann, and Chief Engineer Steinhauser. On some of these occasions First Officer Aashildrød accompanied him. Among other things, Captain Larsen inspected the bow thruster room and the bridge together with Captain Bergmann. Captain Larsen has described the inspection with Captain Bergmann as "general".

A more systematic inspection was undertaken with Captain Schaab. The latter explained the functions of the instruments on the bridge and they went through the various control panels together, e.g. the panel indicating the closing of sternports and sideports. Captain Larsen has described the inspection with Captain Schaab as being thorough and good.

The chief engineer showed Captain Larsen the ventilation and emergency generator rooms and the engine room. He demonstrated the working of the suspension deck and they examined the hydraulic gear together.

During his own inspection and his inspection with First Officer Aashildrød Captain Larsen concentrated on the safety equipment. He inspected among other things the seven smoke-diving stations and checked that the air cylinders were full. He checked the lifeboats and the certificates. He went over the safety log, which contains information about the ship's emergency equipment. He found the equipment to be in good technical condition and the log up to date.

In Cuxhaven Mr. Ole B. Hansen proposed that SeaEscape's emergency plan should be retained, cf. 7.2 and 7.6. Captain Larsen went through the plan with First Officer Aashildrød and they both considered it a good plan. Captain Larsen assigned to Aashildrød the task of adapting the plan to the new crew.

The *Scandinavian Star* left Cuxhaven on 29 March and arrived in Fredrikshavn on 30 March. Here, as mentioned above, Captain Larsen took over the ship at 1820 hours. The *Scandinavian Star* sailed from Fredrikshavn at 2305 hours on 1 April. Captain Larsen spent the time in Fredrikshavn until the ship was put into service on 1 April in making the necessary preparations to have the ship ready for sailing. He has described the preparation phase as hectic.

In the days before the fire on 7 April, Captain Larsen was mainly occupied with all the tasks necessitated by the ship being in service. As mentioned under 7.2, a meeting was held on 5 April at which the holding of fire and abandon ship drills was discussed, and the time for the drills was fixed at Sunday 8 April.

Staff Captain Hansen

Karsten Hansen had the title of staff captain, a title which was taken over from SeaEscape's time. Staff Captain Hansen had an agreement with the shipping company that he would stand in for Captain Larsen when the latter was on shore leave.

Staff Captain Hansen came on board the *Scandinavian Star* on 1 April when the ship was in Fredrikshavn. At first he spent his time getting to know the ship, but at the maritime inquiry he admitted that at the time of the fire he had not managed to become really familiar with the ship. One of the things he did after arriving on board was to examine the fire equipment. He noted the positions of the smoke-diving equipment, but did not test whether any of it was actually in order.

Captain Schaab explained to him the emergency control panel on the bridge. Later on he examined this panel again on his own. He tried some of the fire doors locally. He has stated that he was familiar with the emergency plan, but he was not aware of his functions under the plan, not did he know who else was on his team.

During the week before the fire Staff Captain Larsen was on 4-8 watch. He has described his own working situation as normal. He was not subjected to specially heavy pressure of work, although he had to work hard in periods.

Chief Officer Finstad

Chief Officer Finstad came on board in Cuxhaven on 28 March. While the ship was in Cuxhaven he went over the ship and familiarized himself with conditions on board. He went over it partly on his own and partly with the other navigation officers who signed on on 23 March. He received no instructions from the officers who were leaving.

Finstad has stated that the crew spent the time in Cuxhaven in becoming familiar with the ship and in getting settled in their cabins. Several of them were given the task of cleaning the cabins. He has also stated that some work was done on board in Cuxhaven, including clearing up on deck 3 (C Deck).

Until 1 April one of Finstad's duties was to work out a watch roster for the deck crew. He

was also in charge of training the new fire patrol, as described under 7.7.4.

On 1 April the sea watches were assigned. The deck crew were occupied with clearing up and ordinary maintenance work up until the fire on 7 April. The hawsers were examined and repaired, a laborious and time-consuming job. In addition to his sea watch, Finstad organized the work of the deck crew and was responsible for the ship's maintenance.

First Officer Aashildrød

First Officer Aashildrød came on board the *Scandinavian Star* in Cuxhaven on 23 March. He began at once to get to know the ship, and went over it with Captain Schaab and the previous chief officer, who informed him about the safety equipment. On his own he inspected fire hoses, smoke-diving equipment, the halon and CO_2 systems, foam stations, and the sprinkler system. He checked that the equipment was present, but did not test it. He checked the inspection dates on several of the portable extinguishers and verified the positions of the fire doors in relation to the fire plan. He tested the fire doors by releasing them locally, but did not test the remote control system from the bridge. Mr. Aashildrød also boarded some of the lifeboats to see what condition they were in. He did not examine them more thoroughly, nor did he test the launching apparatus for the boats or rafts.

As safety officer, Mr. Aashildrød was given the task of adapting SeaEscape's emergency plan to fit the new crew. He had no previous experience of preparing emergency plans, but on board the *Holger Danske* he had helped to adjust the emergency plan to accommodate a reduction in the crew. He began working on the emergency plan with Radio Officer Rasmussen while the ship was in Cuxhaven. Most of the work was done in Fredrikshavn on 1 April.

When Officers Aashildrød and Ramussen prepared the emergency plan, they did not have complete information about the safety training and certificates of many of the crew.

In addition to working on the emergency plan, First Officer Aashildrød helped with the preparations and clearing up while the ship was in Fredrikshavn.

During the week before the fire he was on 12-4 watch and took part in the activities in connection with arrivals and departures. He estimated that his working day was about 12 to 14 hours.

Other members of the deck crew

As mentioned under 7.6.1, full preparations were not begun until the ship was taken over on 30 March. The deck crew had a heavy workload from 30 March until the fire. There was a lot of clearing up to do, especially on deck 3. Moorings and hawsers had to be inspected and repaired, which was also very laborious and time-consuming work. In addition to this there was the ordinary maintenance work, all the activity in connection with arrivals and departures, and so on. The statements made after the fire show that the deck crew had working days of over 11 hours, and on several occasions longer than this. Many of the deck crew were not familiar with the emergency plan or their functions under it.

Several of the deck crew spoke no English or poor English. According to the available information, this seems to have applied to at least five of the 12 crew excluding officers, among them the boatswain. The poor command of English possessed by the boatswain and other crew members created difficulties in the performance of the work.

7.6.3 Engineering crew

The statements and other evidence provide conflicting information as to how much the engineering crew did of the ordinary clearing up work on board and whether this work imposed a heavier than usual workload on them. The engineering crew that came with the ship from SeaEscape's employment seem to have continued more or less with their usual work. It should be noted that no extensive engineering repairs or similar work was required. However, the engineering crew hired by Wallem and Knudsen had to take part in the general clearing up and this involved very long working days. Most of the engineering crew had a very poor knowledge of the ship at the time of the disaster. Most of them did not know their positions in the emergency plan.

Many of the Portuguese members of the engineering crew did not understand or had a very poor command of English. This created considerable problems of communication in work on the engines. The non-Portuguese English-speakers had to use an interpreter.

The Committee has found it necessary to review the whole engineering crew's knowledge of the emergency plan and the ship. The information presented below applies to the crew as a whole, except that among the catering personnel there were even fewer who were familiar with the emergency plan.

Chief Engineer Steinhauser

Mr. Steinhauser had sailed on the *Scandinavian Star* since 1 December 1988. He spent the time in Cuxhaven showing the new crew members around. He told the new engineers

and motormen to find out about the escape routes from the engine room and how the pumps worked. He gave no other safety instructions.

Mr. Steinhauser knew the ship well and was aware of his responsibilities under the emergency plan.

First Engineer Rebancos

Mr. Rebancos had sailed on the ship since March 1988. He was familiar with the emergency plan and his duties as specified in it.

Chief Electrician Rytter

Mr. Rytter had sailed on the *Scandinavian Star* for two and a half years when VR DaNo took over the ship. During the preparation phase Mr. Rytter was occupied with the installation of the computer network.

Mr. Rytter knew the ship and also the emergency plan. However, he was not aware that he had been given a new emr number, possibly by mistake, after the change of ownership.

Second Engineer Martins

Mr. Martins arrived on board for the first time on 28 March. He did not know the ship very well. He was not familiar with the emergency plan.

Three of the third engineers came on board for the first time on 28 and 30 March. (One of these was the plumber, cf. 6.3.6.) These three had not managed to become familiar with the ship or with the emergency plan or their positions in it. One of them did state at the maritime inquiry that he knew what he was to do during a fire, but he did not know his own emr number. The fourth third engineer had sailed on the *Scandinavian Star* since 1988. He knew the ship and the emergency plan, but was not aware that he had received a new emr number in the converted plan. He thus did not know his functions under the new plan.

The two repairmen had sailed on the *Scandinavian Star* since 1988 and 1986 respectively. They knew the ship well, and were familiar with the emergency plan. One of them, however, had been given a new emr number in the converted plan, and he was not aware of either the new number or his new functions.

The assistant electrician and the five motormen arrived on board on 28 and 30 March respectively. None of them knew the ship well, and none of them were acquainted with the emergency plan.

7.6.4 Catering crew

The catering crew had a very heavy workload during the preparatory phase. The Committee will first examine the situations of the senior officers in this department and then consider the group as a whole.

Chief Purser Bezzina

Mr. Bezzina came on board the *Scandinavian Star* in Cuxhaven on 23 March. During the first few days on board he carried out various preparatory tasks. He saw to it that the passageway in section 200 on deck 3 (C Deck) was cleared and the cabins locked up. He took charge of the preparation of the cabins and later, when the ship arrived at Fredrikshavn, he saw to the stocking up of the tax-free shops. According to his own statement, Mr. Bezzina had a 20-hour working day.

Purser Forslund

Ms. Forslund arrived on board the *Scandinavian Star* when it was in Fredrikshavn, on 1 April. During the week preceding the fire she was occupied in supervising the cleaning of the passenger cabins, checking in, and office work. She shared the work with Mr. Bezzina by taking care of the administrative tasks while he did the practical work. These two were to relieve each other when the preparatory phase was over, but during this phase they shared the purser's duties. Ms. Forslund has stated that she had a working day of about 20 hours.

Chief Steward Christensen

Mr. Christensen came abord the *Scandinavian Star* on 23 March in Cuxhaven. Here he organized the work relating to the restaurant and galley. From the time the ship started its service until the fire, Mr. Christensen supervised the daily work. He was familiar with the emergency plan and his position in it.

Other catering crew

As mentioned above, the whole catering crew had a heavy workload during the preparatory phase. All the passenger cabins had to be inspected and made ready, and the newly installed tax-free shops had to be stocked with goods. Large quantities of other goods and supplies were also taken on board during the week before the fire. Some of the lower-ranking catering crew probably had working days of 12 to 14 hours during this period, and sometimes even longer. Of the officers, Mr. Bezzina and Ms. Forslund, at any rate, had longer working hours.

As a general rule, the catering crew were poorly acquainted with the ship. They were the group with by far the heaviest workload and therefore had very limited time to get to know the ship. This applied especially to the group that came on board on 30 March.

On the basis of the available evidence, the Committee has concluded that the chief steward, Mr. Christensen, was the only one who was familiar with the emergency plan, and the only one who had had time to become familiar with the ship.

Many of the Portuguese catering crew had insufficient command of English. This caused difficulties with the work. For example, Purser Forslund often had to use the assistant chief purser as interpreter when giving orders.

7.7 PREPARATIONS WITH AN IMPACT ON SAFETY

7.7.1 Overview

This section provides an overview of preparatory work that had an impact on safety, including important preparatory tasks that were not carried out.

7.7.2 The emergency plan

7.7.2.1 Main points

While in Cuxhaven, Captain Larsen decided to retain the existing emergency plan. The first officer was given the task, together with the radio officer, of adapting the plan to fit the new, reduced crew. This was an extremely difficult task from the beginning, for the following reasons among others:

a) SeaEscape's emergency plan was based on a crew of 228. Under VR DaNo the ship was to have a crew of about 100.
b) The first officer had never drawn up an emergency plan.
c) The first officer had little information on the new crew members' qualifications.
d) He had a short deadline and had other duties in connection with the preparation of the ship.
e) His own knowledge of the ship and emergency equipment was limited.
f) There were several faults in SeaEscape's emergency plan.
g) Captain Larsen and the other officers failed to follow up the work of conversion.

Thus the first officer and the radio officer were assigned a task that was difficult to carry out satisfactorily. The results of the conversion are dealt with under 7.7.2.10. SeaEscape's emergency plan will be gone through first.

7.7.2.2 Terminology

The term "emergency plan" refers to the collection of instructions and procedures detailing the crew's duties in an emergency and describing how the ship is to be evacuated. The emergency plan contains the following terms.

Emergency groups

See 7.7.2.4.

Emergency numbers (emr numbers)

Each crew member is assigned a four-figure number indicating his place in the emergency plan. The first two numbers indicate the emergency group and the second two the person's position and duties in the group. For example, 0600 means that the person is in the Power & Propulsion Group with the duty of group leader.

Crew numbers

These numbers divide the crew into three groups: deck, engineering, and catering. Numbers 1-100 indicate deck crew, 101-200 engineering crew, and 201-300 catering crew.

Muster stations

There were four muster stations on the ship, where the crew were supposed to assemble and assist passengers in case of evacuation. These stations were by the "Fantasy Disco" and "Terrace" on deck 8 (Bridge Deck) and in the "Broadway Lounge" and by the swimming pool on deck 6 (Main Deck).

Boarding cards

These cards were to be given to the passengers when they came on board, and were intended to show the passengers which muster station they belonged to. The boarding cards were in different colours. Yellow cards indicated the muster station by the "Fantasy Disco" on deck 8, grey cards were for the "Terrace" on deck 8, green was for the "Broadway Lounge" on deck 6, and orange was for the swimming pool on deck 6.

7.7.2.3 Organization

SeaEscape's emergency plan consisted of the following plans:

Emergency Plan (overview)
Boat & Raft Launching Plan
Emergency Plan (manual)
Evacuation Plan
Emr Numbers List
Crew List

Emergency Plan (overview)

Showed the functions and duties of each crew member in case of fire or other emergency.

Boat & Raft Launching Plan

Showed the duties of each crew member during the launching of lifeboats and rafts.

Emergency Plan (manual)

This booklet had the same contents as the overview plan, but also gave details on the duties assigned to individual crew members in evacuating the interior of the ship.

Evacuation Plan

Showed which areas of the ship were to be evacuated by the various groups and indicated the four muster stations where the passengers were to muster in an emergency.

Emr Numbers List

Showed the distribution of numbers between the various emergency groups in case of fire, evacuation, and launching of lifecraft. The list also indicated the meeting points for the various groups and who they should report to.

Crew List

This is a list of the crew, assigning each member an emr number. It is therefore the key to the other plans.

The Emergency Plan (overview), Boat & Raft Launching Plan, Evacuation Plan, and Emr Numbers List were displayed on posters, which were put up in the crew's mess and the crew accommodation area, aft on deck 2 (D Deck).

The Emergency Plan manual was a pamphlet. This was placed in various places in the crew accommodation area, though not in the cabins.

7.7.2.4 Emergency groups

The Emergency Plan (both the poster and the manual) was built up around a single commanding group: the Operational Command, and three other groups: the Mobile Fire Group, Continuous Run Ship, and Emergency Stand-by Group, which were to be immediately activated in an emergency. There were two further groups: the Evacuation Group and Assistance Group, which the Operational Command could call upon if it was necessary to evacuate passengers. The duties and functions of the groups are described below.

Operational Command

This group was to lead and direct all efforts in an emergency. On the basis of information from the other groups it was to implement and coordinate measures for deploying the crew to the best advantage. The group was also to be in charge of information to the passengers and crew.

Mobile Fire Group

This group was divided horizontally into three subdivisions: Fire Fighters, Fire Limitation Group, and Search & Ambulance.

The *Fire Fighters* were to fight the fire under the direction of the Operational Command.

The *Fire Limitation Group* was to try to limit the spread of the fire and to control areas adjacent to the fire under the directions of the Operational Command.

The *Search & Ambulance* group was to search areas adjoining the fire zone for weak or injured persons. The group was to implement first aid measures and transport sick persons to the ship's hospital. It was to evacuate the area adjoining the scene of the fire under the direction of Operational Command.

Continuous Ship Run

This group had four subdivisions: Navigation & Stability, Power & Propulsion, Document & Valuables Control, and Food Group.

Navigation & Stability was to take care of safe navigation and ensure stability.

Power & Propulsion was to keep normal power and maintain the supply of electricity. To control stability they were to make ready the systems for baling out.

Document & Valuables Control was to take care of documents and valuables.

The *Food Group* was to take care of cooking and other work in progress in the galley and adjoining areas. The group was to pay special attention to deep frying and other hot equipment and otherwise maintain normal conditions in the galley and adjacent areas.

Emergency Stand-by Group (ESB)

This group has four subdivisions: Boat & Raft Preparation, Technical Department, Radio, and Hospital.

Boat & Raft Preparation was to make all boats and rafts ready for lowering and to make all life-saving equipment ready for use.

The *Technical Department* was to take care of all technical, mechanical, and electrical devices to support the emergency in any possible way. In case of local fire in the engine room, the members of the group were to form a fire squad under the leadership of the chief engineer.

Radio was to make the radio station ready for emergency transmission. If necessary the group was to furnish group and zone leaders with communication aids, and make ready the portable radio equipment for taking to the boats.

Hospital was to make the hospital ready to receive and treat injured persons, and to prepare already hospitalized patients for transport to boat no. 9.

Evacuation Group

This group consisted of a commanding group, the Central Squad, and three subdivisions, Evacuators, Zone Leaders, and Muster Station.

Central Squad was to control safe evacuation of all decks, and keep track of the progress of the evacuation.

Evacuators were to evacuate different areas of the ship, as indicated on the Evacuation Plan. The group was to ensure that all remaining life jackets were brought to the muster stations.

The *Zone Leaders* were to ensure safe evacuation of the zones to which they were assigned. They were to ensure that all remaining life jackets were brought to the muster stations and to collect reports from their group and report evacuated areas to the Central Squad.

Muster Station was to assemble all the passengers at the muster stations, and verify that they are wearing their life jackets properly and have assembled at the muster station to which their boarding card has assigned them. The group was to prevent panic from arising among the passengers, divide them into boat groups and accompany them to the boats.

Assistance group

The group was to be prepared to assist the other groups working on the emergency elsewhere in the ship.

7.7.2.5 The idea behind the emergency plan

The strategy behind the emergency plan was that all cases of fire or other dangerous situations would be reported to the bridge immediately. The watch would then alert the crew so that the Operational Command, Mobile Fire Group, and Emergency Stand-by Group could be mobilized. The crew would be alerted by the internal alarm, followed by announcements over the public address system telling the various members of the crew where to meet; for example, "MFG to meet aft on the car deck".

As the emergency groups were mobilized and became operational, the group leaders would keep the Operational Command informed on the bridge. The Operational Command would then gather all information and coordinate the efforts of the groups so as to make the best possible use of resources.

7.7.2.6 Division of responsibility in the emergency plan

Each group or zone leader was supposed to be responsible for instructing the members of his group. The leaders were also responsible for seeing that the second-in-command (emr number XX01) was capable of taking over the leadership.

7.7.2.7 Safeguards

Safeguards were built into the emergency plan by the fact that in case of absence of the leader of a group his place would be taken by the second-in-command. The Emergency Plan stresses that the leader and second-in-command of a group must not be absent from the ship at the same time.

7.7.2.8 Criticisms

The emergency plan contains a number of shortcomings. There are discrepancies between the manual and the poster overview, e.g. emr number 0300 is 1st Officer on the poster and 2nd Officer in the manual, and emr number 0500 is Ch. Officer on the poster and 2nd Officer in the manual.

In the manual and poster the same description is used for several different officers; four officers are called Cruise Staff, three 2nd Officer, and so on. It is misleading to use the same description for different officers, especially when several of them are group leaders. The Evacuation and Boat & Raft Launching Plans contain several emr numbers that are not present in the Emergency Plan. This is a serious error that could lead to lifeboats, raft stations, and evacuation groups being undermanned.

7.7.2.9 Evaluation

If the errors had been corrected, the emergency plan would have been a very useful practical tool in an emergency. The emergency groups were organized in a systematic way and the capacity of the crew was made good use of. The duties of each crew member in an emergency are carefully described and should have left no doubt as to what each person was to do. Evacuation was given high priority and efficient evacuation was ensured by assigning considerable manpower to this task.

The emergency plan seems well thought out, and allowance has been made for the type of accidents that are to be expected on a passenger ship.

7.7.2.10 VR DaNo's conversion of the emergency plan

7.7.2.10.1 Factual information

SeaEscape's emergency plan was based on a crew numbering 228 persons. VR DaNo's conversion was based on a crew of 98, seven of whom had received no emr numbers.

Captain Larsen decided to retain the existing emergency plan on the advice of Captain Schaab and Captain Bergmann.

Captain Bergmann has said that he drafted a boat and raft plan on the voyage from Florida to Europe. In Cuxhaven further work on the plan was assigned to the first officer and the radio officer. It has not been made clear to the Committee whether these two officers were able to avail themselves of Captain Bergmann's plan.

7.7.2.10.2 Shortcomings of the conversion

Only one person, the captain, was allocated to Operational Command, which must be regarded as the most important emergency group. It is difficult to imagine how one person would be able to direct all the emergency groups, collect and coordinate all incoming information, and at the same time keep passengers and crew supplied with the necessary information. The captain has informed the Committee that he does not agree with this judgment. He maintains that there would have been other persons on the bridge that he would have been able to make use of. The Committee's reply to this is that any other people on the bridge would also have other duties in an emergency and thus could not be relied on to carry these out if they also had to help the captain with the extensive coordination and leadership duties assigned to Operational Command.

Eight zone leaders were missing. These were supposed to ensure safe evacuation from various areas of the ship.

The errors described by the Committee under 7.7.2.8 were not noticed. For example, the emr numbers in the previous boat and raft plan, which were not in the Emergency Plan, were used again.

The priority given to the manning of the groups seems illogical. For example, the group that was to safeguard valuables was manned, but two of the evacuation groups, Muster Station and Assistance Group, were not. The assignment of the emr numbers seems haphazard: several officers were given numbers denoting able seamen, one able seaman was given the number of a 2nd officer, and a messgirl was given a cruise staff number.

A shortcoming that applies to the emergency plan as a whole was that not all the numbers that were unused after the conversion had been crossed out.

7.7.2.10.3 Conclusion

As mentioned under 7.7.2.9, SeaEscape's emergency plan could have been a very practical tool in an emergency. But this emergency plan was based on a completely different size of crew, and for this reason it was very difficult to adapt to the new crew. It would have meant a lot of work and involved changing a great many points; for example, the whole structure of the Emergency Plan as such would have had to be altered.

The responsible officers of the *Scandinavian Star* did not give the conversion of the emergency plan the attention it required, and their attempt to apply the existing system was highly unsuccessful. This may be partly due to lack of time and to lack of information about the crew's qualifications. They also do not seem to have studied the strategy behind the emergency plan sufficiently.

In the form in which it was available on 7 April, the emergency plan was only to a small extent suitable for use in an emergency. The evacuation groups were too poorly manned for efficiency, and in several instances the crew's resources had not been properly utilized.

7.7.3 Inspection of safety equipment

7.7.3.1 Overview

Under 7.6 the inspection made by each deck officer of the safety equipment, etc. is described. Under 7.7.3 important aspects of this inspection will be outlined. It should be noted that this outline is not complete. There was other safety equipment on board the ship as well, which the Committee has not found it necessary to comment on.

The reason why the Committee examined the question of inspection of safety equipment is that when a ship comes under new management, the new crew have to inspect all emergency and life-saving equipment on board. They have to verify that all the necessary equipment is present and correct and they have to familiarize themselves with the way it is used.

7.7.3.2 The actual inspections

The lifeboats and some of the life-saving equipment were inspected by the captain and the first officer. The inspection was superficial and did not include checking the equipment in the lifeboats. The ship's command should have noticed the poor maintenance condition of the motorized lifeboats (see 4.4) before the ship was put into service under the new ownership.

In Fredrikshavn two of the lifeboats were lowered, apparently in order to paint over the word "SeaEscape" that was written on the side of the ship, but they were not placed on the water and tested. The Committee notes that there was some inspection of the lifeboat engines. The second engineer, Mr. Martins, and a motorman, Mr. Galinho, tested the engines in two of the lifeboats and found that they would not start. This was reported to the chief engineer, Mr. Steinhauser, who maintained that

they were in order, and that if they did not start this was because they were cold. Mr. Martins asked Mr. Steinhauser to order start spray. There was already a supply of start spray on board.

The Committee also makes the point that in two of the lifeboats the engines had been removed before VR DaNo took over the ship. The engines had been taken on shore in Fredrikshavn, and had not been reinstalled in the boats at the time of the disaster.

The life jackets and lifebuoys were not inspected. A minimum precaution would have been to go rapidly through these to check the numbers. The lifebuoys should have been inspected for damage or faults. Smoke signals and lights should have been checked.

The cranes for the rafts were not inspected or tested. They should at least have been swung out and back. This is necessary because these cranes often stick if they are not regularly checked for free movement.

The watertight doors were not tested. The manual and remote control closing mechanisms should have been checked.

Fire hoses, hydrants, and jet nozzles were inspected by the first officer. They were not tested. Random tests should have been made on fire hoses, hydrants, and jet nozzles.

The fire warning system was probably not tested. At least a sample of fire alarm buttons, etc. should have been tested to see that they functioned.

The fire alarm was tested by the chief officer, first officer, and previous first officer. Ideally the alarm should have been sounded and all the individual alarm horns checked. However, the system was tested, and this must be considered acceptable.

All the fire doors were tested locally by the first officer and some by the staff captain. The remote control release system from the bridge was not checked. This should have been done. In case of a fire it will almost always be necessary to release the doors from the bridge, and the failure to test this must be regarded as a shortcoming. It should be noted that the captain thought that the fire doors were released when he sounded the fire alarm. The self-closing fire door furthest aft on the port side of the car deck, deck 3, did not function as it should during the fire on 7 April (cf. 4.4). The ship's command may be criticized for this.

The functions of the emergency panel on the bridge were not tested. All the functions of this panel should have been tested. Probably the only function tested on this panel was the fire alarm. In addition to this, the starting of the pumps, emergency stopping of the ventilation, and release of the fire doors should have been tested.

The manual fire extinguishers were inspected by the first officer, who verified the inspection dates. This inspection was satisfactory.

The smoke-diving equipment was inspected by the captain, first officer, and to some extent the staff captain. The captain checked that the air cylinders were full. The inspection of this equipment was fairly acceptable, but functional tests should have been made.

The sprinkler system was inspected by the first officer. It was not tested. This should have been done. All the sprinkler heads should have been checked. Sprinkler heads rust easily, so these systems have to be tested at regular intervals.

The signposting of exits, corridors, etc. was also deficient, as described under 4.3.4.3. The ship's command should have made sure that the ship had a proper system of signposting before it was put into service under the new owner.

7.7.3.3 Conclusions

The Committee considers that an efficient preparation of the ship for the new service should have included a systematic inspection of all the important safety and life-saving equipment by the navigation officers. Even though the ship had recently been surveyed, and had been issued with a number of new certificates (cf. 4.5), the final responsibility for the ship's safety lies with her officers, who have a duty to ensure that emergency and safety equipment are present and correct. In this connection it should be noted that SOLAS provisions require a minimum of weekly inspections of equipment including watertight doors, lifeboats and life rafts, launching apparatus, alarm systems, etc. Furthermore, weekly drills are supposed to ensure that important fire-fighting and safety equipment are checked. In addition to the above inspections, the senior officers, and many of the crew, should have familiarized themselves with the use of various items of safety equipment. This should have been done among other things through drills. However, no drills were held, and other forms of training were either not practised or were in many ways deficient.

7.7.4 Training of the fire patrol

7.7.4.1 Introduction

The fire patrol on a passenger ship is important. The fire patrol system practised on the *Scandinavian Star* will now be considered separately.

7.7.4.2 Actual training

On the *Scandinavian Star* the intention was that there should be two men assigned to the fire patrol, one as day watch and one as night watch. The day watch was to be from 0600 hours to 1800 hours, and the night watch from 1800 hours to 0600 hours.

The fire patrol was equipped with a clock device with about 40 keys that had to be turned for each round, which comprised the whole ship. Each round lasted about 45 minutes.

The chief officer was in charge of assigning the watches to the deck crew, and it was he who appointed the fire patrol. As supervisor of the work of the deck crew, he was responsible for seeing that the fire patrol received the necessary training.

In Cuxhaven the chief officer was informed that A.B. Curtis had served as fire patrol while the ship was sailing for SeaEscape. For a number of reasons he did not appoint Mr. Curtis to the fire patrol, which would otherwise have been the natural course of action. Instead he appointed A.B. Reis to the fire patrol, and gave him the night watch.

In order to show Mr. Reis what to do, the chief officer arranged for him to share a number of watches with Mr. Curtis. The training was to start in Cuxhaven and last three nights. Information received indicates that Mr. Reis did not start any watches until the ship had reached Fredrikshavn on 30 March.

The first time Mr. Reis went on fire patrol, he asked Mr. Curtis to show him where the keys were. Mr. Curtis refused, saying that Mr. Reis should first get to know the ship. He waited until the watch on the evening of 1 April, when he accompanied Mr. Reis on his rounds and showed him where the first 15 keys were kept, on decks 6, 7, and 8. At the same time he began telling Mr. Reis how to signal a warning, and showed him some of the fire cabinets and fire buttons. After this he told Mr. Reis to go over the ship on his own, learn the positions of the keys, and to make a plan of all the positions of the keys that he knew about. It seems that Mr. Curtis intended to accompany him on the rest of the round the following evening, but was prevented by other work. Instead he told him orally where the keys on the other decks were kept.

7.7.4.3 Evaluation

The training of A.B. Reis was highly inadequate. At no time did Chief Officer Finstad verify that the shared watch was being carried out, nor did he make sure that Mr. Reis had actually received the necessary training.

Mr. Reis was given no standing orders about how he was to carry out his assignment. He received no instructions concerning the number of rounds, times of breaks, etc., and as a result Mr. Reis made free use of his time, for example taking a break of 1 hour 6 minutes just before the fire on 7 April. If the rounds had been carried out as intended, each one would have taken 45 minutes and there would have been an almost continual watch service. On this basis arrangements should have been made to relieve the watch.

Mr. Reis was not given a patrol plan, nor was he shown the positions of all the keys. He thus only knew the positions of 15-20 of the keys at the time the fire broke out on 7 April.

None of the navigation officers on the *Scandinavian Star* checked the printout from Mr. Reis' clock. Because of this error they were unaware that Mr. Reis did not clock in all the keys and did not make the rounds continuously.

Mr. Curtis was instructed to train Mr. Reis. He did not do so satisfactorily. He left it to Mr. Reis to find out by himself where most of the keys were kept. Mr. Curtis' attitude was that a seaman should be able to find his way around a ship by himself and draw up an effective timetable of rounds on his own. It must be concluded that it was impossible for a new seaman to find the positions of 40 keys on board a new and unknown ship all on his own.

7.7.5 Abandon ship and fire drills

No abandon ship or fire drills were held. This was a clear breach of SOLAS regulations governing the holding of such drills (cf. 7.8).

7.8 EVALUATIONS AND CONCLUSIONS

The Committee was obliged to conclude that, as regards the preparation of the ship, it was not ready to sail with passengers on 1 April.

A responsible shipping organization that acquires a ship and intends to start operating it with a new crew in a new service will draw up or order to be drawn up a programme for the work to be done in the preparatory phase. The crew will board the ship early enough to become acquainted with the ship and to do all the work necessary to put the ship into service in a proper manner. The senior officers will arrive on board particularly early so as to have time to learn and become familiar with their various duties on board. Making ready a ship like the *Scandinavian Star*, if it was done properly, would have taken several weeks from the date of transfer of ownership. It is not possible to indicate the exact time it would have taken to prepare the ship properly for its new service, but it is quite obvious that the time that was

available for preparing the *Scandinavian Star* was totally inadequate.

The preparation programme must be drawn up in such a way that both the shipping company and the captain can follow the progress of the work and see what is being done at all times. This is necessary among other reasons to ensure that all preparations necessary to the safety of the ship are actually carried out. Neither the company nor the captain in this case had any such overview. Nor was there any attempt by the captain or the company to coordinate the preparations as a whole.

The shipping company has the following comment on the Committee's view that a programme should have been drawn up for the work of preparation:

"In this paragraph the Committee makes a very important point, i.e. that a coordinated plan was not made for the work of making the ship ready for operation. The Committee does not assign the responsibility for this deficiency, and says that it will return to this point later in its report. Nevertheless, I shall comment on this here.

"Captain Larsen had been ordered by the shipping company to make the ship ready for safe operation, and had accepted this responsibility. Under these circumstances the shipping company had the right to expect that Captain Larsen, supported by the officers in charge of the various sections, would organize the task in a professional way, including making a list of the work to be done and the deliveries to be made. Such a list would have to assign *priorities*, for example:
– *has* to be done before the ship can sail with passengers,
– *should* be done before the ship sails with passengers,
– *can* be done after the ship is in operation.

"In such a case Captain Larsen would have had an overview of which tasks could be done by the crew and which required assistance from shore. He would have been able to notify the company if the programme could not be implemented, and, by checking his list on 1 April, he would have been able to see whether the ship was ready to sail with passengers on that day.

"One of the many advantages of working according to a well organized plan is that optimal use can be made of the available manpower.

"By 23 March the officers responsible for safety (Mr. Aashildrød), the engine room (Mr. Steinhauser), the restaurant (Bent Klit Christensen), and the hotel (Joe Bezzina) were all on board, so that by this date at the latest it would have been possible to do all the planning. In this connection Captain Larsen could and should have ordered his senior officers to make lists in order of priority of what ought and what should be done and delivered. During the succeeding days he should have followed up the planning by holding daily meetings, at which he should have ordered progress reports from his officers.

"In my opinion a shipping company has the right to expect an experienced captain to be able to solve such relatively simple planning tasks in a satisfactory manner and without interference from the company."

The Committee does not disagree with the company's view that the captain should have tried to plan the preparation work together with the heads of the various departments. What the Committee cannot accept, however, is the total exemption claimed by the company from all responsibility for such planning. The Committee points out that it was the company that established the framework for the planning, among other things by deciding the time of arrival of the crew and the date the ship was to be put into service. Furthermore, the Committee points out that the captain was not assigned total responsibility for the preparations. Renovation, painting, and other work was being done under the direct supervision of the company. The chain of command on board was such that some of the crew, in the accommodation and restaurant section, reported directly to the company in the person of Mr. Ole B. Hansen, and not to the captain. If the captain had been given complete and sole responsibility for planning and carrying out the work of preparing the ship, he should also have been given supreme comand of the entire operation with the power to make decisions about the other factors with impact on the preparation work.

The Committee points out that when the ship put to sea on 1 April, many of the crew on board had a highly inadequate knowledge of the ship. They had only been on board a short time and a very large number of them had had a very heavy workload. The crew had an insufficient knowledge of the emergency plan. To this observation from the Committee, the shipping company has the following comment:

"The Committee has emphasized the importance of the new crew's becoming familiar with the arrangement of the ship, including familiarity with the function and use of important equipment, especially safety equipment.

"In this context the Committee's Chapter 7 has an important shortcoming, since no comparison is made with the existing *practice* or *rules* concerning the training of members of the crew in the function and use of life-saving appliances, fire-extinguishing equipment, etc.

"As regards the *rules*, it is clear from Chapter III, Regulation 18, subsection 4.1 and subsection 4.2 of SOLAS that the authorities do not expect new crew members to be instructed in

the function and use of all the life-saving appliances before a ship is put into operation.

Chapter III, Regulation 18, subsection 4.1 of SOLAS reads as follows:

"'On-board training in the use of the ship's life-saving appliances, including survival craft equipment, shall be given as soon as possible but *not later than two weeks* after a crew member joins the ship.' [Shipping company's italics]

"This is further elaborated in subsection 4.2:

'Instructions in the use of the ship's life-saving appliances and in survival at sea shall be given at the same interval as the drills. Individual instruction may cover different parts of the ship['s live-saving system], but *all the ship's live-saving equipment and appliances shall be covered within a[ny] period of 2 months.*' [Shipping company's italics]

"I interpret these provisions to mean that instruction in the use of life-saving appliances and in survival at sea must be begun at the latest 14 days after signing on and must be completed at the latest 2 months after signing on. Since the fire occurred less than a week after the ship was put into operation and less than 14 days after the new crew had signed on, these regulations cannot in my opinion have been infringed.

"It should be noted that in SOLAS knowledge of life-saving appliances and evacuation is emphasized to such an extent that training in the use of fire extinguishing apparatus is given almost peripheral mention. Thus there are no regulations governing the time intervals for beginning and ending instruction in the use of fire-extinguishing apparatus. The low priority assigned by SOLAS to fire extinguishing compared with evacuation of the ship is grounds for supposing that no authorities would expect on-board training in the use of the ship's fire-extinguishing apparatus to be more intensive than the training required in the use of life-saving appliances and evacuation."

To this comment the Committee has the following reply: The SOLAS requirement concerning abandon ship and fire drills is based on the assumption that the crew as such has the necessary expertise for handling the life-saving equipment and is able to use the obligatory fire-fighting equipment on board the ship. This also applies, obviously, even if large parts of the crew are new. The fact that the training of individual crew members may be somewhat delayed, is another matter.

When the ship sailed on 1 April, the work on the accommodation spaces was not completed. Many cabins were not ready for use. In many ways the ship had a messy, dirty, and shabby look.

A certain amount of important preparation work with a bearing on safety had also been left undone. No fire and abandon ship drills had been held. As regards the requirements for abandon ship and fire drills, Chapter III, Regulation 18 of SOLAS 1974, with amendments of 1983, reads as follows:

"*Abandon ship training and drills*

1. This regulation applies to all ships.

. . .

3 Practice musters and drills

3.1 Each member of the crew shall participate in at least one abandon ship drill and one fire drill every month. The drills of the crew shall take place within 24 h of the ship leaving a port if more than 25 pst of the crew have not participated in abandon ship and fire drills on board that particular ship in the previous month. The Administration may accept other arrangements that are at least equivalent for those classes of ship for which this is impracticable."

In Chapter III, Regulation 25 there is an additional provision for passenger ships. It reads as follows:

"*Drills*

1 This regulation applies to all passenger ships.

2 On passenger ships, an abandon ship drill and fire drill shall take place weekly."

Both these regulations applied to the *Scandinavian Star*.

The Committee points out that a majority of the crew on board were new when the ship was taken over by VR DaNo on 30 March. An abandon ship and fire drill should have been held on board at the latest 24 hours after the ship left Fredrikshavn the first time.

It has been pointed out to the Committee that the 24-hour rule is not absolute. It has been claimed that abandon ship and fire drills may be omitted in cases where it is impracticable to hold such drills. The Committee has not considered it pertinent to decide whether, and if so under what conditions, it would be justifiable to depart from the 24-hour rule. As far as the Committee is concerned, there is no doubt that in this case there were no grounds for omitting to hold abandon ship and fire drills. The fact that an abandon ship and fire drill would have collided with other work that was necessary to prepare the ship for sailing with passengers cannot be accepted as a reason for not holding the drill. The SOLAS regulations concerning abandon ship and fire drills do not justify the reducing of safety priorities in this way.

In the opinion of the Committee, it was a very serious shortcoming that the abandon ship and fire drill was not held. A significant number of the crew were not aware of their functions and duties under the emergency plan, and many of the crew knew little about such things as how to handle the life-saving equipment. A proper abandon ship and fire drill would have revealed these weaknesses. It is obvious that an abandon ship and fire drill with this particular crew would have been very time-consuming. The chief officer has told the Committee that in his opinion an abandon ship and fire drill would have taken a whole day, "considering that the crew were so new".

It has also been claimed, in defense of the drill not having been held, that such a drill was not really necessary. It has been pointed out that seamen know how to handle fire extinguishing appliances, etc. and lifeboats. The Committee does not see the relevance of such an argument, and refers to what has been written above concerning the crew's ability to handle life-saving equipment, etc. Furthermore, and this is in fact the most important point, a drill was necessary in this case to verify whether the crew were aware of their positions in the emergency plan and were able to carry out the duties assigned to them by the plan.

It has also been claimed that the fact that an abandon ship and fire drill was not held made no difference to the outcome of the disaster. The Committee naturally cannot prove that more people would have been saved if the abandon ship and fire drill had been held. But a trained crew would have been able to react rapidly and systematically, and thus effectively, as described under 9.5.

It should also be noted that a trained crew would have been able to carry out the evacuation by lifeboat more efficiently than the way it was carried out here.

It has been claimed that a kind of abandon ship drill was held on board the *Scandinavian Star* on 1 April. Two lifeboats were lowered. It has been said that this was done partly to test the lowering apparatus, etc., but also in order that the boats could be used as a platform from which to paint over the word "SeaEscape" on the ship's side. The boats were only lowered to the level of the word "SeaEscape" on the ship's side. They were not lowered to the water and tested. On the basis of the information presented concerning the lowering of these boats, the Committee is not in doubt that the only purpose of the exercise was to paint over the above text.

A further point as regards the omission of the abandon ship and fire drill is that in 1986, 1987, and 1988, the Norwegian Maritime Directorate found it necessary to remind the officers of the *Holger Danske* of their duty to hold weekly abandon ship and fire drills. This was because this duty was being neglected on board the *Holger Danske*. All the navigation officers on the *Scandinavian Star* had previously served on board the *Holger Danske*, and must have been aware of this reminder from the maritime authorities.

Captain Hugo Larsen has alleged to the Committee that there were very good reasons why drills were not held and also that drills were in fact held, but not recorded in the log, and in one particular year, that the ship was in a shipyard during the period for which there were no drills. In this connection the Committee wishes to point out that the point of referring to the instructions from the Maritime Directorate was to draw attention to the fact that the shipping authorities had emphasized the necessity of holding such drills.

The responsibility for omitting to hold abandon ship and fire drills lies primarily with the captain. As the Committee will return to below, the captain was under considerable pressure to make the ship ready to receive passengers. This may explain why he chose not to hold an abandon ship and fire drill. However, pressure of this kind cannot exempt the captain from his responsibility for ensuring that fundamental safety rules are followed.

The Committee also wishes to point out that the responsible positions of the staff captain and the chief officer should have prompted them to draw the captain's attention to the irresponsibility of sailing without having held the abandon ship and fire drill.

As described under 7.7.2.10.3, the conversion of the emergency plan was highly unsatisfactory. A great deal more work should have been put into it. This was also in the Committee's opinion due to the pressure imposed on the crew to make the ship ready. But here, too, the pressure does not excuse the senior officers from their responsibility. The responsibility for drawing up an emergency plan was primarily the first officer's. He was ordered to perform this task. However, the captain had the overall responsibility, and he had a special duty to verify that the emergency plan was in fact adequate. This he did not do. An abandon ship and fire drill would have revealed many of these weaknesses.

Under 13.3.7.2 the Committee will return to the SOLAS regulations concerning abandon ship and fire drills. In the Committee's opinion the events on the *Scandinavian Star* show that the existing rules need to be improved.

As mentioned under 4.4, workshops and

stores had been set up on the forward part of the car deck, deck 3. These had not been removed by either 1 or 7 April 1990. Workshops like this on the car deck are not in accordance with the SOLAS provisions concerning the protection of cargo spaces for vehicles. The ship's management should have made sure that the car deck was cleared of workshop installations, etc. before it was used for vehicles.

A number of statements have been made about whether the ship was ready to sail with passengers on 1 April. Some of these maintain that the ship was ready for service. These statements must be due to some extent to the fact that the person being questioned did not understand the question. For example, when giving evidence at the Norwegian consulate in Miami, the first engineer, Mr. Rebancos, stated that the ship was ready to be put into service. However, he also said that the crew members did not have sufficient knowledge of the ship and that a great many of them did not know what they were supposed to do in an emergency. He also described the ship as being dirty, apart from the engine room.

Other statements that the ship was ready for service are difficult to explain in any other way than that a negative answer would have had negative consequences for the person concerned. This applies especially to the captain.

As the Committee mentioned at the beginning of this section, it must be concluded that the *Scandinavian Star* was not ready to sail with passengers on board on 1 April. The fact that the ship was put into operation when it was obviously not yet ready to sail with safety, must be attributed to pressure from the owners. The Committee is in no doubt that the crew, and particularly the captain, were under considerable pressure from the shipping company, in the person of Mr. Ole B. Hansen, to put the ship into operation. Whatever the company knew or did not know about the safety aspects of the operation of large passenger ships, it should have been able to see that safe operation was not being given priority when it put a ship for so many passengers and with such an untrained crew into service within so short a time.

The Committee will return under 13.2.4.2 to the need for competence and involvement on the part of shipping companies as regards the safe operation of passenger ships.

7.9 THE SITUATION ON BOARD ON 6 APRIL

The Committee's evaluations and conclusions about the state of readiness of the ship are presented under 7.8. Most of these are concerned with the condition of the ship when it was put into service on 1 April. The disaster voyage started on the evening of 6 April. As can be seen from both 7.2 and 7.6, the outfitting work continued after 1 April, including clearing up, making ready cabins, etc. However, on 6 April the ship still had an unfinished look. A number of cabins were still not ready. It had in fact been difficult to find cabins for all the passengers on the disaster voyage. Parts of the ship were still untidy or dirty. The crew's knowledge of the ship, emergency equipment, emergency plan, etc. was not much better on 6 April than it had been on 1 April. From a safety point of view, it was therefore still not justifiable to sail with passengers on 6 April. The senior officers were naturally aware of the situation prevailing at the beginning of the fatal voyage. On the basis of all the work that remained to be done on 1 April, the company had no reason to believe that the situation had improved so much between 1 and 6 April that it had become justifiable from a safety point of view to sail with passengers.

8. The Development of the Fire and Its Consequences on Board

8.1 INTRODUCTION

In the following the way in which the smoke and flames are thought to have spread during the fire is described. The estimates of the extent and development of the smoke and flames are considered to be accurate, but the times may have varied by a few minutes. This uncertainty is due to the fact that the times of the observations made by passengers and crew of the spread of smoke cannot always be determined precisely, and it is not possible to determine exactly how long it took before the fire ignited in the pile of bedclothes, blankets, paper, etc. set the corridor wall alight.

The times given in the following are based on statements from witnesses, timed radio transmissions between the *Scandinavian Star* and the outside world, and calculations and tests performed by the Danish National Institute for Testing and Verification (Dantest) and SINTEF NBL – Norwegian Fire Research Laboratory. The tests comprised measurements of smoke gas components, development of heat release and smoke production, gas velocities, and material properties that influenced the progress of the fire, such as calorific value and flame spread characteristics of corridor surfaces and the other materials used in the accommodation spaces. Experiments were also performed in full-scale models, igniting corridors and registering the spread to stairways. The full-scale model consisted of a corridor and stairway of the same design and dimensions as that on the *Scandinavian Star*, constructed using materials taken from the ship.

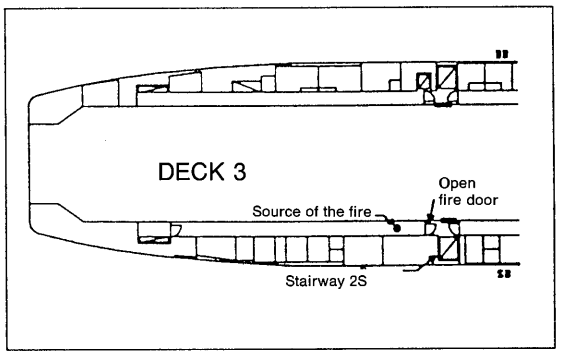
The following description is based largely on the reports from Dantest and SINTEF NBL, whose conclusions the Committee supports on all important points. It should be noted that the Committee does not agree with some of the times estimated by the experts that are directly related to events on board.

8.2 THE MAIN PHASES IN THE DEVELOPMENT OF THE FIRE

8.2.1 Phase I - Starting fire

The fire was probably started some time after 0200 hours. The site of ignition was almost certainly the corridor area adjoining the entrance to stairway 2S on the starboard side of deck 3, as shown in Fig. 8.1.

Fig. 8.1 *The area where the fire started.*



There is little doubt that the fire was ignited with a naked flame, about the size of a match or lighter flame. A glowing cigarette would probably not have been enough to start it. The ignited material is assumed to have been a collection of paper, bedclothes, and blankets that had been deliberately placed at the site.

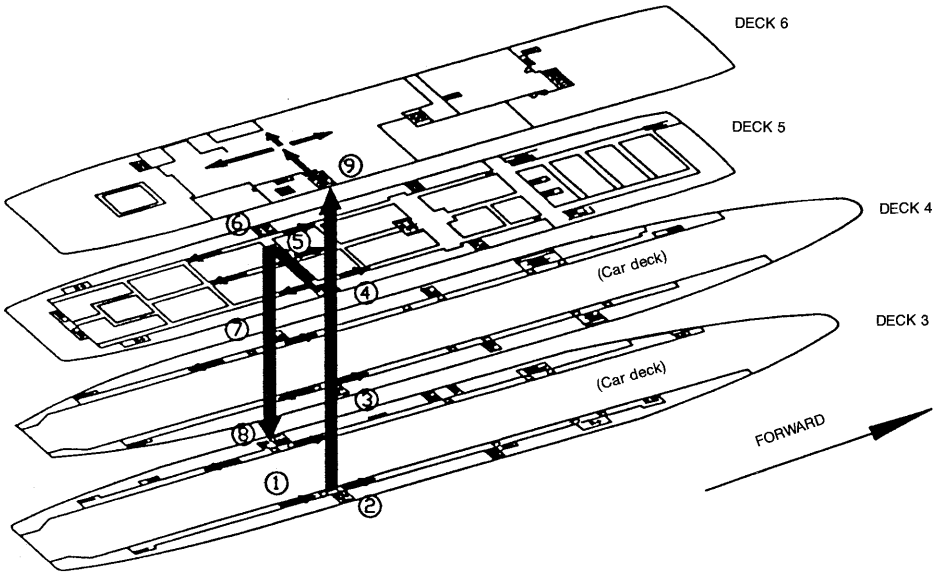
Two to eight minutes after being started, the fire had attained an effect of 200 kW, which was enough to set fire to the corridor wall. From this point onwards the fire spread rapidly. In the following, the time at which the fire had attained an effect of 200 kW has been fixed as the time at which the actual disaster fire started.

8.2.2 Phase II - Intense and rapid spread

One minute after the corridor wall had caught fire, the whole cross-section of the corridor was alight. The fire then spread rapidly to the nearest stairway, 2S on the starboard side. Smoke was drawn up through the stairway and seeped into the corridors on the deck above, fore and aft of the stairway. Two to three minutes after the fire had started, smoke was also observed seeping into deck 5, two decks above the ignition site. Two minutes later smoke was observed on deck 6, and the fire was signalled to the bridge from deck 5.

The flames also began spreading up the stairway, and when they reached deck 5, they were directed across the transverse corridor (see Fig. 8.2) to the corresponding stairway on the opposite side of the deck and down this stairway to deck 3. This spread went extremely fast – witnesses have described it as "a ball of fire" that flashed through the transverse corridor.

Fig. 8.2 *Course of the fire*



Spread of the fire (indicated by encircled numbers)

① Fire ignited here a little after 0200 hours. Two to eight minutes later heat release reaches 200 kW. This has been fixed as the starting time of the disaster fire.

② Fire spread rapidly to this stairway and upwards.

③ Smoke reaches deck [4] about 1 minute after the start and is drawn into the corridors fore and aft of the stairway. The fire door forward of the stairway remains open.

④ Smoke reaches deck 5 after 2–3 minutes and begins seeping into adjoining corridors.

⑤ The fire spreads from the starboard to the port side along this corridor.

⑥ On the port side the fire is drawn down through the stairway.

⑦ Smoke is drawn into the port corridors on deck 4, but in smaller amounts than on deck 5. All the passengers in this area were evacuated.

⑧ The fire spreads down to deck 3, where the fire door onto the car deck remains open.

⑨ The fire spreads into the restaurant section on deck 6, through an open fire door at the top of the stairway.

Smoke also began seeping into the corridors from the stairway on the port side of deck 4. There was less smoke here than in other areas, and no bodies were found in the corridors on the port side.

The primary, life-threatening fire was now limited to the site of ignition, stairways 2S and 2P, and about half of the transverse corridor on deck 5. The material that was burning mostly consisted of the surfaces of the corridors and stairways. The extremely rapid development of the fire during this phase was over in about 10-14 minutes. After this the fire spread from this area to the rest of the ship.

8.2.3 Phase III - Further spread into the cabin areas

After a while the smoke began pouring into the corridors leading away from stairway 2S on the starboard side and the transverse corridor on deck 5. Within 5 to 8 minutes the smoke in some of the corridors on deck 5 already contained so much carbon monoxide that anyone exposed to such smoke would have lost consciousness within 30 seconds. An accumulated fatal dose of carbon monoxide occurs within 3 minutes. In addition the smoke gases contained high concentrations of hydrogen cyanide (prussic acid), which can reduce the above-mentioned times even more.

The fire continued to spread upwards in the ship and into the restaurant section on deck 6.

During the whole of this phase it was primarily toxic smoke that spread through most of the corridors on decks 4 and 5, creating life-threatening conditions for the passengers. The cabins were free of smoke as long as the doors into the corridors were kept shut and the ventilation system was kept on. When the ventilation system was turned off, possibly not until 0230 hours (see 9.4.2.1), the smoke seeped in through the cabin doors, and the concentrations of carbon monoxide and hydrogen cyanide reached critical levels about 15 minutes later.

8.2.4 Phase IV – Persisting, slowly spreading fire

During the next few hours the fire spread progressively along the corridors and into the cabins, where everything burned up and the wall and ceiling panels collapsed. The fire spread relatively slowly because of the lack of air and the many physical barriers (doors, walls) in its path.

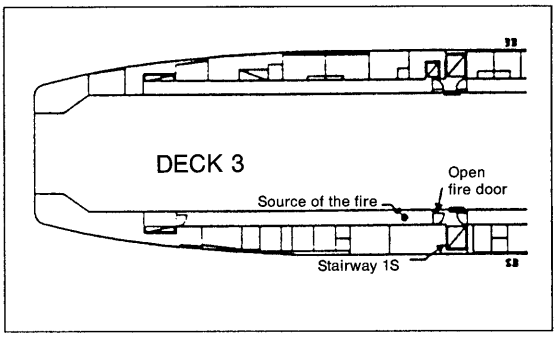
The fire was not finally extinguished until 1600 hours on Sunday, [8] April.

8.3 THE COURSE TAKEN BY THE FIRE IN DIFFERENT CABIN SECTIONS

8.3.1 Deck 3, where the fire started

The starting fire was lit here a little after 0200 hours. After 2 to 8 minutes this fire is thought to have attained an effect of 200 kW, enough to set fire to the corridor walls. Within 1 minute flashover had occurred over the whole cross-section of the corridor. The fire spread rapidly and emitted large amounts of toxic smoke. A critical temperature of 200°C was attained within 2 minutes, and fatal doses of carbon monoxide (CO) and hydrogen cyanide (HCN) were produced within 5 minutes. Within 10-15 minutes the fire in this part of the corridor was beginning to burn out. This section was empty during the disaster voyage, and no bodies were found here (see Fig. 8.3).

Fig. 8.3 *Deck 3, starboard side.*

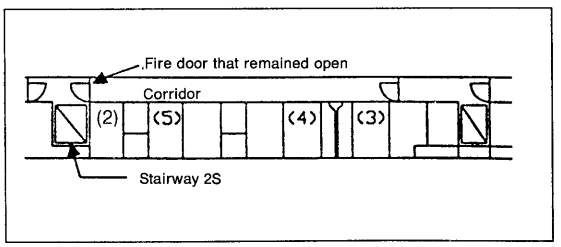


8.3.2 Deck 4

8.3.2.1 Starboard side, corridor forward of stairway 2S

Within one minute of the start of the fire, smoke began to be drawn through a fire door into the corridor forward of the stairway on deck 4.

Fig. 8.4 *Deck 4, starboard side, forward of stairway 2S (figures in parentheses represent numbers of deceased).*



This fire door remained open during the whole fire, which meant that the smoke and flames were able to spread relatively freely. About 6 minutes after the start of the fire the corridor surfaces caught alight, and the fire began to spread along the corridor. After a while the

furniture began burning inside adjoining cabins with open doors. In this corridor the temperature reached a critical level within 5 minutes, and fatal doses of CO and HCN reached critical levels within 7 minutes.

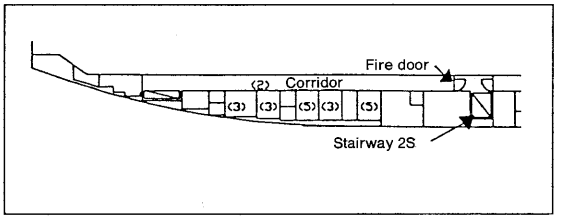
A total of 14 bodies were found in the cabins opening off this corridor (see Fig. 8.4).

8.3.2.2 Starboard side, corridor aft of stairway 2S

It is difficult to give the precise times here, because it is not known exactly when the fire doors were closed. Probably the smoke began to be drawn into the corridor about 1 minute after the start of the fire. By the time the fire doors were closed some time later, the corridor was filled with life-threatening toxic smoke. Even after the fire door had been closed, the smoke continued to leak through openings in the door, although no flames were able to pass.

Twenty-one bodies were found in this section: two on the floor of the corridor, and 19 in the cabins (see Fig. 8.5).

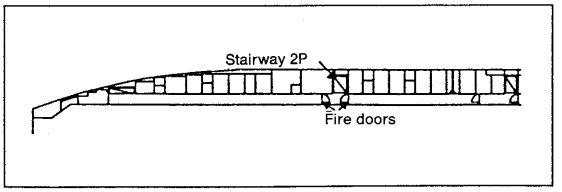
Fig. 8.5 *Deck 4, starboard side, aft of stairway 2S (figures in parentheses represent numbers of deceased).*



8.3.2.3 Port side

This section consists of two corridors, one fore and one aft of stairway 2P on the port side of deck 4. Smoke began seeping into this section 7 to 10 minutes after the fire had started. The smoke was felt to be dangerous, but was much less dense than in other areas, and probably did not have a temperature or toxicity concentration above critical levels.

Fig. 8.6 *Deck 4, port side*



The fire doors to these corridors were all finally closed, and the flames did not spread along the corridors. When the ventilation system creating an underpressure on the car deck was turned off, the spread of smoke in this area also stopped.

All the passengers in this section were evacuated.

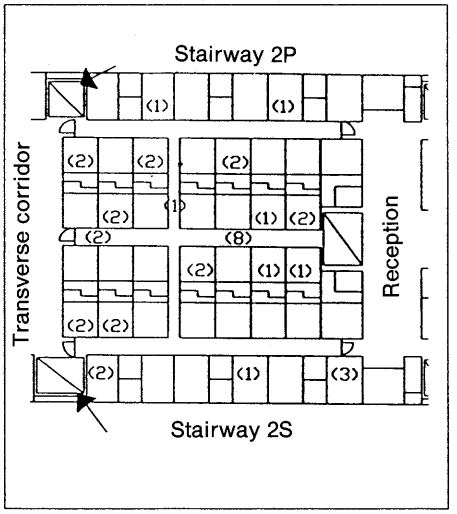
8.3.3 Deck 5

8.3.3.1 The corridors between the transverse corridor by the reception area and the transverse corridor along which the fire spread from starboard to port

Smoke began seeping into deck 5 and into these corridors about 3 minutes after the start of the fire. Large quantities of smoke poured into the corridors ahead of the flames. The smoke was extremely toxic, with CO and HCN concentrations of not less than 25,000 and 1200 ppm (parts per million) respectively. Lifeless bodies had already been observed in the reception area at this point.

The fire door leading from the transverse corridor into the starboard corridor (Fig. 8.7) remained open, allowing toxic smoke, and later flames, to continue spreading into the whole of this area even after the other fire doors had been closed.

Fig. 8.7 *Deck 5, between reception lobby and transverse corridor (figures in parentheses are numbers of deceased).*

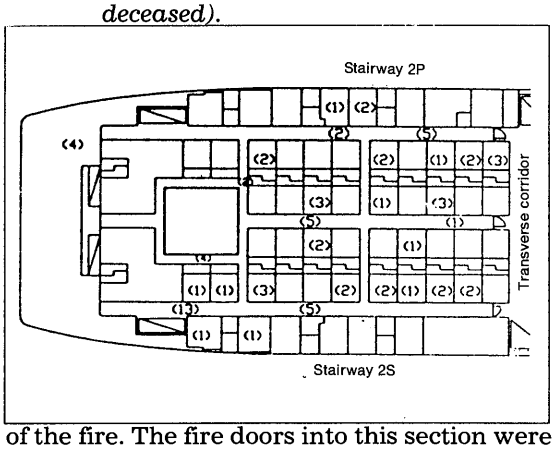


Thirty-eight bodies were found in this area. Ten of these were found in the corridors and the rest in their cabins (see Fig. 8.7).

8.3.3.2 The corridors aft of the transverse corridor where the fire crossed over

Smoke began seeping into these corridors about 3 minutes after the fire had started. A couple of minutes later flames also entered the transverse corridor and spread some way aft along these corridors. The temperature and toxic content of the smoke rose rapidly, reaching critical values 7-10 minutes after the start

Fig. 8.8 *Deck 5 aft of transverse corridor (figures in parentheses are numbers of deceased).*



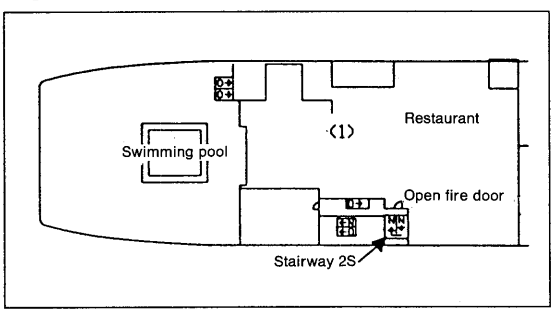
of the fire. The fire doors into this section were all finally closed.

A total of 76 bodies were found in this section. Of these, 37 were found in the corridors and 39 in the cabins (see Fig. 8.8).

8.3.4 Deck 6

At about 0215 hours witnesses observed smoke seeping from stairway 2S into the restaurant section on deck 6. A couple of minutes later the flames also reached this deck, and spread through the fire door at the top of the stairway, as shown in Fig. 8.9. This fire door remained open during the whole of the fire. The flames broke through the glazed door into the restaurant, where they attacked the furniture and surfaces in the restaurant and continued rapidly inwards.

Fig. 8.9 *Deck 6.*



Twenty-five to thirty minutes after the start of the fire the glazed part of the aft wall on deck 6 collapsed and the flames spread aft.

One body was found in the restaurant.

8.4 FACTORS INFLUENCING THE DEVELOPMENT OF THE FIRE AND THE SMOKE PRODUCTION

8.4.1 Composition of the materials

The wall panels and suspended ceilings in the corridors and stairways consisted of a core of non-combustible material surfaced with laminated plastic about 1.6 mm thick. This laminated plastic had high flame spread characteristics and a calorific value of just over 48 MJ/m^2. The standard stipulated in SOLAS 1974 is a calorific value of maximum 45 MJ/m^2 for surface materials in corridors. In SOLAS 1960 the corresponding standard only applies to the total volume of surface materials, and stipulates that they shall have been tested according to a method approved by the administration. This means that the national maritime authority determines the limits. The maritime authorities in Norway and Denmark have not stipulated specific limits for the calorific values of such materials for ships built in 1971.

As can be seen from the above, the calorific value of the surface linings in the corridors of the *Scandinavian Star* was only 3 MJ/m^2 above the requirement stipulated in SOLAS 1974. Nevertheless, this laminated plastic was decisive for the rapid spread of the fire, especially since it formed an uninterrupted surface covering walls and ceiling in all corridors and stairways.

If the surfaces of the suspended ceilings had been made of non-combustible material, this would have created an obstacle to the flashover in the corridor, which could have restricted the fire spread possibilities.

During the early, intense phase of the fire a large amount of grey-black smoke was produced by the burning of the laminated plastic, and considerably reduced visibility along the escape routes. However, this plastic material still satisfies the requirements laid down by the Norwegian and Danish maritime authorities as regards materials with low smoke-producing characteristics.

Similarly, when ignited, laminated plastic produces large amounts of carbon monoxide and hydrogen cyanide. Criteria for measuring the toxicity of smoke gas components have not been included in the regulations applying to materials that can be used on board ship.

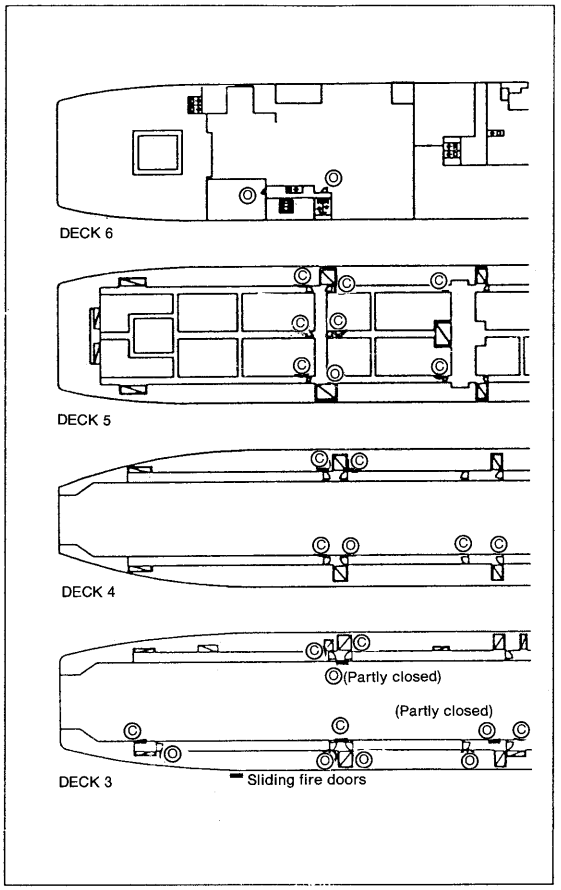
Carpets and cabin furniture had no particular influence on the progress of the fire.

8.4.2 The significance of the fire doors

The fire doors between the various fire zones are normally kept open by means of magnetic catches. When the bridge is alerted to the presence of fire by one of the manual fire alarms in a corridor, the watch is supposed to close the fire doors in the zone where the alarm signal is coming from.

The factor that caused the relatively limited initial fire to develop as it did was that no alarm was ever given from the zone on deck 3 where the fire began. This was because there

Fig. 8.10 *Fire doors in relevant fire zones. (O = open, C = closed)*



was no one there to press the alarm button. Thus the fire door leading from this zone to the stairway was never closed, and the fire was allowed to spread. If the door had been closed early enough, further spread could have been avoided.

Most of the fire doors were eventually closed, although the exact time is uncertain. However, some of the fire doors in the areas affected by fire and smoke remained open during the whole of the fire. Among these were a door into a corridor on the starboard side of deck 4, a door from the transverse corridor between stairways 2S and 2P leading into a corridor on deck 5, a door from stairway 2S opening onto deck 6, and the fire door from stairway 2P opening onto the car deck, deck 3 (see Fig. 8.10). The fire door opening onto the car deck on deck 3 should have been kept permanently closed. The total fire picture, however, seems to indicate that this door remained partly open. The fact that this door was open greatly influenced the progress of the fire.

In addition a fire door was missing on deck 6, but this had no influence on the course of the fire since the sliding fire door from stairway 2S on deck 6 remained open.

The fire doors also affected the course of the fire because, together with the ventilation system, they influenced the supply of air to the fire. Closing the fire doors and turning off the ventilation system is supposed to cut off the air supply. The fact that some fire doors remained open while others were closed greatly increased the draughts through the open doors and helped the fire to spread rapidly.

The open link between stairways 2S and 2P formed by the transverse corridor on deck 5 also created favourable draught conditions which helped the fire to spread rapidly.

8.4.3 The significance of the ventilation system

The ventilation on board was based on overpressure in all living and public spaces and underpressure (suction) on the car deck.

In the early phase of the fire it was primarily the pressure distribution in the ship created by the ventilation system that determined the direction of the fire. Flames and smoke were drawn towards areas of low pressure.

At the start of the fire the sliding door from stairway 2P on the port side leading onto the car deck was open. This created a suction effect, causing the fire to spread rapidly from the stairway on the starboard side across the transverse corridor on deck 5 and down the stairway on the port side towards the source of the suction.

The ventilation system in the restaurant section on deck 6 was out of order during the fire, which meant that the pressure in this section was lower than in the adjoining ones. This caused large amounts of smoke to be drawn upwards and into deck 6 through an open fire door.

The normal practice when a fire is discovered is to turn off the ventilation system and close the ventilation ducts by means of fire dampers in order to subdue the fire and prevent it from spreading by means of the ducts. The ventilation system on the *Scandinavian Star* may not have been stopped until 0230 hours. As long as it was functioning, there was an overpressure in the cabins, preventing smoke from seeping in. The Committee finds evidence that the recirculation of air by the ventilation system was not sufficient to have pumped smoke into the cabins to any appreciable extent.

As the heat released by the fire increased, the buoyancy of the heated smoke gases began determining the course of the air currents and thus the spread of the fire.

8.5 THE EFFECT OF THE FIRE ON THE CONDITION OF THE ESCAPE ROUTES

The physical condition of the escape routes strongly influenced the passengers' possibilities for escaping from the cabins. The relevant evacuation period lasted from the time at which the fire alarm was sounded to the time at which all the deceased are thought to have died, about 30 minutes later.

Although conditions in different corridors varied according to time, the presence of flames, concentration of combustion gases in smoke, and temperature, there were certain common features.

The combustion gases that spread upwards through the stairway and into deck 4 and deck 5 had a very high temperature. As they spread into the cabin sections the temperature in the escape routes rose rapidly to the critical level of 200°C. In most of the corridors in the area affected by the fire this temperature was reached within about 10 minutes of the start of the fire.

Within 8 to 12 minutes of the start of the fire, most of the corridors were filled with smoke. The smoke contained fatal concentrations of hydrogen cyanide and carbon monoxide in the neighbourhood of the stairways, with decreasing concentrations further along the corridors. Inhaling smoke with the highest concentrations leads to unconsciousness within about 30 seconds and to death within 2 to 3 minutes.

There were also relatively high concentrations of carbon dioxide present. This increases the risk of hyperventilation, which induces a more rapid uptake of other gases, so that a fatal dose is reached more quickly.

The fire also consumed large quantities of oxygen, which probably resulted in a lack of oxygen in the escape routes. Normally lack of oxygen increases the speed of the body's uptake of toxic substances.

It is difficult to fix the exact time at which the flames spread to the escape routes. Generally speaking, the flames seem to have appeared after the corridors had become filled with smoke. Thus the flames themselves probably had no significant effect on the evacuation possibilities.

Smoke density strongly influences passengers' possibilities of finding their way during an evacuation. In many of the escape routes the smoke was very dense, with a visibility of well below one metre. One metre is an internationally accepted critical value for visibility.

8.6 CONSEQUENCES OF THE FIRE

When the fire started on Saturday 7 April, the *Scandinavian Star* had 383 passengers and a crew of 99 on board.

A total of 158 people died in the fire. Of these, 156 were passengers and two were crew.

A number of people were taken to hospital. One was hospitalized because of serious smoke-induced injuries, the others were sent home after being examined, without being hospitalized.

8.6.1 Causes of death

The bodies were sent to the Department of Forensic Medicine at the National Hospital in Oslo, Norway, for identification and post-mortem examination, including tests to establish the cause of death for each person.

All the deceased are considered to have died as a direct result of the fire. There is no evidence that any of them were suffering from a disease or an injury that could have contributed to death. Nor is there any reason to assume that any of the deaths were significantly associated with alcohol intake.

In the case of 125 of the deceased, the inhalation of carbon monoxide was probably the main cause of death. A large number of them also had high concentrations of hydrogen cyanide in the blood, but this did not appear to be the major cause of death.

The remainder appear to have died mainly from other causes. For some of them the main cause of death seems to have been hydrogen cyanide poisoning, although in these cases carbon monoxide poisoning also seems to have contributed.

A small number, 10 persons, seem to have died of heat injuries before the concentration of toxic substances in the blood had had time to build up to a fatal level.

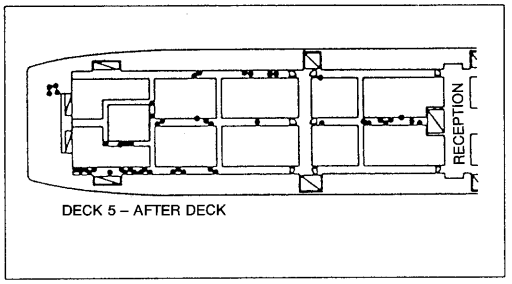
8.6.2 Where the bodies were found

Most of the bodies, 99 in all, were found in their cabins. About 25 per cent of these were found partly or completely inside the bathroom, often with towels over their faces. This type of reaction, in which many passengers seek fresh air rather than trying to escape through smoke-filled corridors, has been noted in other fires. Those who were found in the sleeping compartment of the cabins, seem to have had varying reactions. Some were fully dressed, while others were partly dressed or in their underclothes, which indicates that they may have become aware of the fire at a relatively late stage.

A good 50 of the passengers were found in the corridors, mainly in the after part of deck 5.

Conditions in the escape routes were extremely difficult (see 4.6), with dense, toxic smoke and little light. Furthermore, the escape routes were difficult to follow, involving many changes of direction, and some of the corridors had dead ends. About 20 of the bodies were found in two dead-end corridors (Fig. 8.11). (There were doors out of these corridors, but they were situated in side bulkheads about 3 metres from the ends of the corridors.)

Fig. 8.11 *Positions of deceased found in escape routes on the after part of deck 5.*



Four bodies had been carried out onto the after part of deck 5. One was found to have died on deck 6.

8.6.3 Late effects in survivors

At a late stage in the Committee's work it was faced with the question of whether the disaster could have given rise to late effects in the survivors caused by inhalation of fire gases. The Committee had to consider, among other things, the answers to the following questions:

a) Is it possible for late effects from a disaster fire like that on the *Scandinavian Star* to arise in survivors as a result of the inhalation of fire gases, and if so, which are the fire gases that would cause such late effects?
b) Does the Committee need to have laboratory tests, etc. carried out in order to clarify whether such fire gases were present?

The Committee requested Dr. Finn Levy, senior medical officer of the National Institute of Occupational Health, to prepare a report on the question of late effects. Dr. Levy's report is in the form of a short note, which he wishes to emphasize is due to the short time available and pressure of work. In spite of his reservations, the Committee considers it important to reproduce the note in its entirety. The text of the note, which is dated 11 January 1991, is as follows:

The present inquiry is primarily concerned with whether the following groups of gases can lead to late effects, and in what concentrations: nitriles, PAH, and isocyanates.

A number of questions were posed about the possibility of demonstrating the presence of such gases in the smoke from the products used on board the ship.

1. LATE EFFECTS

1.1 *General comments*

In connection with the disaster the greatest problem is to establish what sort of late effects may develop in the survivors as a result of acute toxicity occurring during the fire itself. Such late effects arise mainly in association with the following organ systems:

1.2 *The brain*: Lack of oxygen or blocking of the supply of oxygen to the brain cells owing to carbon monoxide (CO) or cyanide (HCN) poisoning may cause brain injury.

1.3 *Airways*: Irritation from smoke containing irritating substances like nitrogen oxides, formaldehyde, isocyanates or particles may lead to or aggravate chronic bronchitis, asthma, and other lung diseases. With regard to the lungs, the question of whether inhaled substances can lead to after-effects that we are not aware of at the present time is also under consideration.

1.4 *Skin*: Burns may produce lasting scars.

1.5 *Cancer*: Special attention has been focused on cancer development in cases where polycyclic aromatic hydrocarbons (PAH) and asbestos are thought to be the most significant cancer-inducing agents.

When cancer develops, it is preceded by a long symptom-free period, the latency period, before the cancer shows signs of its existence. Here, too, there is a connection between the duration of the exposure, the amount of the cancer-inducing substance, and the risk of contracting the disease. The question in this case is whether exposure to a high concentration of a potentially cancer-inducing agent may have demonstrably increased the cancer risk beyond the normal risk inherent in exposure to the everyday environment.

2. ASSESSMENT IN RELATION TO INDIVIDUAL SUBSTANCES

2.1 *Polycyclic aromatic hydrocarbons (PAH)*: This is a group of chemical substances that are generally present in combustion gases. Some of them have been shown to contribute to the development of cancer (carcinogens).

PAH are chemical compounds consisting of several carbon rings of the type found in benzene. (There are a large number of different compounds, and there is no reason to go into detail here.) They are formed by the burning of organic material containing carbon and hydrogen. The extent to which new PAH are formed during combustion depends on the composition of the air, the supply of oxygen, the temperature, etc. at the time of formation. It would therefore be extremely difficult to reconstruct the exact physical conditions prevailing at the time of the disaster in a

laboratory for the purpose of documenting the concentration of PAH associated with the fire on board the *Scandinavian Star*. It would be impossible to obtain exactly the same conditions as during the fire.

It must be assumed that the dense smoke created by the fire contained PAH, probably including compounds associated with an increased cancer risk, such as benz(a)anthracene (C_{18} H_{12}) and benzo (a)pyrene (C_{20} H_{12}). These substances are found in exhaust gases from cars and in tobacco smoke. Laboratory findings of PAH levels cannot be applied to individuals in order to determine their risk of developing cancer.

The risk is very small after a single exposure.

It is therefore not probable that a single exposure to PAH in this context would lead to a demonstrably increased risk of developing lung cancer. PAH is also found, as mentioned above, in tobacco smoke, where it is an important carcinogenic agent, and this includes smoke to which "passive smokers" are exposed. The exposure time and concentration of these substances is probably a greater source of cancer risk than the PAH inhaled by the survivors in the situation being considered here. This applies even if the concentration of PAH was relatively high.

2.2 *Nitriles*: Nitriles are organic cyanides (compounds that are chemically related to hydrogen cyanide), the simplest of which is acetonitrile. Here the hydrogen atom in the gas methane has been replaced by a cyanide group (CN). Nitriles are components in a number of synthetic compounds (polymers).

In their pure form nitriles are extremely toxic and require special handling. They are not dangerous when present in the end product (polymer).

The toxicity of nitriles can be compared to that of hydrogen cyanides, and may lead rapidly to death if inhaled or ingested. Certain synthetic materials may release nitriles and cyanides when burned, depending on the temperature and supply of oxygen or humidity.

These substances may lead to residual effects as a result of intoxication with loss of consciousness, in the same way as hydrogen cyanide intoxication or lack of oxygen over a certain time period. Thus, the probability of late effects resulting from nitrile intoxication, like intoxication from the above-mentioned substances, can be inferred from the patient's medical history combined, where necessary, with neurological and neuropsychological examinations.

2.3 *Cyanides*: Cyanides act rapidly and in cases of acute toxicity can lead to loss of consciousness and death within a few minutes.

Examples of approximate times of action before loss of consciousness for different concentrations:

- 110–135 ppm: Fatal or life-threatening after about 1/2 to 1 hour
- 180 ppm: Fatal after about 10 minutes
- Over ca. 270 ppm: Instantly fatal.

100 ppm corresponds to [0.01] per cent HCN gas in the air, which in terms of weight equals 110 mg/m^3 air. The standard values for workplace atmosphere are 10 ppm (11 mg/m^3) over an eight-hour working day. When exposure is discontinued the substance is metabolized and eliminated from the body rather more rapidly than CO.

2.4 *Isocyanates*: Isocyanates are components of a number of synthetic materials, especially foam rubber, some types of insulation material and certain types of two-component varnish (DD varnish). In cured form it is not dangerous. When subjected to heat and combustion, reactive isocyanate molecules are split off, singly or in chains, and so is hydrogen cyanide (prussic acid), all of which are very toxic. Late effects on the central nervous system would depend on the duration of the intoxication during the disaster. Long-lasting loss of consciousness is a sign of serious intoxication with increased risk of persisting injury.

Isocyanates are chemically highly reactive and irritating to the mucous membranes. They may cause injury of the mucous membranes in the airways, resulting in coughing, asthma, and sometimes acute lung injury. These conditions would appear immediately at the time of the disaster, although asthma symptoms from exposure to isocyanates may occur several hours after the substance has been inhaled, and hypersensitivity can last for many months. The effect of isocyanate will be added to the effects of nitrogen oxides, sulphur dioxide, formaldehyde, cigarette smoke, and irritation of the mucous membranes caused by particles.

None of these substances will have late effects if no injury has occurred giving rise to symptoms immediately on exposure and lasting some time afterwards. These symptoms can be demonstrated by advanced lung function tests, including, if necessary, testing for increased reactivity in the mucous membranes of airways.

2.5 *Carbon monoxide (CO)*: Carbon monoxide is an asphyxiating gas formed by combustion, mostly when the supply of oxygen is poor. The gas interferes with the transport of oxygen in the blood, and produces a condition of "internal asphyxiation" in a

similar way to the cyanides, but more slowly. A typical sign of intoxication is that the skin and blood have a redder than normal colour.

The time factor is important here too. Equilibrium is not achieved in the blood for at least 8 hours. The effect on an individual depends on the quantity of carboxyhaemoglobin (COHb), which is CO bound to the red pigment that normally transports oxygen. For example, the equilibrium for 25, 50, 100, and 200 ppm CO (1 ppm = 1 part per million, for CO = ca. 1.12 mg/m^3) is about 5, 10, 16, and 25 % COHb respectively. In the case of higher concentrations, exertion, and heavy work, equilibrium is achieved more rapidly. Values of 500 ppm and 1000 ppm produce about 45 % and 60 % COHb respectively within 4-5 hours.

The following examples show the effect in relation to COHb (the values vary, and some authors have reported [COHb] concentrations up to 10 % higher at the higher levels):

Normally below 2 %, usually below 1 % in non-smokers, while smokers may have 6-10 %.

- 10–20 % Reduced alertness, unaffected test performance, sometimes slight headache and flushing.
- 20–30 % Stronger headache, dizziness, singing in the ears, tiredness.
- 30–40 % Rapid breathing, rapid pulse, loss of consciousness may occur.
- > 40–50 % Life-threatening. Loss of consciousness.
- > 70–80 % Death within a short time.

The risk of late effects can be broadly said to be related to the duration of unconsciousness.

Amounts of CO in the air in excess of 3 % (30,000 ppm) must be regarded as being immediately fatal.

After exposure has ceased, the time taken for the amount in the body to be halved is about 4 hours unless extra oxygen is supplied.

2.6 *Asbestos*: The question of asbestos was not raised, but it should still be mentioned in this connection. Asbestos fibres are known to be carcinogenic. There is a connection between the type of asbestos fibre, the duration of exposure to asbestos, and the size of the dose. Asbestos is widespread in the normal environment, much of it present in car brakes, released from disintegrating materials or released during the renovation of fireproofed installations. The exposure to asbestos of the survivors of the *Scandinavian Star* disaster is considered to be insignificantly small. The exposure may have had some significance for the teams who cleared up afterwards if they stirred up dust by demolishing fire partitions, etc. without wearing adequate protective clothing. Even in this case the risk of a particular individual developing cancer is small, although it is theoretically possible, depending on the type of fibres in the dust concentration and length of sojourn in a dusty environment. Follow-up X-rays of the lungs should be taken every 3-5 years if possible asbestos reactions in lungs or lung membranes are to be detected. The risk of developing cancer is greater for smokers.

3. POSSIBILITY OF DISCOVERING THE PRESENCE OF TOXIC GASES BY RECONSTRUCTING THE FIRE

Documentation of the concentrations of toxic gases in the atmosphere provides a more definite basis for diagnosis of the causes of any late effects. In this context the term "late effects" is used to refer to permanent and/or lasting injuries, and not injuries that occur for the first time a long time after the disaster. The diagnosis of the actual injury (the medical diagnosis) is not influenced by whether or not a toxic gas is shown to be present.

The presence of the types of gas in question can be shown by advanced sampling and analysis in experiments involving the burning of materials used in the accommodation and service areas. However, the method for the precise measurement of isocyanates in fire gases is expensive, and the measurable concentrations are very low. Nevertheless, such findings have a scientific interest.

The other possibility for finding out which gases could have been present in the smoke is based on the materials that were used in the ship, such as floor coverings, textiles, surface treatments (paint, varnish), panels, and insulation material. An analysis of the chemical composition of these materials and of the chemical compounds that can be formed by heat and combustion allows a qualitative estimate to be made of the possible exposures. This would support the documentation that toxic substances can have been released and thus increase the probability of a causal relationship, but it will not make any difference to the actual diagnosis of disease or symptoms or the subsequent degree of invalidity.

4. CONCLUSIONS

4.1 The most significant late effects will be direct results of the inhalation of gases like carbon monoxide and hydrogen cyanide, together with the lack of oxygen leading to loss of consciousness over a certain period in connection with the disaster.

4.2 Lung injuries may arise as a result of the inhalation of isocyanate gas together with other lung-irritating gases and particles.

These are only expected to occur in cases where symptoms presented at the time of and during the first day after inhalation of the gases.

4.3 Any late effects will mostly be a direct continuation of the symptoms that have appeared in close association with the fire. The presence or probable presence of late effects can be shown by special tests that will still be valid at the present time.

4.4 It is not likely that specific diseases will arise at a later date if the exposed persons have been subjected to thorough neurological and, where applicable, physiological lung examinations during the first couple of years after the disaster.

4.5 Knowledge of the composition of the materials involved in the fire makes it possible to estimate probabilities as regards which toxic substances were released into the atmosphere in connection with the fire.

4.6 Quantitative estimates of toxic substances in the air will contribute to evidence about causes, but will not make any appreciable difference to the diagnoses.

4.7 Late effects may also take the form of psychological reactions that appear and continue to manifest themselves for a long time after the disaster. This probably applies especially to persons who have not been followed up since the disaster.

4.8 It must be assumed that carcinogenic substances have had some effect in connection with the disaster. In my opinion it is not possible either to measure this effect or to decide whether it has had any influence on the development of cancer in a particular individual at a later date.

4.9 The development of lung cancer is not considered to be a probable late effect of this disaster. Other causal factors, especially cigarette smoking, are more likely to have represented a larger contribution in terms of duration of exposure.

4.10 Statistically, a certain percentage of the survivors will develop lung cancer for one reason or another. The decision as to whether this should be considered without further examination to be a result of the disaster is one of principle.

In his conclusion, Dr. Levy states under points 4.3 and 4.4 that late effects will "mostly be a direct continuation of the symptoms that have appeared in close connection with the fire. The presence or probable presence of late effects can be shown by special tests that will still be valid at the present time. ... It is not likely that specific diseases will arise at a later date if the exposed persons have been subjected to thorough neurological and ... physiological lung examinations during the first couple of years after the disaster." The Committee is aware that a number of survivors have had thorough medical examinations. The Committee proposes that the central health authorities in Norway and Denmark make sure that all the survivors be given the opportunity of having the necessary medical examinations if they have not already had them. They should also, in cooperation with the relevant foreign health authorities, make sure that such an offer is made to the foreign passengers and personnel. Such examinations must be free of cost for the individual concerned. It may be appropriate for the health authorities to discuss the question of reimbursing public expenses in this connection with the insurance company Assuranceforeningen Skuld.

If these medical examinations indicate the possibility of late effects, it might be reasonable to consider carrying out laboratory tests to determine which fire gases could have been present, if this would help to clarify whether there was a causal connection between the fire and the injuries in the survivors. The Committee does not consider that at the present time, without specific medical indications of late effects, it is justifiable to carry out laboratory tests that would not only be very expensive but that might have doubtful value as evidence.

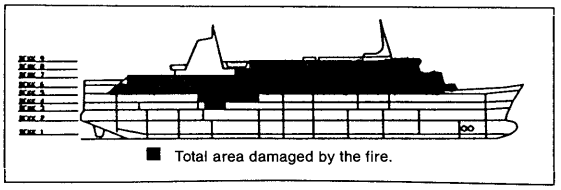
At present SINTEF NBL is in possession of a good deal of material from the ship that may be used later for laboratory tests. The Committee proposes that the Ministry of Justice concludes an agreement with SINTEF NBL concerning the storage of this material so that possible future evidence is not lost.

If the question of laboratory tests, etc. arises in connection with medical examinations, the Committee is willing to contribute to the process of deciding whether such tests should be carried out if formally requested to do so by the Norwegian Ministry of Justice.

8.6.4 Material damage

The fire was mainly limited to the areas on the afterdecks of decks 3, 4, and 5, and the whole of decks 6 and 7, as shown in Fig. 8.12. Most of the fixtures and furniture on the accommodation and restaurant decks were destroyed by fire. There was little structural damage to the ship itself, and the propulsion system was not damaged to any appreciable extent. It would have been possible to have kept the ship operational during the whole of the fire.

Fig. 8.12 *Damage to the ship*



9. The Conduct of the Crew during the Disaster

9.1 INTRODUCTION

Between 0145 hours and 0215 hours two fires occurred independently on board the *Scandinavian Star*. The first was put out before any great damage had been done. The second ended in disaster. The physical development of the fires is described in Chapter 8.

During the first fire a number of crew members were involved in giving the alarm and putting out the fire. In connection with the second fire several crew members played an essential part, mostly on their own initiative, in giving the alarm and in the evacuation work. Others played a more modest role. Others again, perhaps the majority, were never assigned any other part to play than their own personal evacuation. Several of the passengers, on the other hand, participated very actively in the rescue work on board.

The conduct of the crew, considered separately and together, seems to have been less organized and effective than it ought to have been. This may be due to several factors. The crew had had little preparation for the kind of situation that arose, as shown under 7.7.2.8, 7.7.2.10.3, and 7.8, where the deficiencies in the emergency plan and the lack of fire and abandon ship drills is discussed. The efforts of the crew were made more difficult by the rapid spread of the fire and by its physical properties, as described in Chapter 8. Even if these and other difficulties objectively hindered the crew when the fire broke out, the Committee still considers that the crew's conduct in certain areas could have and should have been better than it was.

This chapter gives a more detailed report on and assessment of the conduct and actions of the crew after the fire had broken out. Under 9.2 the conduct of the crew is outlined, followed by a description of the actions of individual senior members of the crew and groups of crew. The Committee then gives its assessment of what they ought theoretically to have done and whether it was possible under the circumstances to have done it. The first fire, fire no. 1, is described separately under 9.3. Fire no. 2 broke out and developed independently of fire no. 1, but the way the crew dealt with the first fire is relevant to the description and evaluation of the way the disaster fire was dealt with (9.4). Finally an overall evaluation of the crew's conduct is given in 9.5.

The description of the actual conduct of the crew is based on the maritime inquiry, police interrogations, logs kept by external participants in the rescue operation, technical findings, and so on.

It is not possible to determine the exact times of the various events, so a detailed list is not given. However, some essential times have been established with reasonable certainty on the basis of statements from witnesses, extracts from the logs of external participants, technical evidence, and experiments reconstructing the fire. These times are given, including the margin of uncertainty where applicable. Otherwise the probable course of events and times are indicated where the Committee considers the evidence to be sufficient.

9.2 OVERVIEW OF MAIN COURSE OF EVENTS FROM 0145 HOURS TO 0330 HOURS ON 7 APRIL 1990

Between 0145 hours and 0200 hours in the early morning of 7 April 1990, a fire started in a bundle of bedclothes in the corridor outside cabin no. 416 on the port side of deck 4 (Ybor Deck). The cause of the fire has not been ascertained with complete certainty. The fire patrol passed the scene at about 0132 hours on his normal rounds, without seeing anything out of the ordinary.

The fire was discovered by passengers occupying the cabins in this corridor, who began putting it out. While they were doing this, various lower-ranking members of the crew, five in all, came by separately. Some of these helped to extinguish the fire, while others ran to warn the reception desk, the bridge, and their commanding officers. The warning to the bridge was taken by a subordinate crew member who climbed four decks with the message. The officer of the watch (first officer) woke the captain and chief engineer by telephone. The captain immediately proceeded to the bridge, took over the watch, and sent the first officer down to investigate what was happening at the scene of the fire. Here he took charge of putting out the remains of the fire and cleaning up the area. When this was over he tried to contact the bridge by means of the fire patrol's walkie-talkie. This was not successful, so he

went up to the reception desk (one deck up) and rang the captain on the bridge and reported that the situation was under control. He then went up to the bridge (three decks up). This took place at about 0215 hours.

The captain sent the first officer down to the scene of the fire outside cabin no. 416 and asked the receptionist by telephone to check the area. No further steps were taken to investigate other areas of the ship for attempts at arson.

Fire no. 2 probably started a little after 0200 hours in the corridor area close to stairway 2S on the starboard side of deck 3 (C Deck), as described under 8.2.1. The first crew member to be aware of this fire was probably the receptionist. She was warned by passengers who saw smoke entering deck 5 (Gulf Deck) from the stairwell on the starboard side aft of the reception. The receptionist rang the bridge and informed the captain. At the same time several of the manual fire alarm buttons were pressed, primarily by passengers and primarily on the afterdeck of deck 5 (Gulf Deck) and deck 4 (Ybor Deck). These transmitted signals to the bridge, where lights on a control panel indicated where the alarm buttons had been pressed.

Immediately after this the first officer returned to the bridge and on the captain's orders sounded a general alarm for the whole ship.

During the next few minutes the alarm woke several crew members in their cabins. Most of them reacted in a highly individual manner. Several tried to reach their posts in the engine room, but had to give up because of smoke. Others ran up to the bridge to find out what was happening. Many of these, and some others, tried to go down to the cabins to help evacuate the passengers. Some went straight to the lifeboat stations on deck 7 (Sunset Deck) and to the mooring deck aft on deck 5 (Gulf Deck) to help the passengers there.

The captain closed the fire doors in the areas where the fire alarm buttons had been pressed. He reduced the ship's speed to zero and turned off the ventilation to the passenger areas. The ventilation to the car deck was probably shut off some time later. The fire pumps were started. The exact times of these actions cannot be determined with certainty.

Mayday was signalled by the radio officer on the captain's orders at 0224 hours. At the same time the captain requested assistance from the *Stena Saga*, which was lying on the same course but about four nautical miles ahead. The captain had radiotelephone contact with the *Stena Saga* several times after this (see Chapter 11).

The captain, and some of the officers on the captain's orders, made announcements over the public address system that there was a fire, that the passengers and crew were to proceed to the boat deck, and that the *Stena Saga* was close by. No special messages were addressed to the crew over the public address system at any time during the fire.

Walkie-talkies were not used at any time during the fire up to the time the captain abandoned ship.

There was no organized attempt at *fire fighting*. Individuals made various attempts to check the fire. At an early stage of the fire, after the alarm had been given, the fire patrol noticed flames on deck 5 (Gulf Deck) in the starboard corridor aft of the reception. He connected up a fire hose in the reception area and tried to fight the fire, but soon had to give up because of the smoke. The situation was similar in the bar area. Later a fire hose was connected on the afterdeck on deck 7 (Sunset Deck) to cool down the area around the emergency generator room and a threatened lifeboat.

There was no centrally organized system of *evacuation*. A number of crew members made individual efforts to rescue people from areas of danger and help them off the ship. This took four main forms.

a) At an early stage of the fire, i.e. shortly after the alarm had been given, several of the crew directed passengers upwards and outside. After a short time the smoke put a stop to these efforts. At this point a crew member put on smoke diving equipment (i.e. mask and air cylinders) in order to operate in the smoke. He was forced to give up after a relatively short time.

b) A little later two more of the crew put on full smoke diving equipment and began searching for passengers on deck 5 (Gulf Deck), working their way aft from the hospital lobby. With some interruptions, one of them, the staff captain, continued his smoke diving efforts until after the captain had left the ship.

c) At the boat stations on deck 7 (Sunset Deck), the passengers were assisted by the crew members who had arrived there shortly after the alarm had been given. Many, though not all, of the passengers were given lifebelts, some received warm clothes, etc., and to some extent places were allotted in the lifeboats.

d) Finally, the crew were responsible for lowering and, to a large extent, releasing the lifeboats from the ship and manoeuvring them over to the surrounding rescue vessels. Eight of the ship's ten lifeboats were used. None of the rafts were used. On the mooring deck aft on deck 5 (Gulf Deck), which was cut off from

the rest of the ship by the smoke and flames, members of the crew rigged up a provisional structure to protect the passengers and later to help them get down into the rescue boats that came alongside.

The crew abandoned ship in the lifeboats together with the passengers. The last lifeboat, containing among others the captain and many of the officers, left the ship at about 0320 hours, i.e. a good hour after the fire had been signalled to the bridge. The staff captain, who was searching the interior of the ship, remained on board together with a few other members of the crew. These crew, and some passengers, were later evacuated from the *Scandinavian Star* by helicopter and rescue boat from the ship's stern.

9.3 THE CONDUCT OF THE CREW DURING THE FIRST FIRE

9.3.1 The fire

The first fire started between 0145 and 0200 hours on deck 4 (Ybor Deck), approximately amidships on the port side. A bundle of bedclothes was burning on the floor of the corridor against the bulkhead beside cabin 416. The fire charred the surface of the bulkhead above the bedclothes and about halfway up the wall.

The cause of this fire has not been established. It is most probable that the bedclothes were ignited by a naked flame, but it is not known with certainty how this was done. When the fire patrol passed the spot on his rounds at about 0132 hours he noticed nothing unusual.

The fire was noticed by the passengers in the adjoining cabins. They began putting it out by dowsing it with water fetched from a cabin in a wastepaper basket and by smothering the flames with blankets. No one pressed any fire alarm buttons.

9.3.2 The conduct of the crew

A relatively short time after the fire had begun to be put out, a lower-ranking member of the crew, the helmsman on watch, who was on his way below decks, came along the corridor. He helped with the extinguishing work and then ran up to the bridge (four decks up) to give the alarm. It was obvious at this point that the fire was under control.

Four more lower-ranking crew members happened separately to enter the corridor while the fire was being put out. They all ran off to deliver warnings. One of them tried to find the fire patrol, but without success. Another tried to find his commanding officers, the pursers. He then returned to the scene of the fire with a colleague, carrying a manual extinguisher. These two then ran up one deck to the reception, where after some delay (possibly due to language difficulties) they managed to warn the bridge by telephone.

One of these crew members claims to have pressed a fire alarm before leaving the scene of the fire. This was not observed on the bridge, however, and has not been otherwise confirmed.

The first notification to the bridge about the fire outside cabin 416 was therefore received at the latest when the helmsman on watch, who happened to be passing on his way below decks, came up to the bridge with the information. The only person on the bridge at this time was the officer of the watch, the first officer. He immediately rang the captain and the chief engineer, who were asleep in their cabins. He told the captain "Someone is playing pyromaniac". The captain soon arrived on the bridge, took over the watch, and ordered the first officer down to investigate the situation.

The first officer went down to cabin 416 without taking a walkie-talkie. There he asked the passengers to return quietly to their cabins, and ordered a deckboy to finish off the fire with more water. He then saw that the area was cleaned, and ordered two of the crew to put the burned remains in a plastic sack and place the sack on one of the wings of the bridge. He tried to contact the bridge by means of the fire patrol's walkie-talkie, but without success. He therefore went up to the reception desk and rang the captain to report on the situation.

In the meantime the captain had rung the receptionist, who reported that everything seemed normal.

9.3.3 Evaluation

The actions described here deviate from the ideal pattern of conduct. When the officer of the watch and then the captain were informed of the fire, they could reasonably assume that it was under control. But the circumstances surrounding the fire indicated that immediate action should have been taken to investigate other areas of the ship. This was especially important in view of the fact that the ship had no automatic fire alarms. The possibility of a pyromaniac had already occurred to the first officer, and the captain was aware of this. There were a number of practical ways of searching the ship. The fire patrol could have been ordered by walkie-talkie to intensify his rounds, the crew at the scene of the fire could have been ordered to search the ship, the first officer could have mounted a search, and other crew members could have been woken.

Ideally, the search should have been started

immediately after the fire had been notified, parallel with the clearing up work by cabin 416, while a strengthening of the watch was being organized. This would also have been a practical possibility. But no orders were given for a search or intensification of the watch. We now know that the second, disastrous, fire was started a very short time after the bridge had received the warning of the first fire. It is thus uncertain whether any practical advantage would have been gained from searching the ship, as ought ideally to have been done. However, the Committee considers that the failure to implement this precaution deserves criticism.

9.4 THE CONDUCT OF THE CREW DURING THE DISASTER FIRE

9.4.1 The start of the fire. Notification of the bridge

The evidence indicates that fire no. 2, which precipitated the disaster, probably began shortly after 0200 hours in the corridor adjoining the entrance to stairway 2S on the starboard side of deck 3 (C Deck). The fire is assumed to have been started in bedclothes and other material on the floor of the corridor, as described in Chapter 8. Within a very few minutes, it is impossible to say exactly how many, the fire had reached such a strength that it set the whole cross-section of the corridor alight. From this point on the fire developed extremely rapidly. From the flashover of the whole corridor, the fire entered the stairway on the starboard side, continued up to deck 5 (Gulf Deck), crossed straight over to the port side and down the stairway there to the car deck, deck 3 (C Deck), while part of it continued up the stairway to deck 6 (Main Deck) and the bar area there. Large quantities of dense smoke were rapidly produced and spread along the corridors on deck 4 (Ybor Deck) and deck 5 (Gulf Deck) in the after part of the ship. Chapter 8 describes the probable physical course of the fire.

It has not been possible to find out exactly who first discovered the fire. The smoke was probably noticed by several people at once in different parts of decks 4 and 5 and in the bar area on deck 6. This appears to have happened a very short time after the fire had passed the initial phase.

The first crew member to become aware of the fire seems to have been the receptionist. She was alerted by several passengers who came running to the reception desk from the starboard corridor aft of the reception lobby. They had seen smoke coming up the stairwell and were shouting "Fire!". Immediately after this the receptionist saw smoke coming down the corridor towards the lobby. She immediately rang the captain on the bridge and warned him of the fire. As the captain received this message, manual fire alarms were set off in different parts of decks 5 (Gulf Deck) and 4 (Ybor Deck). These alerted the bridge and triggered lights on the fire panel indicating the parts of the ship where the alarms had been set off. At the same time the first officer returned to the bridge after having dealt with the first fire outside cabin 416.

The time was now about 0215 hours. The fire was already raging in several parts of the ship. The ship's command on the bridge, the captain and the first officer, had been alerted to the fire. They had very incomplete information of the whereabouts and extent of the fire, but their information clearly indicated that the situation was serious. A number of different measures were thus urgently required.

The measures implemented during the different phases of the fire are described and evaluated below.

9.4.2 Immediate measures

9.4.2.1 Description

a) The captain immediately ordered the first officer to sound the general alarm over the whole ship, i.e. in all the areas occupied by passengers and crew. The alarm was repeated, but it cannot be established how often this was done or for how long. It was probably sounded with some interruptions for several minutes. During the first phase the general alarm, seven short notes and one long note, seems to have been sounded. After this the fire alarm, one continual note, seems to have been sounded.

   The ship's alarm system has been described under 4.3.1.17 and 4.8.2. The Committee notes in this connection that the alarm was sounded by means of horns (mostly klaxons) mounted at different points all over the ship. None of the alarms in the accommodation areas were bells. The Committee's later investigations have shown that the sound of the alarm varied in different parts of the ship. The variations were due to the distance between the cabins and the horns, structural conditions, and the fact that certain horns marked on the fire plan were missing.

   Announcements were also made over the public address system. (See 9.4.3.2.3.)

b) The captain released the *fire doors* zone by zone on the basis of the indicator lights on the fire panel showing the zones where manual fire alarm buttons had been pressed. No general release of fire doors

was carried out. Since no fire alarm buttons had been pressed in the starboard corridor on deck 3 (C Deck), where the fire had started, this procedure left all the doors in this zone open. Other fire doors also remained open, but it cannot be determined whether these doors were relaesed from the bridge. Details are given in 8.4.2.

It has not been possible to find out exactly when the fire doors were closed. Witnesses' statements indicate that this was done successively by zones over a relatively short period. Some of the evidence indicates that at any rate some of the fire doors were not released until several minutes after the alarm was first sounded.

c) *The ventilation* to the passenger areas was turned off. This was done from the bridge, probably by the captain a few minutes after the bridge had been alerted to the fire. It is also possible, however, that the ventilation was only turned off by the chief engineer when he turned off the ventilation to the car deck some 10 minutes later. It is thus not possible to fix the time.

The ventilation system for the car deck was operated separately from that of the rest of the ship. When he tried to make his way down to the engine room the chief engineer observed large quantities of smoke on the car deck. This made him realize that the car deck ventilation was still going and returned to the bridge to turn it off. This probably occurred about 10 minutes after the bridge had been alerted to the fire.

d) The captain reduced the *Scandinavian Star*'s speed to zero by means of the combinator (which regulated both the rpm of the engine and the propeller pitch) on the bridge. The ship lost speed, while the engines were kept going. According to radar observations on the *Stena Saga*, the *Scandinavian Star* began losing speed appreciably at about 0222 hours. At about 0230 hours the ship lay still, and after this it began slowly drifting with the current and the wind, first north and later west. At this time the wind was northeasterly, about 2 m/s, sometimes up to 7 m/s, on average over 10 minutes.

After a while smoke was blown forwards over the bridge from the fire in the stern. To avoid this, an attempt was made, probably at about 0300 hours, to head the ship into the wind. However, it proved to be impossible to regain steerageway. The reason for this has not been established with certainty. It might have been a failure in the pumps delivering hydraulic pressure to the propeller pitch controls, but the cause of this failure has not been found. Another possibility is that the steering signals from the bridge to the engines failed. Manual adjustment of the propeller pitch from the engine room was not possible since at this point there were no longer any crew left in the engine room. Nor could the two bow thrusters be started, for the same reason. Thus the ship could not be manoeuvred once the propulsion system had been stopped.

e) The radio officer was woken up in her cabin by the alarm. She ran to the radio room, just behind the bridge, started the transmitter and alerted Tjøme Radio, asking them to stand by. The captain gave her the position and ordered her to signal Mayday. The signal was received and acknowledged by Tjøme Radio at 0224 hours. The *Scandinavian Star* gave its position and reported fire on board, that there were about 500-600 persons on board, and that "We are entering the lifeboats".

At about the same time as the emergency signal was sent out, the captain contacted the *Stena Saga* on VHF channel 16 (the emergency channel). The *Stena Saga* lay on about the same course, but about four nautical miles ahead. The captain reported fire on board the *Scandinavian Star* and requested the *Stena Saga* to stand by on channel 16. No further details were given. A good 5 minutes later the captain again contacted the *Stena Saga* and requested her to come alongside the *Scandinavian Star*. Immediately afterwards the *Stena Saga* turned northwards and set a course for the *Scandinavian Star*, arriving alongside at about 0250 hours.

f) The fire pumps were started and emergency flares were sent up from the bridge a relatively short time after the bridge had been alerted to the fire. The engine room was notified of the fire by telephone from the bridge.

9.4.2.2 Evaluation

9.4.2.2.1 Premises

When the fire broke out, there were certain precautions that it was essential to take as soon as possible. Among these were sounding the alarm and giving warning of the fire (internally and externally), immediate measures to contain the fire (releasing fire doors and stopping ventilation), and manoeuvring the ship as favourably as posible. As the above presentation shows, all these measures were attempted within the first 5 to 10 minutes of the alert to

the bridge. The bridge was probably alerted at about 0215 hours.

9.4.2.2.2 Sounding the alarm

In all cases of fire on board ship, warning the passengers and crew obviously takes first priority. This was especially applicable here, where there was every sign that the fire was progressing extremely rapidly, and where the time of night meant that most people would be fast asleep.

There are two aspects here that have to be evaluated: The time at which the alarm was given, and the means that were used to give it.

The alarm was sounded almost immediately after the bridge had been notified of the fire. In this respect the crew did what they could.

Witnesses' statements after the fire indicate that a great many of the survivors did not hear any alarm at all, or heard it very late during the evacuation. This may be due partly to technical causes, as indicated under 4.8. However, a contributing cause in the Committee's opinion must have been that the alarm was sounded relatively few times over a few minutes only. An almost continual sounding of the ordinary alarm ought have been an elementary precaution. Considering the information possessed by the bridge at an early stage concerning the spread of smoke into large areas of the accommodation spaces (9.4.3.2.1), it seems obvious to the Committee that every conceivable method ought to have been employed to wake sleeping passengers and alert others as quickly as possible. This was done to some extent, but it was done late and not in any organized way, as shown under 9.4.5.2.

The alarm system required continual manual operation of the alarm buttons. The Committee wishes to emphasize that such a system can hardly be said to be satisfactory, but given such a system, it should have been possible to organize activities on the bridge in such a way that someone could have been deputed to carry out this task. One of the passengers (who was associated with the shipping company) arrived on the bridge to give warning of the fire at an early stage. She was given the task of pressing the alarm buttons, but was not given any further instructions, and after 2 or 3 minutes she left the bridge because she felt she was not needed. Although it may have seemed rational under the circumstances to make use of extra capacity in this way, the Committee criticizes the fact that none of the crew members who were on the bridge at this early stage were given this task.

Giving the alarm was primarily the responsibility of the captain. He, however, had delegated it to the first officer. The blame must therefore be addressed to them both.

9.4.2.2.3 Release of fire doors

The fire doors were released from the bridge in zones, according to the location of the manual alarm buttons that had been pressed. Some fire doors were thus not released, and the others were released in stages, the last ones almost certainly a good number of minutes after the alarm had been given for the first time. We now know that the fire had at an early stage reached such a size that the correct procedure would have been to release all the fire doors at once. In evaluating the actions of the crew, however, the information they possessed at the time has to be taken into consideration. Their information was obviously incomplete and uncoordinated. But the indications on the fire panel from the manual alarm buttons showed early on that large cabin areas were affected by fire or smoke. The signals followed each other rapidly, which indicated that the fire was spreading rapidly. It was also unclear where the fire actually was. This impression of the situation is reinforced by the captain's exclamation when the first officer returned to the bridge after inspecting conditions outside cabin 416 (i.e. directly after the bridge had been notified of the fire): "There's fire everywhere!" In this situation the Committee considers that it would have been reasonable to release all the fire doors immediately, at any rate on decks 4 and 5, where the fire alarms had been activated. Releasing fire doors in particular zones presupposed a knowledge of where the fire was, and no one in fact had such knowledge.

Criticism on this point must be addressed primarily to the captain, who was head of operational command.

The captain has explained to the Committee that he thought that all the fire doors were released automatically when the fire alarm was sounded. Whether or not this misunderstanding made any difference to the speed with which the doors were released, the Committee considers it blameworthy of the captain not to have found out such fundamentally important information beforehand.

9.4.2.2.4 Stopping of the ventilation system

The way in which the crew operated the ventilation system has been shown to have influenced the development of the fire. This factor acted in combination with a number of others, however, including the times at which the fire doors were closed, which of the doors actually were completely closed, the technical

design of the ventilation system itself, and the fact that parts of it were not functioning. This is dealt with in detail under 8.4.2 and 8.4.3. It is thus difficult to establish the relative significance of the times at which the ventilation systems for the accommodation areas and the car deck were turned off. This is made more difficult by the fact that these times are not known precisely.

Turning off the ventilation hinders the spread of smoke and stops the oxygen supply to the fire. On the other hand, in certain situations the ventilation enables people to remain longer in their cabins in smoke-filled areas. However, it is generally recommended that the ventilation system should be turned off as soon as possible during a fire on board ship, and this was one of the instructions in the emergency plan for the *Scandinavian Star*. Nor did the ship's command have any information to prevent them following this practice during this fire.

Fire experts have analysed the significance of the ventilation system for the development of the fire and the spread of smoke. They have concluded among other things that as long as the ventilation system was functioning, it created an overpressure in the cabins, which helped to prevent smoke from seeping into the cabins as long as the doors were shut. This may have increased the passengers' possibilities of escape. Some of the survivors' statements tend to confirm this. Thus it cannot be excluded that some of the passengers were saved by the fact that the ventilation continued to function for some time after the bridge had been alerted to the fire.

The question of when the ventilation system was turned off is uncertain, as shown under 9.4.2.1. Both this fact and the above considerations mean that there are no grounds for criticizing the way the ventilation system was operated.

However, the Committee wishes to point out that the above circumstances indicate that the prevailing practice ought perhaps to be reconsidered. After this experience from the *Scandinavian Star*, the maritime authorities should review the recommended practice in this area. (See also 13.3.4.2.)

9.4.2.2.5 Manoeuvring of the ship

Shortly after the alarm had been given the ship's propulsion was stopped. Sufficient steerageway should probably have been maintained from the beginning. At any rate, it was sensible to try later to regain steerageway, among other things to prevent smoke from blowing over the bridge. The main reason why this was not successful was that there was no one left in the engine room at the time. If there had been they could have been instructed to adjust the propeller pitch locally, or to start the bow thrusters so as to turn the ship into the wind. Neither of these operations were possible from the bridge at this point.

When the fire broke out there was a third engineer and a motorman on watch in the engine room. They were warned of the fire by telephone from the captain on the bridge and by the alarm, which could be heard in the engine room. At no time were they in contact with the chief engineer, and at no time received any orders other than to check that the fire pumps were working. The adjusting of the propeller pitch was done directly from the bridge. At one time the third engineer tried to ring several of the engine crew, without success. Probably a little before 0300 hours the two engine crew vacated the engine room without orders and without notifying anyone. The reason seems to have been that smoke was beginning to seep through the ventilation system for the engines.

According to the emergency plan it was the responsibility of the chief engineer to ensure that the ship's technical and mechanical installations functioned as well as possible in an emergency. In this context the Committee finds the chief engineer's conduct deserving of criticism, since he did not attempt to make direct contact with the engineer on watch and give him orders as to what to do. The chief engineer did try a couple of times to reach his meeting point in the engine room, but gave up because of smoke. At the maritime inquiry, however, the chief engineer stated that it would have been possible to reach the engine room in spite of the smoke. He also stated that the smoke on the car deck when he was there only filled approximately the top third of the space. Under these circumstances the Committee considers that he could also have got hold of smoke diving equipment, for example from the car deck. Whatever the circumstances, the chief engineer was able to make telephone contact with the engine room. He should have obtained information about whether the conditions there justified evacuation. If so, he should have given instructions for measures to be taken before evacuation to ensure that the technical systems were functioning as well as possible; for example, starting the bow thruster motors.

The Committee also finds grounds for criticizing the crew in the engine room for vacating it without notice. There are no indications that it was impossible to give such notification.

When it became necessary to head the ship into the wind, and it was discovered that this

could not be done by means of the engines, other measures should have been tried. The importance of this is shown by the fact that the smoke on the bridge has been given as the most urgent reason why the captain abandoned ship at about 0320 hours (cf. 9.4.6.1 c). There were other possibilities, such as letting go the anchors (which would have acted as sea anchors if they had not reached bottom), paying out hawsers to form a drag loop around the bows, or requesting help to turn the ship from nearby vessels. At this point there were no significant smoke problems on the forecastle of the *Scandinavian Star*.

According to the ship's emergency plan, navigation in such an emergency was to be carried out under the supervision of the Continuous Run Ship/Navigation and Stability group, under the command of the first officer and with responsibility to report to the captain. Both of these were on the bridge. Criticism on this point is thus addressed to them both.

9.4.3 Command functions

9.4.3.1 Introduction

In an emergency like this, taking command and organizing the crew was esential. It was necessary to obtain an overview of the situation, direct the crew to positions where they could be of most use, and keep passengers and crew constantly informed of the situation. Furthermore, communication had to be maintained with the outside world so that help could be supplied where it was most needed. The captain was the responsible member of the crew as regards all these functions.

The emergency plan was an essential tool for organizing the efforts of the crew. Details of its preparation and content are given under 7.7.2. This plan made the senior members of the crew largely responsible for taking command and taking the initiative to carry out essential functions like fire containment and fire fighting, evacuation of cabins, etc. and of the ship as a whole, and so on. The way these functions were carried out will be described in more detail under 9.4.4 to 9.4.6. According to the emergency plan all these groups were to report to the central operational command, which according to the original plan consisted of the captain and four of the crew. When the plan was converted to fit the new conditions, these four positions were not manned. The group thus consisted of the captain only. The result was that even according to the emergency plan the captain was the senior officer in command.

In the following the execution of the various command functions during the various phases of the disaster is described and evaluated, from the moment the fire was signalled until the captain abandoned ship.

9.4.3.2 Description

9.4.3.2.1 Obtaining an overview

The captain received information about the fire and the situation on board from various sources. In the initial phase the signals on the fire panel on the bridge showed him where manual alarm buttons had been pressed. In addition he received a message from the reception desk that smoke was coming towards the reception lobby along the starboard corridor. A passenger had come up to the bridge and told him the same thing. This information was not sufficient to give him an adequate picture of the situation, except that it was serious.

More information was gathered as various members of the crew arrived on the bridge, which they did partly to obtain information themselves. This continued to happen from the time the alarm was given until the captain abandoned ship. At a fairly early stage the captain had become aware that large areas of deck 5 (Gulf Deck) aft of the hospital lobby were so full of smoke that it was impossible to move about without smoke diving equipment. It also became apparent that the starboard side of deck 4 (Ybor Deck) and the car deck were full of smoke, but that the engine room was not affected. It has not been possible to find out exactly when the various items of information reached the bridge. The Committee assumes that this occurred at the latest 10 to 15 minutes after the fire had been signalled to the bridge. At this point it should be noted that large areas of the cabin sections were full of smoke, which was preventing or at any rate considerably hindering evacuation.

At this time the captain had no information about where the fire was or how extensive it was, except for the smoke that was being produced.

Several crew members tried, separately or in groups, to penetrate into the interior of the ship, but were prevented by smoke, especially in the reception lobby on deck 5 (Gulf Deck). No other systematic attempt was made to explore the ship to find the site of the fire.

As the fire developed, it was possible to see directly from the bridge the smoke and flames rising first from the stern of the ship and later amidships. At intervals members of the crew who had been down on deck 5 (Gulf Deck) came up to the bridge and said that it was impossible to move aft of the hospital lobby without smoke diving equipment. They were unable to give more precise indications of the extent of the fire. They described how dead and unconscious persons had been found in the

corridors just aft of the reception lobby. It emerged that the staff captain and one other member of the crew (a third engineer) were using smoke diving equipment and that a search was being made of the area aft of the hospital lobby on deck 5 (Gulf Deck). This operation was being carried out on the personal initiative of the participants.

The captain received no information about whether the various emergency plan groups had been mobilized, nor did he ask for any.

Later the captain received information from various sources about conditions at the boat stations on deck 7 (Sunset Deck). At various times he was able to see the situation for himself, but the view was also sometimes obscured by smoke. He gave no orders for counts to be made of passengers being evacuated in the lifeboats. He received no information on this matter, not did he ask for it at any time.

After this, all the items of information that reached the bridge were based on the actions of individual members of the crew. No attempt was made at any time to obtain information in an organized way. No crew members made use of walkie-talkies. It should be noted that there were a number of walkie-talkies on board, some on the bridge and some in the crew's cabins. All communication with the bridge, apart from telephone conversations with the engine room, took the form of accidental encounters on the bridge during all phases of the fire after the first alarm had been given.

The emergency plan laid down that the leader of each operational group was to acquire a view of the conditions his group was to deal with. Among the most important groups in this context were the fire fighters, fire limitation group, and evacuation group. Certain conditions were immediately obvious without further investigation. But the appointed leaders of these groups made no systematic attempts at any time to obtain the necessary overview that would allow them to carry out the tasks assigned them by the emergency plan.

9.4.3.2.2 Direction and command of the crew

The captain ordered the first officer to sound the fire alarm and the radio officer to signal Mayday (cf. 9.4.2.1). He notified the engine room of the fire, and over the public address system informed the crew (and the passengers) of the fire, ordering a general evacuation. Later he ordered the chief officer to make ready to lower the lifeboats on the port side, and then ordered them to be lowered. He ordered the first officer to take charge of the launching of the lifeboats on the starboard side. At no time were any general orders given for the mobilization of the various groups according to the emergency plan or for where they should mobilize.

The leaders of the main emergency plan groups gave no orders at any time to the members of their groups. The groups were not mobilized, and were not instrumental in dealing with the situation.

In this context the Committee wishes to point out that it was later established that many of the senior group leaders had no idea which emergency plan group they belonged to or what functions they were supposed to carry out.

Nor was the limited cooperation that did take place between various members of the crew at various times during the disaster prompted by instructions or orders from superiors, but appeared to be entirely fortuitous. Several examples of this will be given below. Main examples are the smoke diving efforts, the fire limitation attempts on the after part of deck 7 (Sunset Deck), the evacuation of individuals from the interior of the ship and from the after mooring deck on deck 5 (Gulf Deck), the distribution of life jackets, and the lowering of the lifeboats. There were few examples of such operations being carried out under formal orders or instructions, still less of any sign of organized leadership. The main exceptions are at the beginning, with the orders to sound the alarm and evacuate the ship, and at the end, when the order came to lower the lifeboats.

9.4.3.2.3 Information to the crew and passengers

The first and most important information was the fire alarm (cf. 9.4.2.1).

In addition, a message was broadcast over the loudspeakers that there was fire on board and that everyone was to proceed to the boat deck and put on life jackets. Everyone was asked to remain calm. The message was given in Norwegian and English by the captain, the first officer, and later the staff captain. The times of these messages are unclear. The first one was probably broadcast shortly after the alarm had been given for the first time, and after this it was repeated at various intervals, but it has not been possible to establish the details.

Some time later a corresponding message was broadcast in Portuguese by a Portuguese member of the crew who had arrived on the bridge.

The message was broadcast that the *Stena Saga* was close by and that everyone should therefore remain calm. This was repeated several times.

No other information or messages were

broadcast over the public address system to the passengers.

No special messages, etc. were given to the crew.

9.4.3.2.4 Communication with the outside world

The captain ordered Mayday to be signalled at 0224 hours. At the same time he contacted the *Stena Saga*, cf. 9.4.2.1. After this the captain took contact with the *Stena Saga* five times before abandoning ship at about 0320 hours. No further direct contact between the *Scandinavian Star* and Tjøme Radio or other external rescue stations took place during this period.

One of the main impressions made by this communication is that the captain provided little specific information about the situation on board the *Scandinavian Star*. He mentioned that there was fire on board, the approximate number of persons on board, that the passengers and crew were entering the lifeboats, and whether he thought there was anyone left on board. The last-mentioned item is described under 11.4.6. No information was given about how many had entered the lifeboats, nor was there any such information, as shown under 9.4.3.2.1.

The *Scandinavian Star* did not ask for specific assistance at any time, except by requesting the *Stena Saga* to come to the rescue. For example, no requests were made for assistance in smoke diving or extinguishing the fire.

9.4.3.3 Evaluation

One of the main bases for the conduct of the ship's command during the fire was the ship's emergency plan. As mentioned under 7.7.2, the contents of the emergency plan and the way it was drawn up are open to criticism. Furthermore, the fact that the crew were not given the opportunity to become familiar with their functions under the emergency plan or to practice them in cooperation in fire and abandon ship drills must be criticized. The primary purpose of such drills is to make it possible to organize the efforts of the crew in a rational and effective way. Thus at all levels the crew lacked important necessary conditions for an effective performance when the fire broke out.

Another important factor influencing the conduct of the operational command during the fire was of course the physical course of the fire, especially the speed at which the flames and smoke were spreading. A further significant factor was the lack of an automatic system of fire detection, based on heat or smoke, in the area concerned (which the ship was not obliged to have according to the rules, cf. 4.2 and 4.3.1.2). These factors made it difficult to gain an overview of the situation, and especially difficult to establish where the fire was actually burning during the early phase. This in turn affected the practical possibilities for notifying the passengers and crew, instructing the crew, and directing the external rescue work.

In the Committee's opinion, however, the ship's command failed on several points during the disaster. There was both the opportunity and the possibility of doing more than was actually done in relation to all four of the leadership functions described under 9.4.3.2.

The most important condition for effective action by the crew was that the key officers gained as accurate as possible a picture of the situation and then directed the crew's efforts in the most suitable way. This they failed to do.

None of the key officers attempted at any time to actively acquire a systematic picture of the situation. No coordinated channels of information were set up, no arrangements were made for effective communication (e.g. by walkie-talkie), and no attempts were made to obtain status reports from various parts of the ship. Since no operational groups were established either, as presupposed by the emergency plan, no organized reports were made of what was in fact being done. Even under the difficult conditions prevailing, the information possessed by the senior officers was at all stages more haphazard than it need have been.

No attempts were made to find out how many people were in the lifeboats being launched from the ship. The Committee wishes to point out that the operational command thus lacked a highly relevant item of information when they had to assess the need for continuing to search the ship. We now know that at this time, from about 0300 hours, all the 158 persons who remained on board had probably already died. However, it was not possible to have known this at the time, and it was therefore a serious error not to have tried to count those leaving the ship. If such knowledge had been available the information to the external rescue services would have been even more alarming than it was. The need for massive smoke diving efforts would have been obvious. Criticism for this must be addressed mainly to the captain, but the chief officer and the first officer, who had been ordered by the captain to be in charge on the port and starboard boat decks respectively, should also have thought of organizing a count. Counting would have been an obvious task for the crew members who were assigned by the boat and raft launching plan to command the various boats during an evacuation.

A recurring impression is that many of the

senior officers were unaware of or ignored their leadership functions and instead acted on an impromptu basis. As shown by the descriptions of these actions below, their efforts were in themselves often praiseworthy, and sometimes exceptional, but this did not prevent them from lacking in leadership. No one organized the efforts of the crew that were necessary to evacuate passengers from the interior of the ship, no one tried to organize efforts to limit or extinguish the fire. The total efforts of the crew were thus unorganized and much less effective than they could have been. This conduct definitely deserves criticism, in the Committee's opinion. Even though it must be accepted that the situation made it difficult to organize the crew effectively, the fact remains that few attempts were made to do so, and that whatever could have been done was not done. This criticism is addressed to the senior officers in their capacity as leaders of operational groups under the emergency plan, and primarily to the captain as leader of the operational command.

As a consequence of the lack of any overview of the situation (cf. the above criticism), the loudspeaker messages addressed to the passengers and crew were necessarily fairly general. These people must also have had a very indistinct picture of what was happening. Any information in such a situation would have been useful, and all information would need to be repeated many times, since it could not be relied on to be understood or heard everywhere. The ship's command does not seem to have been sufficiently aware of these considerations. The loudspeaker messages were repeated several times, and in Norwegian, English, and Portuguese. But the information was limited to the fact that there was a fire, that people should proceed to the boat deck, and that the *Stena Saga* was close by. No information was given to either passengers or crew about what was happening, and no instructions about what to do apart from keeping calm. Not were they notified that the fire doors had been or were being closed, which might have made it easier to find the way out. In general the Committee considers that the public address system should have been used more often and more effectively, even taking into consideration the small amount of information possessed by the ship's command. It was primarily the captain's responsibility to have seen to this.

The first communication between the *Scandinavian Star* and the rest of the world, the Mayday signal and the signal to the *Stena Saga*, are dealt with under 9.4.2.1. In Chapter 11 the Committee considers in several places the significance of the information from the *Scandinavian Star* (cf. especially 11.4.3.2.2 and 11.4.6). Information from the *Scandinavian Star* was essential for the coordinators of the rescue forces if they were to take suitable action, especially in the early phase. The situation on board could not be judged from outside. This must have been obvious to those in command on the *Scandinavian Star*. For this reason it was a serious error not to have provided continuous information on the situation on board. If smoke had prevented access to the permanent radio installations, as it did in periods, one of the portable radio sets could have been used instead, as indeed it was later on.

This criticism of the lack of up-to-date information underlines the previous criticism of the senior officers' failure to do what was possible to obtain an overview of the situation and of the number of missing persons. However, even the little information they did have at times was not clearly conveyed. Even this information would have been valuable in a rescue operation. The fact that the rescue coordinators could also naturally have asked specific questions does not relieve the *Scandinavian Star*'s command from its responsibility. The criticism is addressed to the captain as leader of the operational command.

There was one particular central point where the Committee considers that the operational command on the *Scandinavian Star* had the opportunity to provide specific information. It became obvious at an early stage that evacuation below decks would require smoke-diving equipment, and also that there must have been people in the interior of the ship who needed help to come out. All in all, this should in the Committee's opinion have caused those in command to realize at an early stage that massive smoke-diving efforts would probably be called for (cf. 9.4.5.1). In such a case their failure to request assistance for smoke diving from the external rescue services (cf. 11.4.3.2.2) must be criticized. Here, too, the Committee considers the captain to be most at fault.

9.4.4 Fire fighting and fire limitation

9.4.4.1 Description

No real attempts to *fight the fire* were made at any time.

Under the emergency plan fire on board was to be fought by the fire fighters, who were to assemble on the orders of the operational command (the captain). This did not happen. Neither the leader of the group (the staff captain) not its members made any systematic attempt to find out the location of the fire or whether

the group ought to have been mobilized, or to fight the fire. It was later established that the leader of the group was not aware of his position under the emergency plan.

The fire patrol tried early on, presumably immediately after the fire had been signalled to the bridge, to make use of a fire hose in the reception lobby, which he directed down the starboard corridor running aft. He had to give up very soon, however, because of the smoke. Two members of the crew also connected a fire hose in the bar area on deck 6 (Main Deck), but the smoke drove them away before it could be used. Otherwise a fire hose was used on the after part of deck 7 (Sunset Deck) to cool down a lifeboat and the area around the emergency generator room, which threatened to catch fire at a relatively late stage before the ship was abandoned.

The emergency plan assigned a separate fire limitation group to *limit the spread of the fire* in addition to the above-mentioned fire fighters. The fire limitation group was to assemble on the orders of the operational command (the captain). This did not happen. Neither the leader (the chief officer) nor its members made any attempt to find out where the group should assemble or to carry out any of the measures it was supposed to be responsible for. It has since been established that the leader of the group had little knowledge of his own or his group's functions under the emergency plan.

The release of the fire doors and the stopping of the ventilation have been dealt with under 9.4.2.

The chief engineer closed some of the fire dampers in the pantry on the port side of deck 7 (Sunset Deck). He only closed the dampers from which smoke was issuing, since he had to leave his task because of the heat and smoke on the deck. This occurred after the ventilation had been turned off.

Apart from the above-mentioned attempts and the cooling down of a lifeboat and the area around the emergency generator room on deck 7 (Sunset Deck), no other form of fire limitation was attempted.

9.4.4.2 Evaluation

Considering the design and equipment of the ship (especially the signalling system to and from the bridge) and the rapid development of the fire and smoke spread, the fire experts concluded their report by stating that the crew had "extremely limited possibilities for ... extinguishing the fire".

The Committee is aware that even large ship fires can be put out by a determined use of fire hoses with spray and jet nozzles. It cannot be excluded that such action might have produced results in this particular case. But however uncertain the results of efforts to extinguish the fire might have been, the Committee does not feel that this excuses the crew for not having at least tried. When the alarm was first sounded, large areas of the passenger accommodation were filled with toxic smoke. It was therefore natural to give priority to evacuation rather than to putting out the fire. But the evacuation that was being carried out cannot be said to have exhausted the available resources. The effect of the resources that were used could presumably have been increased if they had been combined with fire limiting and fire fighting activities.

If fire fighting and fire limitation had been initiated at this point, it would have been necessary to use smoke-diving equipment. According to the fire and safety plan the ship was equipped with seven sets of smoke-diving equipment distributed at various points outside the engine room and two breathing apparatuses (smoke-diving equipment without fire suits) in the engine room. Only three sets of smoke-diving equipment were made use of for evacuation purposes. The remaining four sets and the two breathing appliances in the engine room could relatively easily have been fetched, if necessary with the help of a smoke-diving appliance, and used for fire fighting and fire limitation.

It would have been understandable if all the equipment had been used for evacuation purposes. But it must be assumed that an organized evacuation search in the relevant areas, which in places were extremely hot, would in itself have required the use of fire hoses to achieve entry.

In any case the crew deserves criticism for not having assembled or established a fire group using the remaining smoke-diving equipment. If evacuation had been found to require priority later, the equipment could have been diverted to this purpose.

Only a few fire dampers were closed, and this was done at a fairly late stage. The fire experts concluded in their report that this helped to keep the air in the cabins with closed doors relatively free of smoke for a longer period than if the ventilation had been stopped and the dampers closed at an earlier point (cf. 8.4.3). It cannot be excluded that this might have helped some people to save themselves from smoke-filled areas. The experts did not find evidence that the open dampers had a negative effect on the course of the fire.

Thus the Committee finds no grounds for criticizing the crew for not closing the dampers, in spite of the fact that this is recom-

mended practice and was included in the emergency plan. However, the Committee wishes to point out that this practice should be reviewed together with the recommended practice for ventilation systems in case of ship fires (cf. 13.3.4.2).

9.4.5 Evacuation from the interior of the ship

9.4.5.1 Description

Most of those who managed to escape from the interior of the ship did so without help. Some passengers, however, were helped by members of the crew. The help took various forms, from pointing out escape routes to carrying unconscious passengers out on deck. Some of the crew members who were helping had smoke-diving equipment, but most of them had no equipment at all and acted individually. There was absolutely no organized evacuation, contrary to the instructions in the emergency plan. No evacuation group was mobilized.

The Committee does not consider it necessary to give details of the evacuation efforts of individual crew members, such as shouting down corridors, directing passengers, carrying or dragging unconscious passengers outside, or banging on cabin doors. The main impression is that certain crew members acted rationally and effectively under the circumstances, lacking as they did any instructions and having to form their own judgments as to what had to be done.

It rapidly became obvious that a longer stay in the cabin areas required smoke-diving equipment. Several members of the crew began to experience difficulty in remaining there, especially on deck 5 (Gulf Deck). Without smoke-diving equipment they had to give up trying to evacuate people from these areas.

One of the able seamen put on smoke-diving equipment at a relatively early stage of the fire. He tried to save a person he found lying in a corridor near the reception lobby but had to give up. At about the same time one of the engineers put on a smoke-diving appliance and together with another member of the crew carried three people from the reception lobby to safety on the open deck.

The most intensive smoke-diving efforts were made by the staff captain, some of the time in cooperation with one of the third engineers. They first went separately down to the hospital lobby and reception area without equipment and helped several people out. The smoke rapidly became too dense and on the initiative of the staff captain they put on smoke-diving equipment after informing the captain on the bridge. Together they searched the cabins on the starboard side and later on the port side aft of the hospital and reception lobbies by banging and kicking closed doors and looking into open cabins. They saved three people. They renewed their air supply several times, went up to the bridge several times to report, and continued their search. The staff captain continued his efforts alone while the captain and remaining officers abandoned ship.

9.4.5.2 Evaluation

a) There is no doubt that a large number of the people on decks 4 and 5 when the fire broke out were completely dependent on help in the form of physical help or directions in order to get out. The area rapidly filled with smoke and it was difficult to find one's way. Closed fire doors made it even more difficult, and so did the signs, which were deficient and in some cases misleading (cf. 4.3.4). It was later established that a considerable number of bodies were found in areas of corridor that showed that they had lost their way.

   In order to escape, it was essential for many of those in the accommodation areas to be woken up. The efficiency of the alarm system depended on the various alarms going off as they should and being loud enough to wake sleeping passengers in all the cabins. It was later established (cf. 4.8) that not all the alarms were loud enough in all parts of the ship. At this point, however, there was no indication that any of the alarms were inadequate, and in the first phase the crew could reasonably have assumed that the alarm system was serving its purpose. However, alerting the passengers was so fundamentally important that all possible means to this end should have been employed as soon as possible, such as banging on cabin doors and making as much noise as possible in the cabin areas. This should have been the first step in the evacuation procedure.

   Evacuation efforts on the part of the crew would thus have had a significant effect on the outcome of the disaster. The question is whether their performance, under the circumstances, could have been better than it was.

b) Some members of the crew made laudable, and some indeed admirable, efforts to evacuate passengers, and exposed themselves to risks, some of them very serious, in order to help people escape from the smoke-filled areas.

   However, the interior of the ship was evacuated without any systematic organi-

zation and without any attempt to mobilize the appointed evacuation groups. It was therefore quite haphazard and unorganized, and in all important respects it was based entirely on the judgment and initiative of individual members of the crew. No equipment of any kind was made use of apart from three smoke-diving sets, and even then no organized attempt was made at smoke-diving, so that this, too, was a result of individual initiative and not of organized leadership.

An important question is therefore whether the evacuation could have been organized better, with special reference to smoke diving.

c) Practical exercises in the form of abandon ship and fire drills and a greater familiarity with the ship on the part of the crew would almost certainly have greatly improved their chances of carrying out a proper evacuation. This also applies if the clear allocation of responsibility by the emergency plan for the leadership and the operational side of the evacuation had been followed. However, this failed because the crew were not familiar with the emergency plan and had no practical experience of it and because no attempt was made to implement it (cf. 9.4.3.3).

Since the accident there has been criticism in several quarters of the fact that not all the crew had sufficient command of a Scandinavian language or English to direct the passengers during the evacuation. It has been established that many of the crew lacked such language skills (cf. 6.3 and 6.4). The Committee has not found any examples where this factor had any practical influence on the evacuation. The Committee does wish to emphasize, however, the undesirability of a situation where such communication problems could have occurred.

d) Evacuation activities in the interior of the ship became almost impossible at an early stage without smoke-diving equipment. The few crew members who tried this collapsed themselves because of the smoke. During the relatively short period from the sounding of the alarm until smoke-diving was required, a certain amount of organization of evacuation efforts could have been done if anyone had assumed responsibility for it.

At least seven complete smoke-diving suits were available, either directly or by using smoke-diving equipment, in various parts of the ship. In addition there were two breathing masks available in the engine room. Furthermore there were a number of reserve cylinders available and a system of refilling the used cylinders from a compressor on deck 8 (Bridge Deck), which was still accessible. Normally it takes about 5 minutes to put on the suit and equipment. In addition there is the time taken by the divers to reach the muster stations after hearing the alarm.

At a very early stage it was clear to the ship's command that smoke diving would be necessary (cf. 9.4.3.2.1). The Committee finds it difficult to accept that such efforts were not mobilized to a greater extent than they were. The failure to inform the external rescue services of this need is dealt with under 9.4.3.3.

The leaders of the fire fighting, fire limitation, and evacuation groups should have noted this need. However, the Committee considers that the captain, as head of operational command, bears the main responsibility. It was primarily his duty to obtain an overview of what was happening and to organize the efforts of the crew in accordance with the most urgent needs.

It may legitimately be asked what effect a disciplined early smoke-diving operation would have had. Evaluating rescue operations by the crew was outside the mandate of the fire experts, as they pointed out in their report. Under the circumstances revealed by their investigation and analysis, they state in their report that the fire development and smoke spread were so rapid that the crew's possibilities for rescue efforts were very limited. The Committee has interpreted this statement to mean that the experts do not exclude the possibility that an early organized effort using the available smoke-diving equipment might have saved more people. Nor is the possibility of such efforts excluded, and there is no indication they ought not to have been made. The experts have confirmed to the Committee that this interpretation is correct. As appears below, there is no disagreement between the Committee and the experts on this point.

The results of a fully equipped smoke-diving operation at an early stage cannot naturally be established. The efforts that were actually made, especially by the staff captain, resulted in several persons being saved from the smoke-filled areas. It may be assumed that some of these would have saved themselves, but others would not. This is a clear indication that more people could have been saved if more smoke divers had carried out an organized search of the passenger accommodation.

9.4.6 Evacuation of the ship

9.4.6.1 Description

a) After the alarm had been sounded, passengers and crew began making their way out onto the open deck.

Some of them arrived first on the forecastle or poop deck (after mooring deck), i.e. onto the open decks fore or aft on deck 5 (Gulf Deck). Directed by a member of the crew, some of them then climbed from the forecastle over the forward part of the superstructure and up to the boat stations on deck 7 (Sunset Deck). From the poop it was possible at first to go up the companion ladders to deck 6 (Main Deck) and from there to reach deck 7. After a while the fire prevented people from using this route, and several passengers and crew remained on the poop deck (see d below).

Some people came out on deck by the swimming pool (which was empty) aft on deck 6 (Main Deck) and were forced by the fire from there up to deck 7 (Sunset Deck).

Most people, however, came directly out onto the port or starboard sides of the open deck on deck 7 (Sunset Deck). Gradually most of the passengers and crew gathered here, and from here most of them were evacuated in the ship's own lifeboats. There were more people on the port side.

Conditions at the boat stations were relatively good at first, but after a while billows of dense smoke from the fire began drifting forwards over the deck. They reduced visibility and sometimes made it difficult to breathe, especially on the port side. For a while the fire threatened to spread to the area around the emergency generator room. The situation was undoubedtly felt to be dangerous by the people on the deck but at no time was it critical. There seems to have been a tendency to panic at times on parts of the deck, especially during the boarding of the boats, and especially when the smoke was at its densest. After a while the captain sent repeated messages over the loudspeakers that the *Stena Saga* was close by and that there was no need for panic. This seems to have had a calming effect for a while.

b) The actions of the crew on deck 7 (Sunset Deck) fell into three main categories: distribution of life jackets and warm clothes, lowering of the lifeboats to boarding height and later onto the sea, and reassuring and directing the passengers, including assigning them to the various boats. The emergency plan groups for boat and raft preparation were not mobilized, nor were the groups that according to the boat and raft launching plan (cf. 7.7.2.4) were to be in charge of the individual lifeboats. The crew's actions were mainly individual and unorganized. The first officer and chief officer were ordered by the captain to take charge of the launching of the lifeboats on the starboard and port sides respectively, but during the launching they went from one side to the other.

Many of the passengers, and some of the crew, had very few clothes on. There was some wind and the air temperature was 2 to 3 degrees above freezing. Several crew members fetched blankets and clothes from their own cabins on decks 7 and 8 and distributed them.

Life jackets were stored in lockers by the boat stations on deck 7 (Sunset Deck), and were handed out by members of the crew and some passengers. Most of the life jackets were stored in lockers right at the top of the ship on deck 9 (Sun Deck). Several crew members and some passengers climbed up there, opened the lockers, and began throwing the life jackets down onto deck 7. Members of the crew on deck 7 handed them out and helped passengers put them on. In this way many people received life jackets and many of these put them on before leaving the ship. Some, however, did not receive life jackets. In some cases this was because they did not have time to get hold of life jackets before entering the lifeboats, but in other cases it seems to have been due to a misunderstanding as to which lockers had been emptied, leading to the idea that there were no more life jackets left. No one seems to have fallen into the sea at any time during the evacuation.

The lifeboats were lowered to the level of deck 7 so that they could be boarded. This probably occurred after 0230 hours. As mentioned above, the captain put the chief officer in charge of the lowering on the starboard side and the first officer in charge of efforts on the port side. The work was done partly by these officers and partly with the help of crew members who happened to be available. During the lowering to deck 7 one of the boats caught on a small davit which by mistake had not been swung in after being used for operating the gangway in port. This boat was no longer usable, but the other nine were lowered without difficulty and ready for boarding.

The boat and raft launching plan had appointed certain members of the crew as commander and second-in-command of each boat, and had delegated other impor-

tant tasks. It also distributed passengers and crew among the boats. The commanders' responsibilities included being in charge of embarkation, lowering the boat, releasing the boat from the falls, and navigation. These instructions were transferred unaltered from the ship's previous trade without any adjustments to take account of the greatly reduced numbers of crew the ship was now sailing with. Nor had any drills been held to familiarize the crew with their tasks, as described in detail under 7.7.2 and 7.8.

None of the appointed boat commanders functioned as such during the evacuation. This was due to several factors. Most of the commanders were unaware of the role allotted to them in the instructions. Others gave priority to other tasks without, however, ensuring that they were replaced. The same applied to the other crew members who had been allotted specific lifeboat evacuation tasks. Some of these did embark in the lifeboats they had been assigned to, and some even performed the tasks they had been given. However, the main impression remains that all operations relating to the lifeboats were carried out in a haphazard and disorganized way, except for the orders for preparation and later for launching, which were given by the captain.

The passengers and crew entered the lifeboats partly on their own initiative and partly under the direction of members of the crew. No counts were made at any time of the number of people in the boats. Some boats were reasonably full, others were almost empty.

At about 0300 hours the first officer judged the smoke conditions on the port side to be so difficult and dangerous that he went up to the bridge and requested the captain's permission to start launching the lifeboats. Permission was immediately given and the first officer ordered the port lifeboats to be lowered, four in all, since one was unusable.

A little later, probably at about 0310 hours, the captain gave orders over the loudspeaker for the starboard lifeboats to be launched, except for boat no. 1, which was to be kept for the remaining crew and any further passengers.

The boats were lowered by the crew. Although they were all finally waterborne, both lowering and release from the falls encountered difficulties, some of them due to difficult smoke conditions. After leaving the ship's side, the boats reached the other vessels that were gathering in the neighbourhood. Only one of the lifeboat motors could be started. The other boats drifted, were rowed, and after a while were towed over to the rescue vessels. The journey took a considerable time in some cases, even though the distances were relatively short.

c) At about 0320 hours the captain decided that the smoke conditions on the bridge made it impossible for him to remain there. Taking with him a walkie-talkie he boarded lifeboat no. 1 (furthest forward on the starboard side), together with among others the chief officer, first officer, chief engineer, and radio officer. A number of passengers and some crew were already in the boat. The boat was launched and rowed over to the *Stena Saga*,which lay some hundred metres from the starboard side of the *Scandinavian Star*.

At this point there were still a number of people left on the *Scandinavian Star* in addition to those who were finally left on board. The staff captain, equipped with a smoke diving appliance, was still searching aft of the reception lobby on deck 5 (Gulf Deck), and there were crew and passengers on the after mooring deck on deck 5. The captain knew that these people were still on board. Afterwards it was found that even more passengers and crew were still on board and in a condition to be rescued. More than 30 people were rescued from the *Scandinavian Star* after the captain had abandoned ship.

During the journey over to the *Stena Saga* the captain had contact with the *Stena Saga* via the walkie-talkie (0322 to 0328 hours, with a couple of interruptions). During this dialogue the question was raised as to whether there was anyone left on board the *Scandinavian Star* (cf. 11.4.6 for details).

d) At a fairly early stage of the fire a number of passengers and crew had gathered on the open deck by the swimming pool aft on deck 6 (Main Deck). The fire prevented them from climbing the external companion ladder to the boat stations on deck 7 above. They were therefore led down one deck by the crew to the mooring deck aft on deck 5 (Gulf Deck). They could only escape from this position by means of external help. They were still there when the captain abandoned ship.

Probably at the captain's request a rescue boat was sent to the stern of the *Scandinavian Star* to take on board the people on the mooring deck. A couple of crew

members had rigged up some of the scaffolding used for painting, so that it was possible by means of ladders to descend to the scaffolding and further from there to the rescue boat (a height of about three decks). Several people climbed down to the scaffolding before the rescue boat arrived, to avoid the smoke. It was especially difficult to get the children safely down to the scaffolding and over to the rescue boat. The crew improvised by using the protective tarpaulins for the capstans as sacks in which to lower the children.

At about 0340 hours the first helicopter arrived at the *Scandinavian Star*. The passengers and crew who remained on board were gradually all rescued from the *Scandinavian Star* by being hoisted up into helicopters. In some cases crew members provided assistance by fastening harness straps, etc.

9.4.6.2 Evaluation

a) The ship was not evacuated in accordance with the established evacuation plans. Nor did the crew follow any other organized plan, except when the captain appointed officers to be in charge of either side of the boat deck and later ordered the lifeboats to be lowered.

It is difficult to obtain a clear picture of the evacuation as a whole. Some witnesses claimed that the atmosphere at the boat stations showed a tendency to panic, that the crew made no attempts to organize or direct the passengers, and that almost everything was left to the passengers. Others maintained that the evacuation functioned reasonably well under the circumstances.

The Committee wishes to make the following points.

The crew primarily lacked routines for cooperation and handling the equipment of this particular ship. This lack was due to the fact that many of the crew had not been made familiar with the equipment, operations, or organization, either through boat drills or in any other way.

The lack of routines could to some extent have been compensated by effective organization. However, the fact that most of the crew did not know their positions under the lifeboat plan meant that any organization had to be improvised. This was only successful to a limited extent. No boat commanders were appointed on the spot, either for embarking or lowering the boats. The distribution of life jackets was not properly organized, which must have been the main reason why a large number of people left the *Scandinavian Star* without jackets, in spite of the fact that a sufficient number were available.

The most serious consequence, however, of the lack of organization was that the operational command had no idea of how many people had left the ship in the lifeboats, nor was there any awareness that this was necessary. This had significant consequences for the rescue operation, as described under 11.4.6 and 9.4.3.3. The smoke conditions may have made counting difficult, but it was obviously not impossible.

During the evacuation there were also difficulties in communication between crew members and between crew and passengers, both on deck and in the lifeboats. The Committee has not found evidence of any serious consequences resulting from this. But the Committee considers it most unfortunate that on passenger ships in this type of service some members of the crew are not able to receive instructions or to direct and inform passengers in an emergency because of language difficulties.

As individuals, many of the crew behaved in a praiseworthy fashion during the evacuation. The Committee wishes to emphasize especially the good seamanship exhibited by the crew who improvised with scaffolding, etc. on the after mooring deck in order to help passengers over to the rescue vessel. Other crew members were undoubtedly of great help to passengers by supplying them with warm clothes, keeping them calm, and directing them.

However, the Committee feels obliged to point out that during the evacuation of the ship as well as otherwise, the crew had no overall leadership, and therefore did not act as a unit. Individual improvisation was only too predominant and only partly successful. This criticism must be addressed to the members of the crew who were assigned specific tasks under the boat and raft launching plan and who were not familiar with the plan. But it is primarily addressed to the captain, who was supposed to organize and take command of this part of the emergency operation as well.

b) Since the disaster the question has been raised in many quarters as to whether the captain should have remained on board and should have ordered other members of the crew to remain as well.

The Committee is of the opinion that he should have remained, for several reasons. The most important was that there were

obviously still people on board. Some of these were on deck (especially the group on the after mooring deck) and needed help to leave the ship. Others were still below decks according to reports from the smoke divers who had been down and investigated. There were no indications that a systematic search had been made of all the areas that could be searched with smoke-diving equipment and where there might still have been people. Not all the smoke-diving equipment on board was in use, and more equipment could have been obtained from other vessels as they arrived. Under these circumstances the Committee considers it obvious that a further attempt to search the ship should have been organized. The captain's role in this context was central. In any case he had a duty to remain on board as long as it was unclear whether every possible person had been rescued. Furthermore, his presence would have facilitated the task of the rescue services that were under way.

The captain has stated that he was able to be of more use on board the *Stena Saga*. The Committee's response to this is that even if the captain could have been of use there, it is difficult to see how this usefulness could under any circumstances have been greater than his presence on the *Scandinavian Star*.

The captain must have been aware, in the Committee's opinion, of the circumstances indicating that he and other members of the crew should have remained on board as long as possible. The remaining question is therefore whether it was possible in practice for him to remain on board.

The captain has himself explained his departure from the ship at about 0320 hours as being due to the smoke conditions on the bridge. The statements of other witnesses and the video recording made on the *Stena Saga* during the relevant period have convinced the Committee that the smoke did make it difficult at times to remain on the bridge. However, it is difficult to see that the smoke made it permanently impossible to remain in any part of deck 8 (Bridge Deck). In any case, conditions were considerably better on the open forward part of deck 7 (Sunset Deck), i.e. directly below the bridge, and on the forecastle, i.e. the open forward part of deck 5 (Gulf Deck). It would in fact have been possible to have remained in both these places during the whole of the fire, and they were both accessible from the bridge. Communication with the rest of the ship could have been maintained by walkie-talkie. Furthermore, the Committee considers that it would have been possible to head the ship into the wind, even without using the engines (cf. 9.4.2.2.5).

On these grounds, the Committee considers that it was the captain's duty to have remained longer on board, and to have ordered other members of the crew to remain as well. The Committee also considers that the captain had the opportunity to remain without exposing anyone to an unacceptable risk. In this connection the Committee wishes to point out that the captain was aware that helicopters would be arriving within 15 to 20 minutes and that anyone still on the ship would be able to be rescued by them even if the lifeboats were out of action. Under these circumstances the Committee considers that the captain's conduct in abandoning ship as early as 0320 hours is to be criticized.

The Committee wishes to make the point here that it is highly probable that those who were found dead on the *Scandinavian Star* were already dead when the captain abandoned ship. However, this assumption could not have been made at the time.

9.5 EVALUATION OF THE CONDUCT OF THE CREW AS A WHOLE

Taken together, the actions of the crew during the fire present a picture of a lack of coordination and leadership at all stages from the discovery of the fire until the final evacuation of the ship. The operational command never functioned as laid down in the emergency plan and the senoir officers never mobilized their emergency groups. This meant that the members of the crew acted most of the time on an individual basis, and that they never conducted themselves as an organization.

The individual efforts naturally varied. There were examples of very good seamanship and of obvious errors of judgment at all levels. On average the conduct of individuals was as would be expected under the circumstances, given the fact that no attempts were made at organized efforts. However, the conduct of the crew as a whole deserved criticism on a number of points.

The first error was made at a very early stage, when no efforts were made to try to protect the ship from further arson attempts even though the presence of a pyromaniac aboard was suspected.

The signalling of the disaster fire to the bridge and the subsequent alarm of the whole ship went well. Whether the immediate pre-

cautions required by the situation were carried out as they should have been is more uncertain. The release of the fire doors should have been handled differently (cf. 9.4.2.2.3). No serious attempts were made to contain or extinguish the fire, and no attempt was made even to mobilize the fire fighting group. The Committee finds this deserving of criticism. The effect of the evacuation efforts would presumably have been greater if they had been combined with measures for limiting and extinguishing the fire. Evacuation of the interior of the ship was obviously the most immediate concern. But even here no organized efforts were made. The evacuation was therefore carried out in a haphazard way based on the initiative of individual members of the crew. This also applied to the smoke diving, which very soon became the most important course of action available to the crew for evacuating the interior of the ship. Not all the available equipment was used, and no organized search was made of the passenger accommodation. The evacuation of the ship itself went better. The crew succeeded in embarking those who had reached the boat deck into the lifeboats. But here, too, there was no overall leadership, and the crew failed to function as a unit.

The fact that the crew did not at any time act in cooperation was not only due to the lack of leadership during the emergency itself. It should be emphasized that most of the crew had a very poor knowledge of the ship and of the emergency plan. This was due among other things to the fact that no fire or abandon ship drills had been carried out, in spite of the fact that most of the crew were new to the ship. However, even with such drills, it would have been difficult for these members of the crew to have become familiar with the ship and with each other in the course of the few days they had spent on board. This situation was aggravated by the hard pressure of work that most of the crew had been under during these first few days (cf. 7.6, 7.8, and 7.9). Finally, it must be emphasized that the fire developed and the smoke spread extremely rapidly from the moment the fire was discovered. This in itself considerably limited the efforts of the crew, especially the possibilities for organizing them.

In this chapter the Committee has described many actions on the part of the crew that deserve criticism and some deserving praise. It concludes with a summary of situations in which the Committee considers more efforts could and should have been made during the fire.

First of all, attempts should have been made to organize and coordinate the actions of the crew as far as possible under the circumstances. This was the most important general condition for an effective performance on the part of the crew. The need for an urgent and thorough search by smoke divers of the passenger accommodation should have been noted. This should have resulted in an effective organization of the available resources and immediate and specific requests for help to the external rescue services. Finally, the persons entering the lifeboats should have been counted in order to provide proper grounds for assessing the need for further rescue work.

The Committee wishes to emphasize that although the actions of the crew, both individually and as a whole, after the outbreak of the fire may be criticized on a number of points, they are characterized by the fact that a fundamental basis for effective action was missing. The foundation for effective action should have been laid before the situation arose. All members of the crew should have been involved in drills and otherwise become familiar with the ship, the emergency plan, and the cooperation between each other that is necessary in an emergency. This would have taken time. Thus when evaluating the crew's conduct during the fire it is a significant factor that the ship was made operational only a few days before the disaster and before such operation was justifiable from a safety point of view (cf. criticism under 7.8).

10. Safety, Regulation, and Control

10.1 INTRODUCTION. OVERVIEW

For reasons of safety, detailed rules have been laid down governing ships and crews. Some of these rules are international and are embodied in treaties and agreements. Some are national and are part of the domestic law of the country concerned.

The rules governing ships and crews contain provisions relating to construction, machinery, technical equipment, safety and life-saving equipment, requirements with respect to safe manning, the crew's training, and so on. The most important of the material requirements that are applicable to a review of the *Scandinavian Star* disaster are dealt with under 10.2 and 10.3.

The responsibility for compliance with these rules lies primarily with the owner and/or the master. However, international conventions and national legislation have also sought to ensure compliance by establishing verification systems involving inspection, certification, and control. A number of different agents are involved in the follow-up and control system. The flag state, the country where the ship is registered, has been assigned essential control functions. Some degree of control is also exercised by the port states, countries at whose ports foreign ships call. The regulatory basis for and the practical exercise of flag state control and port state control are treated under 10.4. Here the Committee will also examine the control system to which the *Scandinavian Star* was subject (cf. 4.4).

The classification societies *class* the ships, in other words they verify that the ship complies with the rules laid down by a particular society for a particular class. This has to be done, among other reasons, in order for the ship to obtain insurance. However, classification societies also perform tasks that extend far beyond classification; for example, a number of countries have delegated part or all of their authority to exercise flag state control to the classification societies or to a limited number of classification societies. The role of the classification societies, both in general and in relation to the *Scandinavian Star*, is also dealt with under 10.4.

10.2 REQUIREMENTS APPLICABLE TO THE SHIP

10.2.1 International regulations, etc.

The International Maritime Organization (IMO), previously the Inter-Governmental Maritime Consultative Organization (IMCO), has drawn up a number of important conventions and recommendations with respect to technical safety standards for ships. However, only the International Convention for the Safety of Life at Sea (SOLAS) contains provisions directly concerned with fire protection.

The conventions become binding on the parties under international law when certain specific conditions, including ratification by a sufficient number of states, are fulfilled. The recommendations, as the name implies, are norms that are recommended, but which are not binding under international law.

SOLAS is under continual revision. The present version was finalized in 1974, with a Protocol of 1978 and amendments of 1981 and 1983. These revisions, however, do not have general retroactive application. Generally speaking, the construction requirements applicable to an individual ship are those that were in force at the time the ship was built. This is stated among other places in Annex 1 of SOLAS. Some of the "new" provisions, however, are also made applicable to "existing ships", and these are specified in the table in Annex 1 to the Convention. Thus, for the *Scandinavian Star* the applicable regulations are those of SOLAS 1960 with certain additional requirements. Ship control, however, must always be carried out in accordance with the latest provisions.

SOLAS 1060 and SOLAS 1974 are drawn up along broadly the same lines: Chapter I contains general provisions, including those covering surveys and certificates, cf. below under 10.4. The remaining chapters list the material requirements. Relevant chapters in this context are Chapter II-2, on fire protection in relation to ship construction, and Chapter III on life-saving appliances and arrangements. Chapter 4 of the present Report contains an outline of important rules relating to fire protection pursuant to SOLAS 1960, and the reader is referred to this presentation. The most important differences between SOLAS

1960 and SOLAS 1974 as regards fire protection are as follows:

- SOLAS 1974 contains more stringent requirements as regards division, fire insulation, and the use of combustible materials than SOLAS 1960.
- SOLAS 1974 contains a requirement for an automatic fire alarm and fire detection system. In SOLAS 1960 this is only listed as one of several alternatives.
- SOLAS 1974 contains specified requirements concerning the total volume, thickness, and inflammability of surface materials in accommodation and service spaces. In SOLAS 1960 these depend on the method chosen.
- The requirements for the ventilation system are more stringent in SOLAS 1974.
- SOLAS 1974 contains more stringent requirements for the design and operation of fire doors.

Principles of fire protection

Both SOLAS 1960 and SOLAS 1974 prescribe a division of the ship into main vertical zones, with fireproof partitions between them. In order to prevent fire from spreading within a main vertical zone, SOLAS 1960 provides a choice of three methods:

Method 1

Use of internal subdivision bulkheads and non-combustible materials.

Method II

Installation of an automatic sprinkler system.

Method III

A combination of internal subdivision bulkheads, automatic fire detection system, and limited use of combustible materials.

SOLAS 1974 does not provide different alternatives for preventing the spread of fire within main vertical zones. It prescribes that only non-combustible materials may be used for bulkheads and insulation. The standards required for insulation materials are linked with the fire risk in individual spaces, and the standard values are given in relatively detailed tables.

The provisions of SOLAS 1974 require the installation of automatic fire alarm and fire detection systems. In SOLAS 1960 an automatic fire detection system is only required in the case of Method III.

Surface materials

In SOLAS 1960, the requirements for surface materials vary according to the fire protection method chosen:

Method I

The total volume of combustible surface materials, decorations, mouldings, and facings in any space must not exceed a volume equivalent to 2.54 mm veneer on the combined area of walls and ceilings. Surface materials in corridors and stairway enclosures must have low flame-spread characteristics.

Method II

No requirements.

Method III

Surface materials in corridors and stairway enclosures and in concealed or inaccessible places must have low flame-spread characteristics.

The requirements in SOLAS 1974 are more or less the same as those in SOLAS 1960 for Method I.

In the first annex to SOLAS 1974, which entered into force on 1 September 1984, the requirements for surface materials have been changed. Thus these materials must have a calorific value not exceeding 45 MJ/m^2, which roughly corresponds to 4.5 mm veneer. The requirements that all surfaces in accommodation and service spaces must have low flame-spread characteristics and must not be capable of producing excessive quantities of smoke continue to apply.

Ventilation systems

The requirements for ships' ventilation systems are rather more stringent in SOLAS 1974 than in SOLAS 1960. These include a requirement for separate ventilation of stairway enclosures that are ventilated and for automatically closing fire dampers in ventilation ducts, and more detailed requirements governing the use of materials.

Fire doors

The requirements for fire doors are more stringent in SOLAS 1974, which requires self-closing fire doors capable of release from a control station.

The chapter on life-saving appliances and arrangements in SOLAS 1974 has also been somewhat amended in relation to SOLAS 1960, and some of the new regulations are also made applicable to existing ships. These include Regulations 8, 9, 10, 18, 19, and 25. These regulations concern, among other things, the posting of emergency instructions and of operating instructions for lifeboats, the manning and supervision of embarkation in the life-

boats, the holding of abandon ship and fire drills for crew and passengers, and the operational readiness and maintenance of life-saving appliances.

The method of construction of the *Scandinavian Star* is described under 4.2.2.1.

A very considerable number of provisions in SOLAS, including those directly relating to fire protection, stipulate that methods, equipment, etc. shall be "to the satisfaction of the Administration" or "as determined by the Administration". Two random examples are Chapter II-2 Regulation 5(f), first paragraph, and Regulation 7(b). What the Administration finds satisfactory or what the Administration determines may vary from country to country. Thus apparently equal rules may be implemented in different ways in different countries. It is a weakness of the SOLAS conventions that the possibility of "lenient" interpretations can in this way reduce material safety requirements. In the IMO the member countries therefore make efforts to agree on joint interpretations and recommendations.

Chapter I Regulation 5 reads as follows:

"(a) Where the present regulations require that a particular fitting, material, appliance or apparatus, or type thereof, shall be fitted or carried in a ship, or that any particular provision shall be made, the Administration may allow any other fitting, material, appliance or apparatus, or type thereof, to be fitted or carried, or any other provision to be made in that ship, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance or apparatus, or type thereof, or provision, is at least as effective as that required by the present regulations.

"(b) Any Administration which so allows, in substitution, a fitting, material, appliance or apparatus, or type thereof, or provision, shall communicate to the Organization particulars thereof together with a report on any trials made and the Organization shall circulate such particulars to other Contracting Governments for the information of their officers."

If implemented in a sensible way, this regulation may represent an opportunity, subject to approval by the administration, to substitute a "functional requirement" as an alternative to an "itemized requirement". A different appliance, etc. may thus be approved providing it satisfies the same standards, such as safety, application, and effectiveness, as the appliance specified in a particular regulation. However, in the case of the above-mentioned regulation there is a certain risk that equipment or technical appliances may be approved that are inferior in application, design, or effect.

SOLAS also contains a number of provisions relating to safety that are not concerned with fire protection, but with, for example, stability. There are a number of other conventions that directly or indirectly deal with safety on board ship. Among these are the following:

The International Convention on Load Lines (1966), the Bulk Chemical Code, the International Convention on Tonnage Measurement of Ships (1969), the International Convention for the Prevention of Pollution from Ships (1973/1978), and Crew Accommodation (ILO).

10.2.2 National legislation

10.2.2.1 General

Article 94 of the Treaty on the Law of the Sea lays down that the flag state has the main responsibility for enacting legislation to ensure the safety of ships. The states that have ratified the SOLAS conventions and the conventions mentioned under 10.2.1 have usually made the provisions of these conventions applicable to their own ships through national legislation, unless they are states where the rules of international law are applicable under domestic law without transformation. In addition to the rules of international law, some countries have additional national requirements. This varies a good deal from country to country.

The Bahamas is the flag state for the *Scandinavian Star*. The requirements governing fire protection, etc. applicable to this ship are thus those of Bahamian law (see 10.2.2.2). In order to evaluate the law of the Bahamas on this point, the Committee has briefly examined Danish, Norwegian, and Swedish legislation in this area, for purposes of comparison.

10.2.2.2. The Bahamas

The provisions relating to the safety of ships registered in the Bahamas are contained in the Merchant Shipping Act of 1976. The majority of the provisions governing fire protection are incorporated from SOLAS 1960 and 1974 with amendments, cf. section 259, cf. First Schedule (Annex 1 of the Merchant Shipping Act). In addition to SOLAS regulations, the Bahamas has incorporated, in accordance with section 176 and section 172, a number of provisions from the United Kingdom Regulations, Rules and Orders.

The other important conventions on safety at sea are also incorporated in the national legislation of the Bahamas.

10.2.2.3 Denmark

The Danish safety requirements for ships are mainly based on Lov om skibes sikkerhed (Act relating to the safety of ships, the Danish Ship Safety Act), cf. Order (lovbekendtgørelse) No. 584 of 29 September 1988. The Act lays down a general requirement for safety at sea

and defines the concept of safety at sea. However, the concept of safety at sea does not in itself provide specific guidance. This is provided by the material regulations pursuant or appurtenant to the Act. The Act incorporates the SOLAS conventions into Danish legislation, but Danish law also contains additional special requirements that are more stringent than the provisions of SOLAS.

The rules for Danish ships apply both to ships registered in the ordinary Danish Ship Register (DAS) and to those registered in the Danish International Ship register (DIS). Order (bekendtgørelse) No. 475 of 11 October 1983 relating to the application of the Ship Safety Act to foreign ships was issued pursuant to the Act. According to these provisions the Act applies to foreign ships in Danish territorial waters and in Danish ports. However, the Danish maritime authorities are given the authority to grant dispensations from this rule if the ship in question complies with the provisions of its country of registration and otherwise appears to be in good and sound condition. In practice, this means that ships that meet the safety requirements laid down by international conventions are regarded as being seaworthy in Denmark.

10.2.2.4 Norway

The basis for Norwegian safety regulations is the Seaworthiness Act, Act No. 7 of 9 June 1903. Section 2 of the Act contains a general provision stating the conditions under which a ship may be considered seaworthy, but this definition provides in itself little specific guidance. The provisions of the SOLAS conventions are made applicable under Norwegian law by means of the provisions of the Seaworthiness Act and appurtenant regulations.

The provisions of the Seaworthiness Act are applicable to all Norwegian ships, both those registered in the Ordinary Ship Register (NOR) and those registered in the Norwegian International Ship Register (NIS), cf. section 1 of the Seaworthiness Act and section 3 of the NIS Act, Act No. 48 of 12 June 1987. The requirements applicable to ships stipulated in conventions and incorporated into Norwegian law by means of the Seaworthiness Act or its appurtenant regulations are also applicable to foreign ships calling at Norwegian ports, pursuant to section 1, fourth paragraph of the Seaworthiness Act, and section 3 of the Regulations of 14 February 1984 relating to control of foreign ships, etc.

Section 41 a of the Seaworthiness Act lays down that Norwegian ships must carry safety certificates as prescribed in international agreements, which means that they must also have certificates of safety for passenger ships.

Regulations governing fire protection have been issued pursuant to section 97 of the Seaworthiness Act. These regulations make the rules of SOLAS applicable under Norwegian law and contain certain additional requirements as well. However, Norwegian provisions concerning fire protection are essentially no more stringent than the provisions of SOLAS.

10.2.2.5 Sweden

In Swedish law the provisions relating to safety on ships are laid down in the Fartygssäkerhetslagen (SFS) (1988:49) (Swedish Ship Safety Act). The Act applies to all ships sailing in Swedish territorial waters and to Swedish ships in general. However, the Act is not applicable where its provisions conflict with the rules of international law.

Pursuant to chapter 2, section 1 of the Act, a vessel is only seaworthy if it is designed, built, equipped, and maintained in such a way that, within the scope of its intended use, etc., it can be considered sufficiently safeguarded against accidents at sea. The Swedish maritime authorities are authorized to lay down regulations providing more specific details about how a vessel is to be built, equipped, etc. in order to be regarded as seaworthy.

Pursuant to this, the Swedish maritime authorities have issued regulations laying down that SOLAS 1974 with amendments is to be applicable. The authorities have also issued regulations governing fire protection on Swedish ships, which contain further requirements, including specification of the size and marking of escape routes, protection of stairways and lifts, and the use of non-combustible materials in accommodation spaces.

The Act also contains provisions governing certification and supervision.

10.2.2.6 Summary and comparison

In general, the material requirements laid down by the Bahamas for safety, especially fire protection, on board its ships do not differ significantly from the safety requirements applying to Danish, Norwegian, and Swedish ships. As a general rule the standard of the requirements is as high as those of SOLAS and other international conventions, with certain supplementary requirements.

10.3 REQUIREMENTS FOR THE CREW

10.3.1 International provisions

The most important convention covering requirements for the crew is the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (the

STCW Convention). Article IV of the Convention stipulates that certificates for ship's masters, officers, and crew are to be issued to candidates who comply, to the satisfaction of the national authorities, with the requirements as to age, health, qualifications, and examinations pursuant to the provisions of the Convention. However, each country has to establish its own training and examination system within the framework of the convention. Article IX contains a provision allowing certain dispensations from these provisions to be granted as long as no risk is involved. The assumption is that the authorities shall ensure that seafarers on their national ships actually have the certificates required under the conventions. This has been expressed by IMO Resolution A 481 on Principles of Safe Manning (see below).

The material requirements are laid down in the annex to the Convention. The requirements are divided into three main chapters: Chapter II on the ship's master and deck department, Chapter III on the engineering department, and Chapter IV on the radio department, radio watchkeeping, and maintenance. The provisions lay down the principles for watchkeeping, the training and examination curriculum for seafarers, and requirements for individual seamen. The conventions do not prevent a particular country's authorities from using other systems than those of the convention that are specially suitable for other types of ships or technical solutions, etc., as long as the standard of safety is at least equivalent to that required by the convention.

IMO Resolution A 481, which contains recommendations on safe manning, is based on several international conventions including the STCW Convention. Being recommendations, they are not binding in international law. However, since these recommendations refer to other bodies of rules and are thus involved in the interpretation of the latter, the provisions of the Resolution have greater force than its status as a recommendation would normally imply.

Resolution A 481 is based on the idea that safe manning is a function of the number of qualified or experienced seafarers necessary for the safety of the ship, crew, passengers, cargo, property, and the marine environment, and that to maintain their efficiency they need proper training, hours of work and rest, occupational safety, health and hygiene, and food. The IMO therefore recommends that the authorities in each country issue ships with a minimum safe manning document, which specifies the basic safety crew required by each ship, cf. Article 1. This document in its turn functions as evidence in case of port state control that the ship is safely manned, cf. Article 2.

Article 3 provides guidelines for determining safe manning. It lists the functions performed by the crew that administrations must take into account when establishing minimum safe manning. Among these functions are the operation and maintenance of fire equipment and life-saving appliances, and evacuation of passengers and non-essential crew members in case of fire. Annex 2 provides more detailed guidelines for applying the principles of safe manning. It is pointed out that the assessment of safe manning may vary according to, for example, the ship's service area and length of voyage, engine capacity, size, construction, and technical equipment. One of the main principles is that there should be a sufficient number of qualified personnel to meet peak workload situations.

Part 5 of Annex 2 deals particularly with safety equipment and the like. It contains the recommendation that all ships should have an emergency organization with a list of duties posted on board. The crew should be assigned to fire parties, boat preparation parties and man-over-board emergencies. The crew should undergo emergency drills in accordance with the requirements of SOLAS 1974. On board ships where the number of passengers in relation to crew is large, the need for manpower is usually determined by emergencies where passengers need to be mustered and evacuated. This should be given great weight when establishing safe manning.

10.3.2 National legislation

10.3.2.1 The Bahamas

Section 184 of the Merchant Shipping Act lays down that "every Bahamian ship is to be manned with a crew sufficient and efficient from the point of view of safety of life for the purpose of the intended voyage". In other words, this is a general requirement for seaworthiness with reference to the crew.

More specific requirements are laid down in Part III of the Act, concerning the master and seamen. This includes specifications of the number and qualifications of the officers.

The officers' certificates must be either issued by the Bahamas or, if issued by a foreign country, accompanied by a licence issued by the Bahamas. Section 68 lists the grades of certificates, and section 69 the conditions for issuing certificates.

Section 69 also lays down provisions for the recognition of foreign certificates. They are approved if the standard of the examinations in the issuing country is equal to that in the Bahamas, and if the certificate serves as evi-

dence that the holder has achieved that standard. If the certificate is approved, the holder receives a licence to serve on Bahamian ships in the rank or station for which he is qualified in the Bahamas. Thus, even if his certificate is recognized, a seaman does not automatically get the same rank as he would in his home country. The decision to accept certificates is made separately for each country issuing certificates. According to information from the Bahamas, not all STCW countries' certificates are accepted, since some of them are not considered to have high enough standards for awarding certificates.

There are no rules governing the number of subordinate crew members apart from the general provision on "sufficient ... from the point of view of safety of life" in section 184. However, section 85 defines the conditions for issuing a certificate of competency for such seamen. When new crew members are hired, their certificates are sent to the authorities for inspection, cf. section 73. If a ship puts out to sea without the necessary crew, both the owner and the captain are responsible. They may be summarily condemned to pay a fine and the ship may be suspended from the register, cf. section 74.

The Bahamas issues safe manning certificates for ships at the request of the owner.

In addition to the requirements for the certificate, crew members are also required to have sufficient knowledge of English (cf. section 77), although this is not an absolute requirement. Section 77, first paragraph, reads as follows:

"Where in the opinion of a registrar or an inspector the crew of a Bahamian ship consists of or includes persons who may not understand orders given to them in the course of their duty because of their insufficient knowledge of English and the absence of adequate arrangements for transmitting the orders in a language of which they have sufficient knowledge, the inspector shall inform the master of his opinion and the ship shall not go to sea, and the inspector may suspend the certificate of registry of the ship until the position is rectified."

This indicates that "adequate arrangements for transmitting the orders in a language of which they have sufficient knowledge" may apply instead of the requirement of English in the case of individual crew members.

10.3.2.2 Denmark

The main rules governing crews are embodied in three acts, the Act relating to ships' crews (Lov om skibes besætning, SBL), cf. Order (lovbekgj.) No. 585 of 29 September 1988, the Shipping Act (Sønæringsloven, SNL), cf. Order (lovbekgj.) No. 372 of 31 May 1990, and the Act relating to the signing on of seafarers (Lov om mønstring av søfarende, ML), cf. Order (lovbekgj.) No. 580 of 29 September 1988.

SBL lays down provisions concerning the crew's size and composition, SNL provisions concerning qualifications, and ML regulates the verification of compliance with the requirements for crews.

Pursuant to Section 1 of SBL, the Act applies to Danish ships. Section 3 lays down that each ship shall have a master and the necessary crew for the maintenance of safety of life at sea. The Danish maritime administration determines the requirements regarding the size and composition of crew for individual ships, taking account of the type of ship, its arrangement and equipment, the purpose of the voyage, and the ship's trade area, so that the crew is able to perform all functions necessary to maintain the safety of the ship and those on board, cf. section 4 of the Act.

Section 6 of SBL lays down certain provisions with respect to the qualification requirements for the approved crew. In addition the crew have to meet the qualification requirements pursuant to section 13, first paragraph, of SBL.

Sections 2 to 22 of SNL lay down the requirements that have to be complied with in order to obtain the certificate of, for example, master or chief engineer. These include examination certificates, experience, sight and hearing tests. Deck and engine crew are required to have theoretical training or practical experience.

Section 23 a of SNL lays down that for ships registered in the DIS, a certificate issued in accordance with the provisions of the STCW Convention is regarded as equivalent to a Danish certificate issued in accordance with the provisions of SNL. According to section 6, subsection 1, of SBL, ship's masters and navigation and engineering officers must have STCW endorsements in addition to the requirements laid down in SNL. The crew of a DIS ship are required to have valid certificates with STCW endorsements.

The STCW endorsements are issued in accordance with the provisions of Article VI of the STCW Convention, cf. section 2, subsection 6 of SBL. Section 6 of SBL lays down the requirements that have to be satisfied by masters and engineering and navigation officers.

With respect to passenger ships, the Danish maritime administration may, in consideration of the ship's arrangement, equipment, trade area or number of passengers, increase or reduce the requirements made pursuant to

section 6 in order to secure an STCW endorsement, cf. section 9 of SBL.

According to section 13, subsection 2, of SBL, the Danish maritime administration may decide that members of the crew who are not covered by SNL, e.g. catering personnel, must have undergone a safety training course.

Under "special circumstances", and subject to Denmark's obligations under the STCW Convention, the Danish maritime administration may grant dispensation from the requirement of a certificate endorsed by the STCW Convention, cf. section 16, subsection 2, of SBL, but only for a maximum of six months.

10.3.2.3 Norway

Safe manning is included in section 2 of the Seaworthiness Act. Thus, a ship that does not have a crew with a sufficient number of qualified seafarers, may not sail. Section 93 provides the authority to lay down further regulations concerning manning and the qualifications required for serving in the positions covered by the manning regulations. The appurtenant regulations are the Regulations of 17 March 1987 concerning the manning of Norwegian ships.

According to section 4 of the Regulations, the basic safety manning is to be determined for every ship by a special evaluation. The Norwegian Maritime Directorate issues a Specification of Crew, giving details of the job specifications, qualification requirements, etc. of the crew, cf. section 5, cf. section 4. The manning is required to be sufficient to maintain the safety of the ship and of those on board. This evaluation is to take into consideration the particulars of each individual ship, and the crew must be adequate to take care of the relevant safety operations on board, cf. section 4. The section also contains a number of guidelines for exercising discretion.

The regulations only provide for the determination by the Maritime Directorate of a minimum safety crew. This is in accordance with IMO recommendations. The need for additional crew members, i.e. crew for commercial tasks on board, such as tax-free shops, is left to the master and the owners. This section of the crew is referred to as "additional manning" in the Regulations. If no one has been employed to carry out the commercial duties on board ship, and if this means that members of the basic safety crew must carry them out on overtime in addition to their normal work, this situation would be liable to be in conflict with the principles of the Resolution that the crew should have sufficient rest, etc.

As mentioned above, the Specification of Crew lays down qualification requirements. Section 6 of the Regulations refers to the relevant regulations concerning certification, which are as follows:

> Various Regulations of 11 December 1981 concerning qualifications required for shipmasters and mates, for ship's engineers, for marine electro-automation officers, for cooks and catering officers. Regulations of 2 June 1987 concerning qualification requirements for personnel not requiring a certificate of competency, and Regulations of 1 July 1987 concerning permission for the holder of a foreign certificate of competency to serve in posts for which a certificate of competency is required, on Norwegian ships, drilling units or other mobile offshore units.

The regulations of 1981 lay down requirements for training and practice for the relevant positions. As a general rule the certification requirements here are similar to those laid down by the STCW Convention. The Specification of Crew contains the number of crew that are required to be on board, in addition to the positions that require a certificate of competency. Section 3 of the Regulations of 2 June 1987 requires that these crew members shall have undergone basic safety training. This does not apply to those who have at least one year's practice on board or who are members of a "cruise catering crew" or others who are engaged in connection with hotel-keeping, etc. The master must be able to show documentary evidence of the crew's qualifications at any time.

The Regulations of 1 July 1987 contain provisions applying to the holders of a foreign certificate of competency to serve in posts for which a certificate of competency is required, on Norwegian ships, cf. section 2. Section 3 lays down that the Maritime Directorate may after individual consideration permit the holder of a foreign certificate to serve in a post for which a certificate of competency is required, in such positions as the holder's qualifications entitle him/her to hold, pursuant to Norwegian provisions. Permission may also be given after a general evaluation of the maritime education and certification requirements of the country issuing the certificate. According to section 3, subsection 2, certificates issued by states which have acceded to the STCW Convention will normally provide the basis for such permission.

In addition to the above requirements, the holders of foreign certificates must also document the following in order to be issued with a qualification document by the Norwegian authorities: 1) a satisfactory knowledge of English, Norwegian, Danish, or Swedish; 2) a

health certificate in accordance with the provisions in force for the health of seamen; and 3) a satisfactory knowledge of the responsibility of the position concerned, cf. section 4. The qualification document is valid for up to five years, and only together with the appropriate certificate.

According to section 5, the master and owner of the ship are obliged to ensure that the person employed is actually qualified for the position, irrespective of the approval of the Directorate.

10.3.2.4 Sweden

Chapter 5 of the Fartygssäkerhetslagen (SFS, the Ship Safety Act) contains basic provisions concerning the manning of ships. The chapter starts with a general provision stating that a ship is to be manned adequately. The provisions apply to both Swedish and foreign ships. The remaining provisions, however, apply to Swedish ships only.

More detailed provisions concerning the qualification requirements of crew members are laid down in regulations (SFS 1982:892) relating to the competency of seafarers. They contain detailed rules governing the training and function requirements for the various members of a crew.

Competency based on training has to be confirmed by a certificate. For other positions competency has to be documented by evidence showing that the competency requirements have been met.

Chapter 5 of the Fartygsäkerhetsförordningen (SFS 1988:594) (regulations concerning ship safety) contains further provisions dealing with manning and qualification requirements for crew.

Sections 5 and 12 of the Ship Safety Act lay down provisions concerning minimum manning. The Swedish maritime administration determines the minimum manning, on the basis of safety considerations in relation to the service in which the ship will be engaged.

According to section 5, a particular consideration when determining the minimum manning is how the work on board is organized, which provisions or agreements regulate the working hours of the personnel, and for passenger ships, whether there is sufficient personnel to man the lifeboats, rafts, and other life-saving equipment.

The Swedish provisions do not lay down any requirements concerning the crew's knowledge of languages.

10.3.2.5 Summary and comparison

The main conclusion from the above is that the requirements concerning the crew's qualifications differ little for ships registered in the Bahamas compared with those registered in the Scandinavian countries. Denmark, Norway, and Sweden require that a minimum safe manning be determined. This is not a requirement in the Bahamas, but there, too, there is a general requirement that the crew must be sufficient from the point of view of safety of life. As already mentioned, minimum safe manning for a ship can be determined at the request of the owner by the maritime authorities of the Bahamas (the Bahamas High Commission in London). This implies among other things that the established minimum safe manning is normally used as a standard in flag state control (the Bahamas) or port state control.

10.4 CERTIFICATION, INSPECTION, AND CONTROL

10.4.1 Introduction

The master and the owner of a ship are responsible for the ship's safety, which includes the obligation to ensure that the condition of the ship as specified in the ship's certificate is maintained. There are various systems for ensuring that the rules are observed. Under Article 94 of the Treaty on the Law of the Sea, the flag state is responsible for laying down rules to ensure the safety of the ship, and pursuant to Chapter I Regulation 6 of SOLAS, the flag state has the primary responsibility for verifying compliance.

The control functions exercised by a flag state are in practice often delegated to classification societies. This applies particularly to countries with small maritime administrations.

Classification societies have varying standards, and therefore many countries that delegate flag state control functions to classification societies, do so only to certain specific societies, especially the five "major" classification societies, the American Bureau of Shipping, Bureau Veritas, Germanischer Lloyd, Lloyd's Register, and Det norske Veritas. Two other classification societies to which such authority is also delegated are the Japanese society Nippon Kaiji Kokay and the Italian society Registro Italiano Navale. The role of the classification societies is discussed in more detail under 10.4.4.

In addition to flag state control, countries at which a ship calls, port states, also exercise control functions. In recent years an increasing importance has been attached to these control functions. One of the reasons for port state control is that flag state control is not sufficient to reveal all the faults, deficiencies, and weaknesses in a ship. It is often the port state, or at any rate a country other than the country of

registration, that suffers most from a disaster at sea, such as heavy pollution caused by accidents to tankers. Port state control is discussed in more detail under 10.4.3.

There is, however, a further type of control function or inspection in addition to those carried out by or on behalf of flag states or port states. The classification societies *class* ships, i.e. they survey ships in order to determine whether they fulfil the society's requirements for a ship of that particular class.

In its review of the survey and inspection of ships below, the Committee has concentrated only on passenger ships. The rules are often the same for other types of ships, and the Committee's comments will often be applicable to other types of ships as well. However, there may also be differences, and these will not be dealt with in this report.

10.4.2 Flag state control

10.4.2.1 International rules, etc.

According to Chapter I Regulation 6 of SOLAS, the maritime administration of the flag state is responsible for inspections and surveys, which may be carried out either by officers of the administration or entrusted to specially nominated surveyors or recognized institutions, such as classification societies. Whatever solution is chosen, the flag state has to fully guarantee that the survey or inspection is complete and efficient. Different countries choose different solutions, but delegation to classification societies is very common. In many cases the responsibility is divided, for example with the administration carrying out the initial survey and the classification societies the periodic surveys. Chapter I Regulation 13 also permits the administration in one country to exercise control functions on behalf of another country.

The extent of the inspections to be carried out by the flag state is specified in Chapter I Regulation 7 and Regulation 6 of SOLAS. According to Regulation 7 passenger ships must be surveyed before they are put into service, and after that periodically once every 12 months and otherwise if the occasion arises, i.e. after accidents, etc.

Regulation 7 (b) specifies the scope of the initial survey. It must include a complete inspection of the ship's structure, machinery, and equipment. The survey must be such as to ensure that all equipment, including lifeboats, fire-protection equipment, and fire-detecting and extinguishing appliances fully comply with the requirements of the Convention and of the regulations, etc. that the flag state has promulgated as a result of the Convention. Periodical surveys are also to be comprehensive. Inspections carried out to ensure fire safety are to be as thorough as initial surveys. Such surveys must ensure that the ship and its equipment are in all respects satisfactory for the service for which the ship is intended.

When the surveyor has satisfied himself that the ship complies with all the necessary requirements, a *Safety Certificate for Passenger Ships* is issued as a confirmation of this. If a dispensation from any provisions of the regulations has been granted, a separate certificate of dispensation should be issued. The certificates are to be issued by the administration of the flag state or by a person or institution to whom authority has been delegated. In all cases the flag state bears the full responsibility for the certificate. The certificates are evidence that the authorities have found the condition of the ship to be in compliance with the regulations. The certificates have a function in connection with port state control, see 10.4.3. Safety certificates for passenger ships are not to be issued for more than 12 months at a time, but in certain cases dispensations from this rule may be granted.

After a survey has been completed it is prohibited to make alterations in the hull, machinery, equipment, etc. without the consent of the authorities, cf. Regulation 11. Between surveys the owner and the master of the ship are responsible for maintaining the ship in a condition that complies with the regulations.

10.4.2.2 The Bahamas

10.4.2.2.1 Legislation of the Bahamas

According to section 173 of the Merchant Shipping Act of 1976, passenger ships shall be surveyed before they are put into service and after that periodically at least once a year. Inspections are also to be carried out after accidents, etc. These regulations follow the pattern of SOLAS. The surveys are intended to verify whether the condition of the ship conforms to SOLAS requirements and to the regulations pursuant to section 171 and section 175.

Pursuant to section 65, certain classification societies have been nominated to carry out such surveys. These societies are the seven societies mentioned under 10.4.1.

Parallel with these surveys, a system of *nautical inspectors* has been established for the inspection of specific parts and functions of the ship, including life-saving appliances and fire protection and other safety equipment, cf. section 168. These inspectors carry out annual inspections, in which, in addition to inspecting the ship, they verify the crew's certificates, etc. Further details are given under 10.4.2.2.2.

The Bahamian legislation covering flag state

control is in principle in accordance with international rules. Bahamian flag state control does, however, have certain weaknesses. These will be dealt with under 10.4.2.2.2 and 10.4.2.6.

10.4.2.2.2 Bahamian practice with regard to control and follow-up of ships registered in the Bahamas

As mentioned under 10.4.2.2.1, the Bahamas has entrusted part of its flag state control to the seven major classification societies, which have been authorized to carry out surveys and issue certificates pursuant to certain specified conventions, including SOLAS, MARPOL, Load Line, and so on. When discussing the flag state control carried out by the classification societies, it is the implementation of these delegated functions that the Committee is referring to.

In addition to this the Bahamas exercises a form of control, and thus to some extent verifies the work of the classification societies, through its nautical inspectors. The Committee will examine the way in which these surveys and inspections are carried out. It should be noted that here, too, the examination will focus on the verification and certification that takes place in accordance with SOLAS, in particular the inspections and surveys on which safety certificates for passenger ships are based.

As regards the surveys and inspections carried out by the classification societies, the Committee wishes to point out that its information is based on the procedures followed by Lloyd's Register. The reason for this is that the *Scandinavian Star* had been classed by this society since 1987. When the Committee discusses the flag state control carried out by classification societies on behalf of the Bahamas, it is referring specifically to the practices of Lloyd's Register. The Committee has not had the time available to investigate the way in which surveys and inspections are carried out by the other six classification societies approved by the Bahamas to act on its behalf. However, the Committee has met with representatives of Den norske Veritas (DnV) and received information about how this society carries out surveys on behalf of flag states, which is also relevant to the surveys carried out on behalf of the Bahamas. If, when discussing the flag state control carried out on behalf of the Bahamas by classification societies, a classification society other than Lloyd's Register is referred to, this will be specified.

The flag state control carried out by the seven classification societies on behalf of the Bahamas is based on a simple general agreement. The agreement, which is in fact a one-sided authorization, entitles the classification society to carry out inspections and to issue certain specified certificates. It is assumed that the classification society that classes the ship is also the one that will carry out the flag state control and issue certificates.

In principle it is the owner who is responsible for seeing that the ship undergoes the periodical surveys and is issued with the prescribed certificates. Every third month the owner receives details of the duration of the various certificates from Lloyd's Register. Towards the end of the period of validity of the certificate, the owner is supposed to notify the classification society. The classification society is also supposed to note when the period is due to end, and if the owner does not notify the society, the latter is supposed to send a reminder. If the reminder is not acknowledged by the owner, the situation is reported to the Bahamas, and may result in the ship being struck off the register.

When surveying a passenger ship for the purpose of issuing a safety certificate, the classification society investigates whether the ship and its technical equipment are in accordance with the relevant SOLAS convention. The surveyor looks at plans, reports of previous inspections, etc. in this connection. Lloyd's Register has informed the Committee that the survey status for each ship is kept up to date, and that the surveyors study this material before carrying out the survey. Lloyd's Register has a data base (Survey Control Information) containing information on all the ships classed by the society, and the surveyors have access to this information at all times.

Certain problems arise if a ship changes classification society, as was the case with the *Scandinavian Star*. The *Scandinavian Star* was classed by Bureau Veritas until 1987, when it changed over to Lloyd's Register. In such a situation, where Lloyd's Register takes over the classification of a ship from another member of IACS (see 10.4.4), Lloyd's Register has explained to the Committee that:

"Lloyd's Register relies to a significant extent on the fact that the plans of the ship have already been approved and that surveys during construction and periodical surveys have been carried out by a *competent classification society*." (Summary notes from a meeting between representatives from Lloyd's Register and the Investigation Committee on 8 October 1990.)

In other words, in such a situation Lloyd's Register would assume that previous surveys had been sufficient and effective and had registered any faults or defects in relation to

SOLAS safety requirements, when for example issuing safety certificates in accordance with SOLAS.

This factor should be considered in the context of any transfers of documents in the form of plans, etc. from the old to the new classification society. Lloyd's Register has told the Committee that in such cases the new society receives "the current survey status from the relinquishing society" (minutes of meeting). The relinquishing society does not transfer plans, etc. of the ship. Lloyd's Register has emphasized to the Committee that this is in accordance with agreements between members of IACS.

Lloyd's Register applies to the owner of the ship for the plans and other necessary information concerning the ship, and relies on sufficient information being supplied by the owner. When Lloyd's Register took over the *Scandinavian Star*, it received the original steel construction plans of the ship used for the first classification, and a Fire and Safety Plan showing the ship as it was after the alterations on decks 5 and 6.

It should be noted here that at one point rebuilding was carried out on decks 5 and 6 of the *Scandinavian Star*. Both Bureau Veritas and Lloyd's Register were unaware of this. When the ship changed classification societies Lloyd's Register received the original building plans and no plans showing the alterations, apart from the Fire and Safety Plan, which showed the ship in its altered form.

A point the Committee will return to under 10.4.2.6 and 13.3.1.2 is that the general information given above shows that a surveyor who is to survey a ship that has transferred to a new classification society for the purpose of issuing a certificate pursuant to SOLAS may lack information of considerable significance for his survey.

Lloyd's Register's surveys for the purpose of issuing safety certificates for passenger ships are in all important respects a verification of technical conditions. There is little verification of the crew's operational capabilities and capabilities in an emergency. As regards drills, Lloyd's Register had the following to say at its meeting with the Committee:

"Our Survey checklist includes a requirement to check the dates of the drills required by SOLAS Regulations. This is the only check we have to carry out concerning drills.

. . .

"Lloyd's Register has no responsibility with respect to manning levels, the qualification of crew drills.

. . .

"I am not aware that any administration requires us to witness the drills."

(Minutes of meeting)

Lloyd's Register has maintained that it is the duty of the national authorities to verify the practical execution of drills. Lloyd's Register also explained that its surveyor is required to verify the presence of the emergency plan on board, but not to examine the contents of the plan, apart from the language it is written in.

Lloyd's Register has alleged that the periodical surveys for the purpose of issuing passenger ship safety certificates do not involve the obligation to check the crew's ability to act in the interests of safety. The Committee will return to this under 10.4.2.6.

As mentioned under 10.4.2.2.1, the Bahamas has a system of nautical inspectors as part of its flag state control. These inspectors may carry out surveys for the classification societies, but they are not employed by any classification society. Nor are they employed by the Bahamas, but are engaged to carry out individual assignments.

One of the main tasks of a nautical inspector is to check the ship's certificates. He also checks the ship's books to verify that the regulation drills have been carried out. He has the authority to order drills to be carried out and sometimes does so. As a rule, however, a nautical inspector merely checks the dates of the drills in the log. The representative from the Bahamas High Commission in London has told the Committee that the Bahamas assumes that the surveyors from the classification societies witness drills during the surveys they carry out on behalf of the Bahamas. It was pointed out to the Committee that the system of nautical inspectors in many ways resembles port state control. The system is meant to be a means of monitoring the flag state control functions carried out by the classification societies on behalf of the Bahamas. The inspections by the nautical inspectors are in fact more limited, both in time and scope, than the periodical surveys carried out by the classification societies as delegated.

The above leads to the conclusion that nautical inspectors would only to a very limited extent, and only under exceptional circumstances, verify the crew's ability to carry out emergency operations.

The Committee also wishes to point out that it is the owner who contacts the nautical inspector. The owner is given a time limit for having the inspection carried out. A nautical inspector does not arrive on board unannounced. The Committee further points out that the Bahamas does not keep copies of the plans, etc.

for the individual ships sailing under its flag. Thus, the inspector who inspects the ship normally has access to much less information about the ship than, for example, the surveyor from the classification society. In this connection the Committee makes the point that without the shipowner's consent the nautical inspectors do not have access to the classification societies' data bases and the information they contain.

Under 10.4.2.6 the Committee presents a summary and evaluation of the flag state control exercised by the Bahamas with regard to its ships.

The surveys and inspection of the *Scandinavian Star* carried out by Lloyd's Register and the nautical inspector from the Bahamas are described under 4.6.

10.4.2.3 Denmark

Danish legislation is based on Chapter 3 of the Lov om skibes sikkerhet (Danish Ship Safety Act), on "Inspection, etc.". Pursuant to section 12, subsection 1, the Danish maritime administration is responsible for overall control. The objective of such control is to ensure compliance with the Act and its appurtenant regulations. The administration has the authority to board any Danish-registered ship at any time. The ship's owner, master, and chief engineer, and those deputed to act on their behalf, have the duty to provide the inspecting officer with all necessary assistance and information in connection with the inspection.

Pursuant to section 12, subsection 2, rules may be laid down governing when and according to what guidelines a ship is to be inspected. Such provisions have been established by two sets of regulations, Order (bekendtgørelse) No. 463 of 29 July 1988 concerning inspection and certificates, and Regulations (Teknisk forskrift) No. 5 of 4 May 1990 concerning control of foreign passenger ships. Pursuant to these regulations, the following surveys have to be carried out of passenger ships:

1. Before the ship is put into service, cf. section 3, subsection 1.
2. Whenever "significant alterations" have been made, cf. section 3, subsection 3.
3. Periodical (every 12 months) surveys, cf. section 4.
4. Extraordinary surveys, cf. section 16.

In all important respects these provisions have made the provisions relating to surveys and control functions of international conventions such as SOLAS, etc. applicable under Danish law. In principle, inspections for implementing control in accordance with SOLAS are carried out by an inspector from the maritime administration. The periodical surveys of cargo ships are delegated to the five major classification societies. Flag state control of passenger ships, on the other hand, is always carried out by an inspector from the maritime administration. Other functions are also sometimes delegated, in individual cases and in general.

The maritime administration lays down detailed rules for individual surveys, cf. section 2, subsection 2. These rules are in agreement with the provisions of the conventions to which Denmark is party.

The maritime administration issues the relevant certificates pursuant to SOLAS, MARPOL, etc. In addition to the certificates required by these conventions, passenger ships receive a national permit to sail with passengers, granted on completion of the principal survey, cf. section 21, subsection 1. Section 21, subsection 4 lays down that no passenger ship may be put into service without such a permit. Violation of this provision constitutes an offence. Setting sail with a certificate that has expired or when a prescribed survey has not been carried out is also prohibited.

During the periodical surveys the maritime administration inspector also verifies the crew's ability to act in the interests of safety, including their ability to handle fire-extinguishing and life-saving appliances during drills. This practice was begun before the disaster on the *Scandinavian Star*, and since then directives have been issued to place even greater emphasis on verifying operational aspects.

When the classification societies exercise control functions pursuant to SOLAS, this applies to cargo ships, and does not include checking the crew's actions to the same extent. The Danish maritime administration carries out unscheduled inspections in addition to the ordinary periodical surveys that are part of flag state control. These unscheduled inspections are also made on ships that are normally periodically surveyed by classification societies. Unscheduled inspections are always carried out by the maritime administration's own inspectors.

10.4.2.4 Norway

Section 1 of the Seaworthiness Act lays down that Norwegian ships are subject to supervision under the Act. This supervision "comprises all circumstances that govern or may affect the seaworthiness of the ship". General supervision of ships is the responsibility of the Norwegian Maritime Directorate, cf. section 3, second paragraph.

The executive agency of the Maritime Directorate is the Ship Control, but the Directorate may also, pursuant to section 4, appoint other persons or institutions to exercise control functions, including the five major classification societies that are approved by the Norwegian authorities, i.e. the American Bureau of Shipping, Bureau Veritas, Germanischer Lloyd, Lloyd's Register, and Det norske Veritas.

All inspection of cargo ships in the NIS fleet that is required for the issue of certificates according to SOLAS, MARPOL, etc. is delegated to the five approved classification societies. There is no general delegation of control, however, as regards passenger ships, whether registered in NIS or NOR. Here the Maritime Directorate has chosen to exercise control functions itself. The control functions in relation to passenger ships are limited to defined partial surveys and to being present at the quarterly abandon ship and fire drills. The situation as regards Norwegian cruise ships based in Florida, USA, is somewhat different. Here the local surveyor from Det norske Veritas carries out technical surveys for certification purposes under the supervision of the Ship Control's permanent inspector in Miami.

The provisions distinguish between periodical (requested) surveys for the issue or renewal of certificates and supervision (inspection). The surveys are systematic, in accordance with the provisons of the international conventions.

Section 12, subsection 2, of the Seaworthiness Act lays down that the supervising authorities are entitled to go on board in order to survey a Norwegian ship, in whole or in part, and that the shipowner has a duty to assist at such surveys.

The rules for the obligatory inspection of passenger ships by the authorities are laid down in Chapter VIII. According to section 95 the initiative lies with the shipowner, who is to "request" such a survey. However, the Directorate, or where applicable the classification society to whom authority has been delegated, is responsible for ensuring that the necessary inspection takes place even if the shipowner does not request it.

Pursuant to section 96 the ship must undergo a complete survey before being put into service, followed by periodical surveys, normally once a year. Furthermore, extra surveys are to be carried out if the ship is subjected to repair, damage, or alterations of any significance. In addition to the periodical surveys, unscheduled inspections have to take place, in accordance with Chapter I Regulation 6 of SOLAS.

If the ship is found to be unseaworthy, it may be detained pursuant to section 24 of the Seaworthiness Act. The supervising authorities issue the recommendations that have to be complied with in order for the ship to be considered seaworthy.

In conclusion, it can be said that in all important respects Norwegian flag state control follows the pattern established by SOLAS.

Surveys in connection with the annual renewal of certificates for passenger ships are concluded with an abandon ship and fire drill, during which the crew have to show that they are able to carry out their duties according to the ship's safety plan, including the use of fire-extinguishing and life-saving appliances.

Supervised drills like this are repeated every quarter. In cases where the classification societies are appointed to supervise the drills, they follow the same procedure as the ship control authorities. These routines have been carried out for many years without any particular changes. No changes have been made since the *Scandinavian Star* disaster, but it has been impressed on the ship control authorities and the classification societies that they must keep a strict check on the crew's qualifications in relation to safety on board.

The ship control authorities frequently carry out unscheduled inspections on board both NIS and NOR ships. Regular revision of the approved classification societies is also practised, in which the supervisory and follow-up systems are reviewed and random samples of control documentation are checked.

10.4.2.5 Sweden

As described under 10.2.2.5, the Fartygssäkerhetslagen (Swedish Ship Safety Act) contains provisions governing ship control, in Chapter 10 of the Act. The Swedish maritime administration is responsible for supervising ships and their equipment pursuant to the Act and its appurtenant regulations. Supervision is carried out through surveys and inspections. Surveys are systematic and made on a regular basis in connection with the renewal of certificates.

A vessel contructed for registration in Sweden must be surveyed for the purpose of establishing whether it is seaworthy before it is put into service. A foreign ship that is to be registered in Sweden must also be surveyed for seaworthiness unless the maritime administration considers such a survey unnecessary. Ships must also be surveyed if they have undergone extensive repairs, alterations, or renovation, or if they have been damaged in a way that could affect their seaworthiness.

Inspections are carried out when the maritime administration has grounds for doing so.

During an inspection the inspecting officer must investigate whether the working environment is satisfactory, the ship's cargo is stowed properly, the manning is adequate, and the condition of the ship as a whole is satisfactory. The inspectors from the maritime administration have access to the ship and may carry out any inspections they find necessary.

The shipowner and the shipping company are responsible for seeing that the ship undergoes the prescribed inspections. Together with the ship's officers, they are obliged to provide the inspector with all necessary assistance during the inspection.

When a ship is contructed or altered at Swedish expense, and the ship is to be surveyed pursuant to the provisions of the Act, the owner or the agent responsible for the order has the duty to send plans of the ship to the maritime administration in good time before the work shown on the plans has begun.

A Swedish passenger ship must have an inspection log. When inspections or surveys are made, the inspector must enter details of the survey or inspection in the log. Any qualifications or recommendations must be recorded in the log. The inspection log and the ship's certificates must be kept in an accessible place on board the ship.

As regards the issue of certificates, the Act permits agreements to be entered into with specific classification societies for the issuing of certificates on behalf of the maritime administration. This type of delegation has only been practised to a very limited extent. An agreement has been made between the maritime administration and five major classification societies with respect to MARPOL.

After the *Scandinavian Star* disaster, the maritime administration issued regulations (tjenesteforskrift (2/90) om tilsyn av sikkerhetsorganisasjonen på passagerfartøy) concerning inspection of the safety organization on board passenger ships. One of the provisions states that the emergency organization must be adequate and functional. This is to be demonstrated by drills. A passenger ship is not considered to have an acceptable standard of safety if its key personnel do not have a specified training in fire-fighting, etc. The remaining personnel have to have the knowledge and experience necessary to cooperate with the key personnel in evacuating the ship. They must also be able to provide first aid, and to operate fire-extinguishing appliances and similar equipment. The safety standard is not considered satisfactory if the crew is unable to cooperate during drills because of language difficulties. Shipboard conditions must not be such as to hinder the crew's ability to cooperate in the interests of safety. These conditions are verified by inspections, which are particularly aimed at passenger ships on short runs. The inspectors are issued with checklists.

Unscheduled inspections of Swedish passenger ships were rare before the *Scandinavian Star* disaster, mainly because there was little replacement of ships. Ships were usually replaced by newly built ships, and contact between the maritime administration and shipping companies was good. Since the *Scandinavian Star* disaster the number of unscheduled inspections has increased considerably.

10.4.2.6 Summary, comparison, and evaluation

Under 10.4.2 the Committee made the following points about the flag state control exercised by the Bahamas:

The Bahamas has no separate administration for ship control, apart from the nautical inspectors. The responsibility for carrying out periodical surveys, etc. and for issuing certificates under the terms of the major international conventions is delegated to the seven major classification societies.

The control functions exercised by the classification societies and by the Bahamian nautical inspectors are concerned to a very small extent with the crew's operational abilities and abilities in an emergency. Any checking in this respect consists purely of a verification of certificates. The ship's minimum safe manning certificates and the crew's own certificates are checked.

It seems obvious that satisfactory flag state control should include the above-mentioned operational functions. There is no question that ship's crews vary in quality. Their degree of competency is often not as high as it should be. There is frequently a high turnover rate of large sections of a crew. This means that the ability of the crew to operate fire-extinguishing and life-saving equipment and the like, and to carry out abandon ship and fire drills satisfactorily needs to be checked. Another factor that shows the importance of verifying operational aspects is the frequency of human error and of the failure of the system (i.e. the shipping company) to provide adequate working or training conditions as causes of serious accidents at sea.

Countries with a long seafaring tradition regard the verification of the crew's ability to act in the interests of safety as an obvious and important part of the control of their passenger ships. The Committee wishes to point out that the Bahamas High Commission was under the impression that Lloyd's Register included the inspection of such operational functions in

their surveys. Lloyd's Register, on the other hand, considered this to be the responsibility of the national administration. The Committee's understanding is that the parties are agreed on the importance of inspecting such operational functions, and that the only source of disagreement was the question of whose duty it was to do so.

It is not clear whether SOLAS requires that the survey carried out for issuing a passenger ship safety certificate should include a verification of the crew's ability to act in the interests of safety. Chapter I Regulation 7 (b) of SOLAS, taken in isolation, may be interpreted as meaning that there is no such requirement. On the other hand, such a requirement does seem to be contained in Chapter I Regulation 12 relating to the issue of passenger ship safety certificates, in the form of the reference to other provisions such as those in Chapter III. In the Committee's opinion the latter interpretation is clearly supported by the facts, but the Committee finds no evidence that the flag state control exercised by the Bahamas, which has included so little inspection of the crew's ability to act in the interests of safety, has been in conflict with the provisions of SOLAS. However, the Committee does consider that the Bahamas deserves criticism for not having ensured that its flag state control included the verification of such important operational functions. The Bahamas should have registered the need for such a control function and ensured that it was incorporated into flag state control, as many other maritime administrations have done. The Committee points out that the flag state control of the Bahamas follows the rules of SOLAS, and that SOLAS, when applied under domestic law, must be assumed to *authorize* verification of the crew's ability to act in the interests of safety, even though it does not prescribe such a control function as an *obligation*.

The Committee also makes the point that in its opinion Lloyd's Register should have noted the need for verification of important operational functions in the interests of safety and should have raised the question with the Bahamas of whether such matters were being taken care of satisfactorily. The classification societies, and this naturally also applies to the six other classification societies to which the Bahamas delegates flag state control, must, in cases such as this where they are responsible in practice for the major part of flag state control functions, consider it their business to ensure that the flag state control as a whole is as good as possible.

In the event of a change of classification society, the new society may lack relevant documents pertaining to the ship, such as plans (see 10.4.2.2.2). This affects the classification society's ability to exercise the flag state control functions delegated to it in a responsible manner. This is particularly important when the flag state itself, as in this case, does not possess any documentation pertaining to the ship.

As regards the flag state control practised by the Bahamas, the Committee feels obliged to call attention to the very modest size of the country's maritime administration. The major part of the administration is located in the Bahamas High Commission in London. Of the fifteen people who comprise the administration, i.e. the Maritime Division of the Ministry of Transport, twelve work in London. Of these twelve, three have master's certificates and one has a chief engineer's certificate. All four certificates are British.

The size of an administration is not always related to its efficiency and ability to carry out important functions. The maritime administration of the Bahamas, however, is so small that it is difficult to see how it could follow up satisfactorily all the significant issues and problems that naturally arise in connection with control of a fleet of the size registered in the Bahamas.

As regards flag state control in Denmark, Norway, and Sweden, the Committee wishes to make the following points.

There is very little delegation of flag state functions as regards the supervision of passenger ships. Such supervision is carried out in all important respects by the maritime administration's own inspectors in Denmark, Norway, and Sweden. Assessment of the crew's ability to act in the interests of safety forms part of passenger ship inspection. Inspections may be carried out without warning. Although inspections have been intensified to some extent since the *Scandinavian Star* disaster, this description of the situation was also applicable before the disaster.

Inspection of cargo ships is delegated to a much greater extent, especially in Denmark and Norway. The crew's ability to act in the interests of safety does not appear to be verified, apart from the routine verification of certificates. Cargo ships are also subject to unscheduled inspections.

10.4.3 Port state control

10.4.3.1 Introduction

As mentioned under 10.1, states at which a ship calls are also entitled to exercise control functions over the ship and its crew. This control has an important function. Effective port state control ensures that ships in techni-

cally poor condition or with incompetent crews, which represent a human or environmental hazard, are prevented from sailing.

The relevant port states in the case of the *Scandinavian Star* were Denmark and Norway. The *Scandinavian Star* arrived in a Danish port (Fredrikshavn) on 30 March 1990. It began its regular run between Denmark and Norway, from Fredrikshavn to Oslo, on 1 April, and arrived in Oslo for the first time on 2 April. The ship was not subjected to control by Norwegian or Danish maritime authorities before the accident (cf. 10.4.3.2.7). The case of the *Scandinavian Star* indicates that the provisions governing port state control and its practical application should be re-examined. Under 10.4.3.2.3-10.4.3.2.6 the Committee will examine port state control in Denmark, Norway, and Sweden, and compare it with port state control in the United Kingdom and the USA. A summary, comparison, and evaluation will be given under 10.4.3.2.7. First, however, the international rules on this subject are examined.

10.4.3.2 International rules, etc. on port state control

10.4.3.2.1 Port state control pursuant to IMO conventions, especially SOLAS

The most important IMO conventions contain provisions governing port state control. In its review of these provisions, the Committee will focus on SOLAS and the Paris Memorandum (10.4.3.2.2).

SOLAS authorizes states to exercise port state control functions in relation to other states. The Convention presupposes that some degree of such control will be carried out by the port states, without specifying in more detail their obligations to do so under international law. However, and this is important, the Convention also establishes a framework for the control functions a country may exercise in relation to ships from another contracting state. These limits are not entirely clear, however, and are interpreted differently by different states.

Chapter I Regulation 19 of SOLAS lays down that all ships are subject to control by the port state. The main point of the control is to establish that the ship has valid certificates from the flag state. In addition to the certificates, the ship's books have to be inspected in order, among other things, to establish that the prescribed drills have been held.

According to Chapter I Regulation 19 (b) of SOLAS, the ship's certificates are to be accepted as evidence of a satisfactory standard unless there are "clear grounds" for believing that the condition of the ship or its equipment is not substantially in accordance with what is stated on the certificate. Inspections are also to be carried out if any rebuilding, etc. has taken place without the permission of the authorities.

If the ship's master cannot produce valid certificates, the ship's books reveal that the conditions for issuing the certificates no longer apply, or there are other "clear grounds" for such action, the ship may be subjected to a more thorough inspection. The question of what constitutes "clear grounds" is one of discretion. The Paris Memorandum contains provisions defining what can be considered clear grounds. As the Committee will return to below, the interpretation of "clear grounds" varies considerably from country to country.

A more thorough inspection by the port state authorities will concentrate primarily on the technical condition of the ship and the condition of the technical equipment, which are the main subjects of the certificates. However, as regards the crew, while SOLAS regulations stipulate the specific qualifications for and skills at performing a particular operation satisfactorily required for a certificate, it should be possible through port state control to require a practical demonstration that the crew are in fact able to perform the operation. For example, it ought to be permissible to verify whether the crew can operate fire-extinguishing and smoke-diving equipment, lifeboats, and so on in an entirely satisfactory way.

Control exercised pursuant to these regulations is to be carried out in such a way as to avoid a ship being unduly detained or delayed, cf. Chapter I Regulation 19 (f). However, pursuant to Chapter I Regulation 19 (c), the officer carrying out the control must take the necessary steps to make sure that the ship does not leave port until it can proceed to sea or to the nearest repair yard without danger to passengers or crew.

If the control gives rise to any form of "intervention", the nearest diplomatic representative of the flag state and the organization that has issued the certificate are to be notified. The facts concerning the intervention also have to be reported to the IMO. If, in spite of the deficiencies, the ship is allowed to proceed to another port for repairs, the authorities of that port are to be notified, cf. Chapter I Regulation 19 (d) and (e).

10.4.3.2.2 The Paris Memorandum

The provisions of SOLAS give the port state the right to control foreign ships, and they assume that such control will be carried out. However, there is no actual obligation to carry out port state control pursuant to the Convention. In order to establish an effective system of

port state control, 14 European maritime administrations concluded an agreement in 1982 to carry out port state control. This agreement is the Memorandum of Understanding on Port State Control, or the Paris Memorandum.

The parties to the agreement pledged themselves to establish an effective system for port state control that ensures that all ships, whatever their flag state, comply with the provisions of the treaties included in the Memorandum. These include the most important IMO (previously IMCO) Resolutions and ILO Convention 147, the Minimum Standards Convention.

The Memorandum has a wider scope than the conventions themselves. Control is to be carried out not only on ships to which the conventions apply, but also on ships from countries that have not acceded to the conventions. Pursuant to section 2.4 the parties pledge themselves not to give such ships preferential treatment, i.e. to apply the same rules to them as to the ships to which the conventions apply.

The states pledge themselves to carry out frequent control inspections. The objective, which according to section 1.3 should have been reached in 1987, is that each state should carry out control on about 25 per cent of the ships that call at its ports (ships that call regularly at a particular port count only once in this context). Sections 3.3 and 3.4 provide guidelines for selecting the ships. Inspection of ships that have been inspected by other countries' authorities within the last six months should be avoided unless there are clear grounds for doing this. Special attention should be paid to ships that may represent a particular hazard, such as oil tankers or gas carriers and ships that have recently been found to be deficient in some way. In order to keep track of which ships have been inspected and when, of deficiencies revealed by the inspections, recommendations, etc., a system of reporting and a regularly updated data base have been established for the use of the contracting parties.

The inspection must be carried out by a qualified person appointed by the administration of the port state. In the Nordic countries and the United Kingdom the maritime administration's own inspectors are responsible for control. In 1981 it was accepted that Italy should use its national classification society since it has no official institution with suitable inspectors. The other contracting parties always use officers of their own administrations for port state control.

Under the Paris Memorandum port state control is based on the system and the framework established in the IMO and ILO conventions. This is basically an inspection of the ship's certificates, books, etc. Only if these documents provide grounds, or if there are "clear grounds for believing that the ship does not substantially meet the requirements of a relevant instrument" is a more detailed inspection carried out.

In contrast to, for example, SOLAS, the Paris Memorandum gives examples of "clear grounds". Section 3.2 states that such grounds are, inter alia:

- a report or notification by another Authority;
- a report or complaint by a master, a crew member, or any person or organization with a legitimate interest in the safe operation of the ship, shipboard living and working conditions or the prevention of pollution, unless the Authority concerned deems the report or complaint to be manifestly unfounded;
- other indications of serious deficiencies, having regard in particular to Annex I.

SOLAS lays down the framework for the control that may be carried out if there are "clear grounds", cf. 10.4.3.2.1. Port state control under the Paris Memorandum is assumed to be pursuant to the provisions of IMO Resolution A 466 and Resolution A 481. Appendix 1 of Resolution A 466 contains "Guidelines on Control Procedures". It should be noted that these guidelines are mainly concerned with the technical inspection of the ship. However, these Resolutions contain no legal or de facto obstacle which would prevent an inspection of the crew's ability to act in the interests of safety from being included in port state control under the Paris Memorandum.

If port state control reveals deficiencies that may involve a risk to safety, health, or the environment, the port state authorities shall ensure that the hazard has been removed before the ship is given permission to leave the port. As under SOLAS, there are requirements concerning notification of diplomatic representatives, etc. If the hazard cannot be repaired in the port where the ship is moored, the ship may be given permission to move to a port where repairs can take place on condition that this will not involve an unreasonably high risk. In such cases the authorities of the receiving port are to be notified.

10.4.3.2.3 Denmark

The Danish administration's authority to carry out port state control of foreign ships is established in Order (bekendtgørelse) No. 475 of 11 October 1983. Port state control is practised within the framework established by SOLAS and the Paris Memorandum, etc.

The Committee has been informed that Den-

mark is making efforts in the practical exercise of port state control to achieve the objective laid down in the Paris Memorandum of control of 25 per cent of foreign ships calling at Danish ports. There are no guidelines or instructions for selecting ships for control except that all foreign passenger ships in regular traffic to Danish ports must be inspected once a year.

In practice, Danish port state control consists mainly of a verification of certificates. Since the *Scandinavian Star* disaster, however, the practice has been changed, and more thorough inspections of passenger ships are carried out even when no "clear grounds" can be demonstrated. The inspections comprise what are known as "key areas", such as lifeboats and emergency pumps, but operational conditions are also inspected.

Port state control is carried out by the maritime administration's own inspectors. In practice this control acts as a check on the work of the classification societies, so that there is no question of delegating any of these duties to these societies.

If a substantial deficiency is discovered through port state control that should have been noted by the classification society, the maritime administration demands a report from the classification society. A fairly sizable number of ships are detained after port state control; in 1989, 32 out of a total of 581 inspected ships were detained. Ships that are detained are reported to the IMO.

As regards the development of port state control in Denmark, the Danish maritime administration has written to the Committee as follows:

"Since 1978 there has been a continual improvement of port state control, and before the fire on the *Scandinavian Star*, the [maritime administration] was of the opinion that this control, as regards both the number and the form of the inspections, satisfied the demands that Denmark was obliged to make in its capacity as a port state.

"In order to increase safety on passenger ships, the [maritime administration] issued the following technical regulations (enclosed) on 4 May 1990:

"Technical regulations concerning extra fire equipment in passenger ships
Technical regulations concerning the mustering and registration of passengers
Technical regulations concerning the fire patrolling of passenger ships
Technical regulations concerning the control of foreign passenger ships.

"During the summer of 1990 an inspection campaign was carried out on passenger ships, which concentrated primarily on realistic drills to assess the crew, operational conditions, all the crew members' qualifications, their training in operating life-saving appliances and fire-fighting equipment, knowledge of the ship, etc. Thus these inspections in principle exceeded the limits for normal port state control."

Emphasis is placed on the need to harmonize the practice of control among the various countries that are party to the Paris Memorandum. This is partly so as to avoid unfair competition between the ports, and partly because Denmark wishes to subject foreign ships to control to the same extent and in the same way as it wishes Danish ships to be subjected to control in foreign ports. In this connection it is pointed out that about 85 per cent of Danish shipping revenues are derived from transport between third countries. In order to contribute to efforts to harmonize port state control in the countries party to the Paris Memorandum, Denmark sends inspectors to the port state seminars that are held for inspectors from these countries.

10.4.3.2.3 Norway

The authority to exercise control over foreign ships is established in section 1, fourth paragraph, of the Seaworthiness Act, cf. Regulations of 14 February 1984. Section 3, second paragraph, of the Regulations lays down that the supervising authorities have the right to go on board foreign ships. Section 12 of the Seaworthiness Act concerning the exercise of such control has similar application.

Section 3, subsection 2 of the Regulations defines the "legal basis for control". Control based on international conventions, including SOLAS, is normally supposed to be limited to ensuring that the ship has valid certificates. According to section 3, subsection 3.1, certificates "shall be accepted unless there are obvious grounds for assuming that the condition of the ship ... does not correspond substantially with the particulars of that certificate." The provisions of the Regulations should, however, be seen in the context of the provisions of the conventions, and the authority to carry out control must be assumed to be in accordance with the conventions. The extent of the control based on SOLAS and the Paris Memorandum is discussed under 10.4.3.2.1 and 10.4.3.2.2.

In the practical execution of control, it should be noted that Norway has reached the level set by the Paris Memorandum. In 1988 28 per cent of ships calling at Norwegian ports were inspected. Control is carried out by the Ship Control's own inspectors.

There is no special system or instructions for the inspection of ships or the selection of ships for inspection. According to the Paris Memorandum, control of ships that have been in-

spected by the other Memorandum countries during the previous six months should be avoided. Norway is often the last port of call, so that to fill the quota Norway will often have to control all ships calling at a Norwegian port that have not been inspected. To some extent previous experience of the standard of ships from the various countries is used as a guideline when selecting ships for inspection.

In practice, port state control consists mainly of the verification of certificates. Only if there are "obvious grounds" for it, is a more thorough inspection carried out. In such cases it is primarily the technical condition and technical equipment of the ship that are inspected. Particular attention is paid to technical fire and life-saving equipment.

As regards subjecting the crew to control, the Maritime Directorate has written to the Committee as follows:

"Port state control focuses primarily on the technical condition of the ship. Control of the crew's professional qualifications is difficult, since in contrast to the technical condition, they are not subject to such clear and demonstrable criteria that deficiencies can be proved and provide grounds for recommendations or detainment of the ship.

"Existing provisions and agreements, however, do not stand in the way of control of the crew. Such control would comprise verification of the number of crew and of the certificates of crew in positions requiring certificates. The competency of an individual crew member to fill his position cannot be verified in practice.

"Since the *Scandinavian Star* disaster, inspectors sometimes request that the fire pumps be started or that fire and abandon ship drills be held. But even now the qualifications of the crew members are examined to a very limited extent. The crew list is examined and the fact that the officers have the prescribed certificates is checked."

Before the *Scandinavian Star* disaster there was no system whereby the Maritime Directorate or the inspectors were notified of ships coming into port. A system has now been established involving the piloting authorities, charterers, and port authorities.

In its practice of port state control, Norway tries to follow the provisions of the Paris Memorandum, and for this purpose, like Denmark, it sends delegates to the port state seminars for inspectors from the acceding countries. At a meeting on 31 July 1990 with the Maritime Directorate, the importance of the following point in this context was pointed out: "as a result of Norway's dependence on being able to sail between other countries, Norway is interested in complying with the provisions of the Memorandum concerning the type of control to be carried out." (Minutes of the meeting).

10.4.3.2.4 Sweden

Control of foreign ships is carried out according to the provisions of the Fartygssäkerhetslagen (Swedish Ship Safety Act). In Sweden, too, port state control is based on verification of the ship's certificates, and the Swedish provisions also contain a condition that there must be special grounds for proceeding to a more thorough inspection.

Port state control is always carried out by the maritime administration's own inspectors. The Regulations (tjenesteforskriften) No. 2/90 and the inspection system outlined under 10.4.2.5 in this connection, are also applied to port state control of passenger ships.

At present Sweden carries out control on 25 per cent of all ships. The Committee has understood that the maritime administration no longer feels unconditionally bound by the "clear grounds" requirement in order to carry out an inspection that covers more than the ship's certificates. On foreign passenger ships efforts are made to monitor the crew's ability to act in the interests of safety.

10.4.3.2.5 United Kingdom

The United Kingdom is one of the parties to the Paris Memorandum. Together with SOLAS, this forms the framework of international law for the port state control exercised by the United Kingdom.

Port state control of passenger ships has been intensified in several ways, particularly since the *Herald of Free Enterprise* disaster. First, many more ships are inspected. In spite of the formal basis of control being a verification of the ship's certificates, the Committee received the definite impression that this did not represent any real obstacle to a more thorough inspection if this seemed desirable, even if there were no "clear grounds" in the traditional sense.

In the fairly frequent cases where inspections involve more than a simple inspection of certificates, the crew's ability to act in the interests of safety is regarded as an important part of the inspection – "the scope of the inspection has been widened to include important operational aspects of the ship, particularly those connected with emergencies" (Note from the Department of Transport to the Committee). At regular intervals a team of surveyors will visit a particular port and successively board as many ships as possible, to carry out an effective inspection of the operational and safety procedures.

The Committee makes the point that the United Kingdom requires passenger ships using UK ports to have certificates showing the maximum permitted number of passengers. Such certificates are issued by the UK on the basis of a very thorough survey of the ship and the crew. The United Kingdom has entered into a number of bilateral agreements for the reciprocal recognition of passenger number certificates. These have been agreed with countries whose ships are in regular traffic between the UK and the country concerned, including Norway, Sweden, and Denmark. These countries' ships thus do not require UK certificates, but a ship registered in the Bahamas and in regular traffic between the UK and Denmark, for example, would require such a certificate.

10.4.3.2.6 USA

The port state control practised by the USA is based on SOLAS and the national provisions in Titles 46, US Codes 3303 and 3305. The primary objective of American port state control has been to ensure that ships carrying passengers from US ports comply with the safety requirements of SOLAS.

US control is also based on the certificates issued by the flag state. The US Coast Guard has emphasized the following to the Committee:

"In keeping with the spirit of SOLAS, the Coast Guard relies upon the certificates issued by each vessel's flag administration as the primary means of demonstrating compliance with the Convention."

However, the system of selecting ships in the USA is different from that of the other countries the Committee has examined as regards passenger ships. First, all ships taking passengers on board in a US port are subjected to a survey. In other words, there is no random sampling of this type of ship. A ship has to have undergone a survey in order to be allowed to leave a US port with passengers who came on board in the USA.

Secondly, these surveys have a much greater scope than the checking of certificates. The "clear grounds" requirement is not interpreted as being an obstacle to a system of regular detailed inspections in addition to verification of certificates.

As regards the scope of the inspections, the US Coast Guard has written:

"In verifying compliance with SOLAS, we place primary emphasis on the overall condition of the hull, machinery, and safety equipment, and the structural fire protection. Recently, we have increased our attention to the human element in maritime safety. We are concentrating more on the cooperative effort of the officers and crew when conducting emergency drills, ensuring effective communication among crew members and with passengers. We are examining initiatives that seek to improve the 'human factors' aspects of passenger vessel operation."

As regards the practical exercise of port state control, the US Coast Guard has informed the Committee that no foreign passenger ships of over 100 tons gross tonnage or with berths for at least 50 passengers may leave a US port after taking passengers on board in that port unless the Coast Guard has made sure that the vessel complies with the requirements of SOLAS. The Coast Guard has a special control verification programme for passenger ships that operate from American ports. The programme starts before the ship's first call at an American port. The plans of the ship that are approved by the flag state have to be sent to the Coast Guard Marine Safety Center (MSC) at the latest 45 days before the ship arrives at an American port. Among the information that has to be supplied is the following:

- date on which the keel was laid,
- vessel's previous names, if any,
- country of registration,
- fire control plan,
- plan of escape routes,
- total number of passengers and crew,
- method of fire protection used on board.

After examining the plans and information the MSC sends the material accompanied by any comments to the relevant Coast Guard officers at the vessel's first port of call.

The vessel's owner has to arrange a time for the control verification examination with the responsible Coast Guard officer as far in advance as possible. This examination is very thorough and usually takes three to four days. A detailed manual has been prepared on the conduct of the examination.

One of the points on which the examination focuses is the active and passive fire protection installations, including structural fire protection, and the life-saving equipment. The Coast Guard officer has to witness fire and abandon ship drills and has to make sure that the crew are able to carry out their work, know their duties in an emergency, and are familiar with the ship. Equipment and installations with an important impact on safety are thoroughly examined.

When the control verification examination is over, a certificate is issued in the form of a letter stating that the examination has been

carried out. The letter has the same period of validity as safety certificates pursuant to SOLAS.

If the ship continues to operate from the USA, it has to undergo annual surveys and less extensive quarterly inspections. The objective of the annual survey is to ensure that the vessel maintains the standard of the ship, safety equipment, and crew that prevailed during the first examination. The surveys include the operation of all fire detection and sprinkler systems, checking that the fire doors function, and verifying that the life-saving appliances and fire-extinguishing equipment are in good condition. As in the control verification examination, abandon ship and fire drills have to be demonstrated.

One of the concerns of the quarterly control inspections is the satisfactory operation of the vessel. Escape routes are checked to make sure that they are open and not blocked in some way, and the condition of the ship and the crew's familiarity with it are verified. Usually the quarterly inspections include witnessing abandon ship and fire drills as well.

As the above indicates, the US Coast Guard control places considerable emphasis on ensuring that the operation of ships is satisfactory.

10.4.3.2.7 Port state control. Summary, comparison, and evaluation

In terms of international law, SOLAS forms the framework for port state control in the USA, the United Kingdom, Denmark, Norway, and Sweden. The four latter countries are also bound by the Paris Memorandum. However, in spite of the fact that the basis and framework of port state control in international law as applied to foreign ships are more or less the same for all these countries, the practical implementation of port state control differs, as shown under 10.4.3[.2].2 to 10.4.3[.2].6. The differences include the number of ships inspected, the intervals between inspections, and the system and scope of control and inspection.

Norway and Denmark were the port states for the *Scandinavian Star*. In a summary, comparison, and evaluation of port state control it is therefore relevant to focus on the control practised by these two countries. Danish and Norwegian port state control has been implemented in very similar ways. It has been based on the verification of certificates, and only in the event of "clear grounds" for supposing that the actual condition of the ship does not correspond with the particulars on the certificate have more detailed inspections been carried out. The more detailed inspections have concentrated on technical aspects of the ship rather than on the crew's operational abilities in the interests of safety. As regards the latter aspect, however, certain changes have taken place in both countries.

The form of port state control implemented in Denmark and Norway has suffered from certain obvious weaknesses. There are a number of reasons indicating that it is in need of a considerable reorganization in favour of more thorough and frequent inspections, including the verification of the crew's ability to act in the interests of safety. The Committee wishes to make the following points.

There may be shortcomings in flag state control. Crews vary in quality and may lack the necessary competency. In this connection attention is drawn to the practice of replacing large sections of the crew at the same time and fairly frequently. Replacing a large proportion of the crew may have a considerable negative influence on the standard of safety on board, especially since it takes time for the new crew to become familiar with the ship, the operation and function of the safety equipment, etc.

These are some of the main reasons justifying a reorganization and intensification of control functions, as mentioned above. The system of inspecting a random sample should be abandoned in favour of a model more like the system practised in the USA. All passenger ships in service to Nordic countries, whatever their flag, should be subjected to inspection before being allowed to take on passengers, and should later be inspected at regular intervals, cf. 13.2.4.1.

If an inspection is to be effective, it must have a wider scope than a mere verification of certificates. The requirement of "clear grounds" for proceeding to a more detailed inspection must be abolished. Further, such inspections should not only cover, as before, the technical aspects of the ship and its equipment but also the crew and their ability to act in the interests of safety. In addition to the above point about the frequent replacement of large parts of the crew, and the varying standards of competency, the Committee wishes to point out that it seems to be generally accepted that most serious accidents at sea are partly or wholly due to "human error" or to the failure of a particular system (for example the shipping company) to provide adequate working or training conditions. This makes it all the more important to verify the crew's operational abilities in an emergency.

It might be claimed that instead of reorganizing port state control, it might be better to concentrate on improving flag state control. The Committee considers that there are many

good reasons for improving flag state control. However, the Committee does not consider that an improvement in flag state control would in itself remove the need to make port state control more effective. At any rate until it becomes obvious that the average ship and her crew are achieving a much higher standard than at present, port state control needs to be implemented differently from the way it is at present.

In this connection the Committee wishes to call attention to a point that was made by representatives of the British maritime administration. When passengers leave the United Kingdom by ship, they do not think about which flag the ship is flying. They take it for granted that safety is independent of flag, and that the British authorities have verified that the ship and her crew have the necessary standards of safety. The same consideration would apply to ships sailing from Norway or Denmark. In the Committee's opinion passengers are entitled to expect that the Norwegian or Danish authorities have exercised the necessary control and have not assumed that a foreign flag state, perhaps in a different part of the world, has sufficiently ensured the safety of Norwegian and Danish passengers.

The Committee's conclusion is, as mentioned above, that the port state control system practised in Denmark and Norway has a number of weaknesses, and that it needs considerable reorganization. When considering whether the Danish and Norwegian maritime administrations deserve criticism for not having made changes in the system, a number of factors have to be taken into account.

One of the first questions to be asked is whether the conditions that justify a reorganization were or ought to have been known. The answer to this must be in the affirmative. The inspections made under the previous limited control often revealed serious deficiencies in the ships inspected. Furthermore, there has been strong criticism of the quality of some of the classification societies' survey work, and as previously described, flag state control is often delegated to classification societies. The maritime administrations should also have been aware of the shortcomings of ship's crews and of the weakness inherent in the practice of replacing large sections of crew at frequent intervals.

On the other hand, it must be said in defence of the Norwegian and Danish maritime administrations that the system they have implemented appears to be in accordance with the form of port state control that SOLAS and the Paris Memorandum have laid the foundations for (cf. 10.4.3.2.1 and 10.4.3.2.2). Furthermore, the Norwegian and Danish practice appears, as far as the Committee can judge, to be similar to that of most of the countries that are party to the Paris Memorandum.

An exception to this rule is the United Kingdom. As described under 10.4.3.2.5, particularly since the disaster involving the *Herald of Free Enterprise* the UK has intensified its port state control in several ways, including more frequent inspections, a disregard, at any rate to some extent, of the requirement of "clear grounds", and, in the event of more detailed inspections, a verification of the crew's ability to act in the interests of safety.

The Committee points out in this connection that the intensification of port state control implemented by the UK can be largely justified within the framework laid down by the Paris Memorandum and SOLAS (cf. the discussion of this question under 10.4.3.2.1 and 10.4.3.2.2). The requirement of "clear grounds" is fairly flexible and allows room for discretion. Thus discretion can be utilized to implement more detailed inspections more often than has been the traditional practice. In the event of more detailed inspections, it would not contravene the provisions of SOLAS or the Paris Memorandum to extend the inspection beyond a purely technical verification of ship and equipment, even though, as mentioned above, the intention behind these bodies of rules seems to have been primarily to ensure the verification of technical aspects of ships.

Thus, criticism of the unsatisfactory implementation of port state control is primarily a criticism of the actual system that SOLAS and the Paris Memorandum appear to have instigated. The port state control practised by Norway and Denmark has been in accordance with this system, and therefore, as mentioned above, it has in the main conformed with the system apparently practised by many other countries. In the Committee's opinion this makes it understandable that there has been no reorganization in Denmark and Norway, but the Committee considers that this still does not entirely exempt the Danish and Norwegian authorities from blame. It is after all the duty of the maritime authorities to register the actual requirements of the control system and to adapt the system, within the limits of the legislative framework, to these requirements. The fact that control systems elsewhere are also unsatisfactory may explain why the system has not been changed, but does not exempt the authorities from their duty to try to correct existing faults in their own system.

It may be asked whether the criticism should be addressed to the maritime administrations in Denmark and Norway (Søfartssty-

relsen and Sjøfartsdirektoratet respectively) or to some other quarter. In this connection the Committee makes the point that it has received a definite impression that there are general considerations of shipping policy, which coincide with objectives in the shipping industry itself, underlying the way the control system is organized. Thus Norwegian measures with regard to foreign ships are intended to be drawn up in such a way as not to run the risk of negative consequences for Norwegian ships in traffic between third countries. The Committee wishes to point out that such general considerations cannot exempt the maritime administrations from their responsibility for establishing adequate control systems, unless they receive clear political instructions regulating the form and content of the system.

The *Scandinavian Star* was not inspected by the Danish or Norwegian authorities. This must be regarded as a consequence of the way in which port state control has been implemented. The Committee calls attention to the fact that an inspection by the port state authorities along the lines indicated above would have revealed the crew's operational incapacity with respect to essential emergency procedures. However, if such a system of inspection had been in existence, it would be reasonable to assume that the ship would have been made ship shape in a satisfactory way, and that the crew would have undergone the necessary training and drills, etc. precisely for the purpose of such inspections.

10.4.4 The role of the classification societies

There are a large number of classification societies. The seven major societies are listed under 10.4.1, but there are others, of varying quality. The International Association of Classification Societies (IACS) comprises the most "serious" of the classification societies. The association has 11 members.

The classification societies play an essential role in the control of ships. The societies class ships, and verify and certify that they are built and maintained in accordance with a comprehensive system of rules. The fact that a ship is classed means among other things that the ship, the cargo, and so on, can be insured.

The application of classing is therefore primarily confined to the private sphere. In addition to this, however, many classification societies carry out control functions in the purely public sphere as well. As mentioned above, a number of countries have partly or wholly delegated the authority to exercise flag state control to the classification societies or to particular societies.

The delegated authority may be limited, e.g. to verification for compliance and the issue of certificates pursuant to one or more specified conventions, but it may also consist of very wide powers, amounting to virtually all aspects of flag state control. The Bahamas is an example of the latter case. Authority is usually delegated to a few classification societies, for example to the five or seven major societies (see 10.4.1). However, in some cases authority is delegated to other societies, which may not always have the necessary competence to carry out flag state control in an adequate manner.

In some cases detailed instructions are given to the society for the exercise of delegated control, and sometimes flag states have a verification system for monitoring the work of the societies. But in other cases neither of these precautions is taken.

The principle of allowing classification societies to act on behalf of the authorities is open to criticism. Commercial relations exist between the society and the shipowner, which is a far from ideal basis for the society in its role as representative of the authorities. It is not realistic to imagine that all flag states would in the foreseeable future have the resources to take over all the control functions at present delegated to the classification societies. But it does seem to be essential that flag states follow up the control functions carried out on their behalf by the classification societies, and that they make completely sure that the societies carry out the tasks delegated to them in a responsible way.

The Committee is aware that classification societies have been criticized by insurance companies among others for the poor quality of their surveys, and is acquainted with specific examples of such poor work. The Committee has not, however, had time for a detailed examination of these examples, which would in any case be outside a reasonable interpretation of its mandate. The Committee therefore wishes to emphasize that it has no evidence on which to form an opinion on the extent to which surveys carried out by classification societies are deficient in quality.

The tasks carried out by Lloyd's Register on behalf of the Bahamas and the verification carried out by the Bahamas through its nautical inspectors have been dealt with under 10.4.2.2.2 (see also 10.4.2.6).

11. The Rescue Operation

11.1 INTRODUCTION

Immediately after the *Scandinavian Star* had sent out a distress signal, a major rescue operation was launched, coordinated (cf. 11.2.3.2) by the rescue coordination centre at Sola, Norway. A large number of rescue units, comprising helicopters, aircraft, and rescue vessels, were called up from Norway, Sweden, and Denmark, and a considerable number of other vessels also took part. The efforts of many of these vessels and other units to rescue crew and passengers from the burning ship were outstanding.

With hindsight, it seems obvious that some aspects of the rescue operation should have been organized differently. The Committee considers it important for the sake of future rescue operations to go through and evaluate this rescue operation, including a brief review of the regulations on which the work of the rescue services is based.

The chapter starts with a brief examination of some of the main points of the regulations governing rescue operations at sea, and an outline of the structure of the various national rescue services involved. This is necessary to explain the rescue service terminology used in the chapter and to clarify the functions and duties of the various parts of the rescue services.

11.2 THE RESCUE SERVICES – RULES AND ORGANIZATION

11.2.1 International agreements concerning rescue at sea

The International Convention on Maritime Search and Rescue, hereafter referred to as the Maritime Rescue Convention, is the main international body of rules governing the search for and rescue of human life at sea. The Convention entered into force in 1985. Denmark, Sweden, and Norway are among the states that have ratified it.

Some of the Convention's provisions deal with the organization of maritime rescue services and international cooperation in this respect. These include the decision to establish Search and Rescue Regions (SRR) in agreement with neighbouring countries, each with at least one Maritime Rescue Coordination Centre (MRCC), and if necessary subordinate centres known as Rescue Sub-Centres (RSC). The Convention also contains provisions governing the duties and operational procedures of these rescue centres.

The Convention has been supplemented by the IMO Search and Rescue Manual. This is a set of guidelines for the promotion of international routines for carrying out search and rescue (SAR) operations.

A second manual based on the Convention is the Merchant Ship Search and Rescue Manual, MERSAR. This contains guidelines for masters of ships that may be called upon to carry out activities in connection with SAR operations.

SOLAS

There are other conventions and agreements with a bearing on maritime rescue services. One of the most important is the International Convention for the Safety of Life at Sea (SOLAS). This contains provisions concerning the responsibility of the master of a ship when he becomes aware of an emergency at sea involving a risk to human life.

Radio Regulations

The Radio Regulations (RR) appurtenant to the International Telecommunication Convention contain provisions governing communications in an emergency.

Nordic rescue agreement

An agreement has been entered into between Denmark, Finland, Norway, and Sweden concerning cooperation across territorial borders for the purpose of preventing or limiting injury or damage to people, property, or the environment in the event of accidents. The agreement entered into force for Denmark and Norway in 1989. It has not yet entered into force for Sweden and Finland, but this has had no practical consequences for the present rescue operation.

11.2.2 Organization and tasks of rescue services in the Scandinavian countries

11.2.2.1 Norway

The administrative coordination of the rescue services, which comprise land, air, and sea rescue services, lies with the Ministry of Justice and the Police. The service is run as a collaboration between public and private insti-

tutions under the coordination of two main rescue coordination centres (RCC), 55 local rescue sub-centres, and 16 air rescue sub-centres.

The two main rescue coordination centres, which are based at Sola, outside Stavanger, and in Bodø, are responsible for rescue operations in their geographical areas. This takes place directly from the main rescue coordination centre or by assignment to local rescue sub-centres, air rescue sub-centres for missing aircraft, or to other appropriate institutions or organizations.

The coordination centres are manned round the clock, usually by two rescue coordinators. Each main rescue coordination centre is run by a chief executive headed by the chief of police in Stavanger or Bodø and consisting of representatives of the defence forces, Norwegian Telecom, civil aviation, and the health services. In addition there are a number of advisers who can be called on when the need arises. The chief executive meets together in the event of major rescue operations.

The local sub-centres are attached to local police forces and on Svalbard to the *sysselmannskontoret*. These are obliged to notify the appropriate rescue coordination centre of all possible cases of rescue, and are responsible for coordinating rescue operations in their districts.

The centres are manned by police personnel. The local sub-centres also have a chief executive consisting of the chief of police and representatives of the fire and health services, the pilot and port authorities, the defence forces, Norwegian Telecom, and the civil aviation service (where there is an air rescue sub-centre in the relevant police district). The chief of police may appoint advisers from other institutions when necessary. The chief executive and the advisers are called on when the need arises.

On Svalbard the local rescue sub-centre is organized somewhat differently.

Sixteen air rescue sub-centres at the larger airports are also responsible to the main rescue coordination centre. The air rescue sub-centres have to alert the appropriate main rescue coordination centre when an aircraft is in distress, and they coordinate the rescue operation until or unless the main rescue coordination centre decides otherwise. The air rescue centres are headed by the chief air traffic controller and his staff.

11.2.2.2 Sweden

The responsibility for the rescue services in Sweden is divided between different authorities. Thus the maritime authorities are responsible for the life-saving part of the maritime rescue service, the civil aviation authorities for the air rescue service, and the police for the mountain rescue service. Furthermore, in each municipality there is a municipal rescue service with responsibility for preventing and limiting damage to persons, property, and the environment within the municipality. The service corresponding to the fire service in Denmark and Norway is responsible for the municipal rescue services.

A central government rescue authority is responsible for making sure that coordination and cooperation between the various rescue services functions as it should.

The Swedish maritime search and rescue region (SRR) is divided into three maritime rescue areas, each with its own MRCC. These are situated at Swedish Telecom's coast radio stations in Stockholm, Göteborg and Härnösand. The MRCC are manned round the clock by a rescue coordinator, and an assistant rescue coordinator also has to be immediately available. A subordinate officer also has to be on call and able to meet within 30 minutes. An advisory group of experts may be consulted in case of need.

The task of the MRCC is to coordinate and supervise search and rescue operations at sea involving danger or possible danger to human life, and to arrange for the transport of sick and injured persons from vessels.

There are three maritime rescue sub-centres (MRSC) in Sweden. Two of these are attached to the naval coast radio stations and one to the coast guard centre. The MRSC are also manned round the clock.

11.2.2.3 Denmark

The Danish rescue services are divided into a sea and an air rescue service. They are based on collaboration between local and central government authorities and private organizations.

The Ministry of Industry is responsible for the maritime rescue service and the Ministry of Transport for the air rescue service. The Ministry of Defence has the operational responsibility. There are sea and air rescue councils under the Ministry of Defence that serve as permanent advisory bodies to the ministries and other authorities involved in the rescue services. These councils contain representatives from the Ministries of Defence, Fisheries, and Industry, the Prime Minister's Office, the Commissioner of Police, the civil aviation authorities, navigation authorities, and the post and telegraph services.

The navy has an MRCC in Århus (MRCC Aarhus, part of the naval operational com-

mand), and the air force has an air rescue coordination centre at Karup (RCC Karup).

The MRCC are always manned by a rescue coordinator, who is able to call on a team of personnel.

The MRSC include the headquarters of three maritime districts and four coast radio stations.

The air rescue service does not normally have sub-centres, but these can be constituted in case of need at civil airports and military air bases.

11.2.3 Actors in the rescue work, particularly with regard to duties and authority

11.2.3.1 Rescue coordination centres

According to the Maritime Rescue Convention, the rescue coordination centre is "a unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region".

The tasks of the rescue coordination centre are laid down in the Maritime Rescue Convention and in the national provisions relating to maritime rescue services. Some of their main tasks are summarized below.

A rescue coordination centre must prepare detailed plans for the conduct of search and rescue operations in its own area. It must hold regular drills and maintain a state of readiness in keeping with its sphere of responsibility, as well as supervising the sub-centres under its authority.

When a rescue coordination centre receives a distress signal, it must carry out the investigations necessary to establish the facts of the situation and to decide on the extent of the required operation.

It is the rescue coordination centre that initiates and coordinates the operation. To achieve this it calls up and coordinates the available rescue units in accordance with a plan of action that it has drawn up.

One of the tasks of the rescue coordination centre is to notify the owner of the vessel and the appropriate authorities of the operation being launched. Other rescue coordination centres and sub-centres and other rescue units which may be concerned in the operation must also be notified and kept informed of developments.

When the emergency no longer exists, or further search seems useless, the rescue coordination centre terminates the operation and notifies the authorities and individuals who had previously been informed.

The sphere of authority of the rescue coordination centres in each country is established by national provisions. The formal delegation of authority and the sphere of responsibility vary somewhat from country to country. A brief summary of some of the common characteristics of the spheres of responsibility of the rescue coordination centres in Denmark, Norway, and Sweden, will be given in the following.

The rescue coordination centres are authorized to initiate and terminate SAR operations, and may in this connection call up and coordinate the activities of units at the disposal of the SAR organization.

The rescue coordination centres may delegate part or all of the conduct of an SAR operation to a sub-centre or to an on-scene commander (OSC).

The coordination of an SAR operation may also be transferred from one rescue coordination centre to another by agreement between the centres.

11.2.3.2 Cooperation between several rescue coordination centres in an SAR operation. The responsible rescue coordination centre

Both the Maritime Rescue Convention and the legislation of the countries concerned contain provisions relating to cooperation between several different rescue coordination centres.

There must always be one rescue coordination centre with the main responsibility for an SAR operation (the responsible RCC).

When a rescue coordination centre is notified of an emergency, and it does not know whether other centres are taking action, it should itself initiate appropriate action and then confer with other neighbouring centres in order to decide which centre should be the one to assume responsibility for the SAR operation.

Normally it is the centre responsible for the area in which the disaster has occurred that is designated responsible RCC. When it is not known exactly which centre is responsible for the area containing the vessel in distress, the responsible RCC is designated by agreement betweeen the centres involved. Unless otherwise agreed, the centre designated as responsible RCC is that "responsible for the area in which the vessel was according to its last reported position".

The responsible RCC must notify other appropriate centres where necessary of all the circumstances surrounding the emergency, and of the progress of the operation.

The Maritime Rescue Convention presupposes close cooperation between rescue coordination centres across territorial borders. The

parties to the Convention are thus enjoined to coordinate their SAR organizations and to provide each other with all necessary assistance in SAR operations.

The Maritime Rescue Convention recommends that the parties authorize their rescue coordination centres to request assistance from the other countries' rescue coordination centres, including the supply of vessels, aircraft, personnel, and equipment, and to grant such assistance at the request of another rescue coordination centre. This recommendation has been followed up by the Scandinavian countries.

Thus rescue coordination centres from several countries can take part in the same SAR operation. [In the Scandinavian countries] a rescue coordination centre that is not acting as responsible RCC is then temporarily designated a "subordinate centre" (*undersentral*). This is not to be confused with the term "rescue sub-centre" used in the Maritime Rescue Convention, cf. 11.2.1.

In this chapter the term "responsible RCC" will be used to refer to the rescue coordination centre with overall responsibility for a rescue operation. In the case of the *Scandinavian Star* the centre concerned was first RCC Sola and then, after 1200 hours on 7 April, MRCC Göteborg.

11.2.3.3 Rescue sub-centres

A rescue sub-centre is defined by the Maritime Rescue Convention as a "unit subordinate to a rescue coordination centre established to complement the latter within a specified area within a search and rescue region".

The functions of the rescue sub-centre are also defined in the Convention and in national legislation. They are in the main identical with those of the rescue coordination centres.

When a rescue sub-centre receives a distress signal, it should immediately initiate appropriate action and notify the rescue coordination centre. Otherwise a sub-centre is only involved on the orders of a rescue coordination centre. During an SAR operation it is the responsible RCC that delegates tasks and authority to act to the sub-centre.

11.2.3.4 On scene commander (OSC) and coordinator surface search (CSS)

On scene commander, or OSC, is the international term used for the commander of a rescue unit who has been made responsible for coordinating SAR operations in a specified search area. The functions of the OSC are specified in the Maritime Rescue Convention.

When several rescue units are to be involved in an SAR operation, one of them should be designated OSC as soon as possible, and preferably before arrival in the area. The OSC is normally designated by the appropriate rescue coordination centre or sub-centre. If this is not possible, the units concerned have to appoint an OSC by agreement between themselves. Until an OSC is designated, the first vessel to arrive on the scene should assume the OSC's duties and responsibilities.

The OSC's function is to establish the probable position of the object of the search, and to specify the search area and designate appropriate units to initiate rescue action as soon as the object is located, to the extent that these functions are not carried out by an appropriate rescue coordination centre. The OSC also coordinates traffic and communications at the scene of action where this is not taken care of by the appropriate rescue coordination centre.

The OSC is also responsible for implementing the plan for the conduct of the operation prepared by the centre or sub-centre coordinating the operation.

The OSC must periodically report to the responsible RCC concerning developments and any units that are no longer necessary. It must also report the number and names of survivors, the names and destinations of units carrying survivors on board, specifying which survivors are on board each unit, and request additional assistance from the centre when necessary, for example, where medical help is needed to evacuate injured survivors.

During the operation, the OSC has to keep a detailed record of the progress of the operation, containing arrival and departure times of the units involved, and make a thorough search of relevant areas, at the same time reporting observations and findings, new measures taken, and results achieved.

If no rescue units (including naval vessels) are available to assume the duties of an OSC, but other ships are participating in the operation, one of these should be appointed Coordinator Surface Search (CSS). CSS is the international term for a vessel that is not a specialized rescue unit that is designated to coordinate SAR activities in a specified area. The functions of a CSS are regulated by the Maritime Rescue Convention and MERSAR, and by national legislation, but the relevant provisions are brief and some of them are unclear and incomplete, cf. 11.2.4, 11.5.4, and 13.3.9.4.

The CSS may be designated by mutual agreement between the vessels participating in the operation. Although this is not specified in the Convention, the responsible RCC must also be able to designate a CSS, unless otherwise specified in a particular country's legislation. It must be assumed that a request to act

as CSS may also be declined under certain circumstances, for example, if the vessel is unsuitable.

When selecting a CSS, the vessel's suitability must be considered, including its radio capacity and arrival time.

The extent to which a CSS can be expected to perform the tasks of an OSC will depend on the type of vessel and the crew. Normally a CSS cannot be expected to meet the same requirements as an OSC. Nor do the international rules specify the tasks of a CSS to the same extent as those of an OSC. Thus both the Maritime Rescue Convention and MERSAR merely stipulate that the CSS should be responsible for as many of the tasks of an OSC as it is able to perform.

11.2.3.5 OSC-Air

Aircraft take part in many SAR operations as well as ships and land-based rescue units. When the designated OSC lacks the expertise or the equipment to coordinate the air traffic involved in the operation, it may be appropriate to divide the OSC function and appoint an aircraft as OSC-Air.

The international rules contain no separate provisions relating to OSC-Air, and the prevailing rules governing OSC are applied as far as is appropriate.

The responsible RCC designates the OSC, CSS, and OSC-Air and assigns them their functions. For the designation of CSS, the reader is referred to 11.2.3.4. In case of doubt about the functions or authority delegated to each party, the responsible RCC makes the final decision. If the responsible RCC is not able to make such a decision, the authority to make it is assumed to rest with the unit with the most comprehensive sphere of responsibility. Normally this would be the unit with responsibility for surface functions.

It may be asked whether it is OSC-Air or the OSC/CSS responsible for surface functions that should be in charge of the rescue activities of air-borne units. The above seems to indicate that the last-named OSC/CSS is responsible for deploying rescue units, including air-borne units unless otherwise specified or unless aeronautical safety considerations indicate otherwise.

The Committee is aware that the British have proposed that the term OSC-Air should be replaced by Coordinator Air Assets, CAA, in order to avoid confusion in the use of the term. According to this proposal, the term OSC should only be used if the plane or the helicopter is actually coordinating the operation at the scene of action, and then without the addition of "air".

11.2.4 Division of responsibility, functions, etc.

11.2.4.1 The responsible RCC, OSC and CSS

The duties of the responsible RCC and of the OSC and CSS have been described under 11.2.3.1, 11.2.3.2, and 11.2.3.4. The provisions governing the function of OSC imply, and it is only an implication, that as regards coordination of activities at the scene of action, the OSC is subordinate to the responsible RCC. This means that in principle the responsible centre can give the OSC general and detailed instructions concerning the deployment of the rescue forces, etc. The extent to which the responsible centre makes use of this authority depends on several factors. One of these is the expertise of the OSC concerned. If it is, for example, a large naval vessel, there will seldom be any need for the responsible RCC to give instructions about the deployment of resources. Another factor governing the extent to which the responsible RCC makes use of its authority to give instructions is of course the information it possesses regarding the development of the situation. In principle, however, the responsible RCC has the overall responsibility for coordinating the operation, including the rescue work carried out at the scene of action.

The rules relating to the office of CSS are brief and on many points unclear and incomplete. The MERSAR instructions, which have the status of recommendations, do not make it clear whether or not there is a hierarchical relation between the CSS and the responsible RCC. According to MERSAR, the CSS is designated by agreement between the ships involved. The instructions have the following wording as regards the relations between the CSS and the responsible RCC:

"3.6.6 On assuming the duty, the CSS should immediately inform a CRS [coast radio station]. He should also keep it informed of developments at regular intervals.

"3.6.7 The CSS should keep the RCC/RSC coordinating search and rescue operations informed at regular intervals and whenever the situation has changed."

On the basis of these instructions it is difficult to deduce any general hierarchical relation between the responsible centre and the CSS. On the contrary, they seem to indicate that the CSS should occupy a more or less independent position. In spite of the wording of the instructions on this point, however, the Committee finds it difficult to accept that the rules are meant to be interpreted in this way. The need for the responsible RCC to take command, including the need to participate actively in coordinating activities at the scene

of the disaster, is quite different as regards a CSS than as regards an OSC. The rules otherwise assume that the CSS will often not be able to carry out the duties of an OSC, cf. MERSAR 1.5.3.

Formally speaking, it may be pointed out that an OSC is normally part of the national rescue service, so that there is a priori a hierarchical relation as regards SAR operations. A merchant ship has no such point of departure. However, the office of CSS is assumed voluntarily, and in the Committee's opinion it must be read into the agreement on which the office of CSS is based that the latter is part of the specific SAR operation. This must in turn imply that the overall responsibility, and authority, lie with the responsible RCC.

Whatever the interpretation of the rules on this point, it should at any rate be obvious that the centre coordinating the SAR operation must act and show initiative at least to the extent it would do so with respect to an OSC, in order to make sure that the rescue work is being carried out satisfactorily.

11.2.4.2 Responsible RCC and OSC-Air

No rules have been laid down regarding the office of OSC-Air, cf. 11.2.3.5, nor is the authority of this office in relation to the responsible RCC regulated in any way. The Committee considers, however, that the responsible centre must obviously be able to give instructions to OSC-Air.

11.2.5 Putting out fires at sea. The tasks and duties of the maritime rescue services

11.2.5.1 Norway

The primary task of a rescue service is to save human life. Putting out fires to prevent material damage at sea is considered to be the ship's responsibility. Sometimes a fire has to be put out in order to save life, and as long as extinguishing a fire or smoke diving is necessary in this connection, it is the duty of the rescue service to ensure that such resources are supplied. In such cases the fire service is called on for assistance.

The fire services are municipal, and the duty of a particular fire brigade to render assistance is geographically restricted to the borders of the municipality. This means that their obligation to answer calls for help at sea is territorially limited to the waters inside the municipal boundaries. Outside the municipal boundaries, assistance from a fire brigade is based on voluntary action. To the Committee's knowledge there have been at least two occasions when a fire brigade has voluntarily mobilized to extinguish a fire at sea at the request of a rescue coordination centre. One of these two occasions has occurred since the *Scandinavian Star* disaster.

11.2.5.2 Sweden

In Sweden, too, the fire services are municipal and are part of the municipal rescue service. The municipal rescue services have the duty to assist the maritime rescue service if requested by a maritime rescue coordinator, but their duty to provide assistance is restricted to Swedish maritime rescue areas. Certain of the larger fire brigades are specially qualified by agreement with the central government authorities to assist in cases of accidents involving dangerous goods at sea. Some fire brigades are specially trained for fire fighting at sea.

11.2.5.3 Denmark

In the Danish maritime rescue service, the fire service is not among the resources at the disposal of the rescue coordination centres. In some ferry ports there are emergency groups trained in fire fighting, but their responsibility only begins when a ferry enters the port. The fire service has no personnel trained to fight fires at sea. It has been generally assumed that ships should be equipped to fight fires themselves.

11.3 RESCUE FORCES AVAILABLE FOR MOBILIZATION

11.3.1 General remarks

The Committee found it relevant to consider what rescue forces are available in the event of accidents in the Skagerrak. In this context a distinction has to be made between specialized and other rescue forces. The primary purpose of the specialized rescue forces is to be employed in rescue operations. The other forces are primarily intended for a purpose other than rescue operations. The latter forces are often, though not always, less suitable for use in a rescue operation than a specialized force, and may not always be available in the event of a rescue operation.

The resources most obviously needed in a major disaster at sea like a fire on board ship are ships, helicopters, medical personnel and equipment, and smoke divers and fire-extinguishing equipment. The Committee has received lists of the available rescue vessels and helicopters from Norway, Sweden, and Denmark.

11.3.2 Vessels

Annexes 28, 29, and 30 to the Report consist of lists of the rescue, coast guard, and naval

vessels, etc. available in Norway, Sweden, and Denmark for rescue operations in the Skagerrak. Considered as a whole, this contingency force is good, but the Committee wishes to point out that the Norwegian rescue units seem to represent a considerably weaker force numerically than the corresponding units available in neighbouring Swedish waters.

In addition to the specialized and other rescue units, there are normally a large number of ships, including passenger ferries, in these waters. Thus, on the whole there are normally a large number of vessels available for rescue operations in the area. Furthermore, several of the large ferries in regular traffic in this area have helicopter decks.

11.3.3 Helicopters

Annexes 28, 29, and 30 provide an overview of the helicopter strength in Norway, Sweden, and Denmark. Taken as a whole the available force seems large, but the question is whether it is sufficient for situations where large numbers of people may need to be evacuated by helicopter. The rescue coordination centre at Sola has emphasized that the helicopter contingency strength in Eastern Norway is not high enough. It is based on the helicopters belonging to the armed forces, which have other primary purposes. It should be noted that the SAR helicopter that was stationed at Torp air base, Norway, on the night of the disaster is no longer stationed in Eastern Norway.

The Committee has not had the time to make a thorough examination of the helicopter contingency strength to see whether it is sufficient for its intended purpose. The Committee has had to confine itself to pointing out that in the context of the disaster the rescue services and the responsible ministries ought to examine the contingency strengths in this respect, taking due account of the likelihood that a situation will occur in which a large number of people will have to be evacuated by helicopter. In this connection the Committee wishes to point out that on the night of the disaster the weather was almost ideal for evacuation by lifeboat. The situation would have been very different if the weather had been too bad for the use of lifeboats.

The Committee also wishes to point out that Captain Nordgren of the *Stena Saga* has commented that passenger ferries in the Skagerrak fairly often require the use of a helicopter to transport seriously ill passengers. He has said that in such cases it has often taken a very long time for the helicopter to arrive. The Committee recommends that the Scandinavian rescue services take up this question in connection with their assessment of the total available helicopter strength.

11.3.4 Emergency medical aid

The availability of emergency medical aid at the scene of the disaster was sufficient, cf. 11.4.3.1.4. Whether the available medical resources were utilized adequately is evaluated under 11.4.4.2. Hospitals on shore were rapidly mobilized to receive casualties, and the few injured survivors who were taken to hospital on shore were immediately given medical care. The disaster was not really a test of the capacity of the emergency medical resources. The Committee has not had time for a detailed examination of the emergency medical resources to discover whether they are sufficient to meet disasters with a different outcome, for example, where a large number of people require treatment for serious burns or smoke injuries. However, the Committee calls attention to the fact that at the conference arranged by the Committee at RCC Sola on 22 August 1990 (cf. Annex 31), it was pointed out that the emergency medical resources are not sufficient to cope with emergency treatment on a large scale (cf. the statement by Dr. Eielsen, head of department at Rogaland Hospital, Norway). In the Committee's opinion the central government health authorities should review this question.

11.3.5 Smoke diving and fire fighting

The reader is referred to 11.2.5 and 11.5.5. The Committee wishes to point out that in Sweden the fire service has a duty to provide asssistance in the event of fire at sea if requested by the rescue coordinator. Some major fire brigades have personnel trained in fire extinguishing on board ship. Sweden thus has a standing contingency force of professional smoke divers available for rescue work on board ships. Neither Norway nor Denmark has such a force. In these countries the availability of smoke divers depends on volunteers from the relevant fire brigades. Thus access to such personnel is fortuitous. In this area the *Scandinavian Star* disaster has revealed a serious weakness in the contingency rescue forces, which the Committee will return to under 11.5.5.

11.4 CONDUCT OF THE RESCUE OPERATION

11.4.1 Chronology of the external rescue operation

0224 hrs: Mayday signalled from *Scandina-*

vian Star to Tjøme Radio. 500 to 600 people on board "We are entering the lifeboats."

0225 hrs: *Scandinavian Star* alerts *Stena Saga* and requests her to stand by.

0225 hrs: Mayday relayed from Tjøme Radio: "*Scandinavian Star* on fire. Ship being abandoned. Immediate assistance required" (in English and Norwegian). Several ships report for action immediately. Rescue coordination centre (RCC Sola) notified.

0237-0242 hrs: Contact between RCC Sola and MRCC Göteborg and RCC Karup. Request for and offers of help. Agreement between RCC Sola and Göteborg that RCC Sola will be responsible RCC.

0247 hrs: *Stena Saga* appointed CSS.

0250 hrs: *Stena Saga* reaches *Scandinavian Star*.

0328 hrs: Captain of *Scandinavian Star* notifies *Stena Saga* of evacuation.

0335 hrs: First rescue helicopter reaches disabled ship.

0530 hrs: First smoke diver lowered to *Scandinavian Star*.

0711 hrs: *Stena Saga* is last ship to report number of survivors and deceased taken on board.

1155 hrs: Towing of *Scandinavian Star* to Lysekil, Sweden, begins.

1200 hrs: MRCC Göteborg takes over as responsible RCC.

1200 hrs: The *Nord-Jylland* takes over as OSC.

2117 hrs: *Scandinavian Star* docked in Lysekil.

11.4.2 Notification and initial organization of rescue work at rescue coordination centres

11.4.2.1 General remarks

The rescue centres, RCC Sola, MRCC Göteborg, MRCC Aarhus, and RCC Karup, were all notified, at about 0230 hours, of the *Scandinavian Star*'s position, that she was on fire, that the passengers and crew were abandoning ship, and that immediate assistance was required. Details are given in the logs in Annexes 24, 25, 26, and 27. It was agreed between RCC Sola and MRCC Göteborg that the former should coordinate the rescue operation. All the rescue centres scrambled rescue units, and helicopters, planes, and rescue ships were sent from Sweden, Denmark, and Norway to the disabled ship. Medical personnel and smoke divers were also transported to the scene by boat and helicopter. In addition to the boats, planes, and helicopters mobilized to provide assistance, a large number of ships in the area reported to the rescue coordinator and participated in the rescue work.

From the beginning the *Stena Saga* coordinated the on-scene rescue operation, and was appointed CSS by RCC Sola. The *Stena Saga* was CSS until 1200 hours, when the rescue vessel *Nord-Jylland* took over as OSC in agreement with RCC Sola. The first Danish helicopter to arrive at the *Scandinavian Star*, S-61 Rescue 278, was appointed OSC-Air. At 0600 hours a Danish plane, C-130 Rescue 680, took over as OSC-Air.

From 1200 hours on Saturday MRCC Göteborg took over as main rescue coordinator.

11.4.2.2 Norway

The distress signal was received by RCC Sola at 0230 hours. Helicopter authorities at Torp air base and Squadron 330 were scrambled at 0237 hours, and RCC Karup and MRCC Göteborg were contacted and asked to scramble at 0241-0242 hours. An agreement on the coordination of the rescue operation was reached. Mayday was relayed over Tjøme Radio on channel 16 at 0225 hours and over Rogaland radio on 500 KHz at 0250 hours. A number of vessels set a course for the disabled ship. The *Stena Saga* was appointed CSS. A Danish rescue helicopter was appointed OSC-Air, cf. 11.4.2.1. The police forces in Stavanger and Tønsberg were alerted at 0305 hours. Instructions were given to warn hospitals and to use Torp air base as a reception centre. Further details are given in the log from RCC Sola.

11.4.2.3 Sweden

At 0227 hours MRCC Göteborg overheard the dialogue between the *Scandinavian Star* and Tjøme Radio on channel 16. MRCC Göteborg contacted Tjøme Radio at 0230 hours and then RCC Sola, with whom it agreed that RCC Sola would act as responsible RCC. The assurance was given that all available units would be called in to help. From 0236 hours helicopters, rescue vessels, and pilot boats were scrambled. At about 0330 hours MRCC Göteborg contacted the Göteborg fire service concerning smoke divers. Further details, including the further organization of rescue work by MRCC Göteborg, are to be found in the log in Annex 25.

11.4.2.4 Denmark

The Danish naval operational command (Søværnets operative kommando) received the Mayday signal via Blaavand radio at 0231 hours. RCC Karup was notified at 0239 hours. MRCC Aarhus contacted RCC Sola at 0252

hours to offer assistance. Naval vessels, rescue boats, and helicopters were scrambled from 0243 hours onwards, and made their way rapidly to the disabled ship. The first rescue helicopter, Rescue 278, took off at 0308 hours. Further details, including the further organization of rescue work by MRCC Aarhus, are to be found in the log in Annex 26.

11.4.2.5 Evaluation of the initial stage of the rescue operation

The Committee is aware that questions have been asked in certain quarters concerning whether RCC Sola should have been designated responsible RCC and whether MRCC Göteborg should have taken over this office at an earlier time. The Committee does not feel that there are grounds for criticizing RCC Sola or MRCC Göteborg for agreeing that RCC Sola would act as responsible RCC. The *Scandinavian Star*'s position was on the borderline between the Norwegian and Swedish sea rescue areas. The *Scandinavian Star* had Norwegian navigators and mainly Norwegian passengers. Norway was the natural transport destination for many of the survivors. A large number of rescue units were being called out from Norway as well as from Sweden. The rescue coordination centres in Norway and Sweden are used to cooperating with rescue coordination centres and rescue units from different countries, and the main priority in the present situation was the immediate appointment of a responsible RCC. This was done at once, and, as mentioned above, the Committee cannot see any grounds for criticizing this decision.

The Committee finds it understandable that the responsibility for coordination was not transferred to MRCC Göteborg until 1200 hours on Saturday in spite of the fact that it had long been obvious that the *Scandinavian Star* was inside the Swedish maritime rescue area. The rescue coordination centres had called in personnel and made plans based on RCC Sola as the coordinator of the operation, and it would not have been easy to change over to another centre at, for example, 0500 or 0600 hours. A factor in favour of an earlier changeover was that RCC Sola did not manage to maintain very much communication with the CSS and therefore had no overview of the situation at the scene of action. MRCC Göteborg could probably have maintained better communication and information. However, in the Committee's opinion, RCC Sola, as coordinator of the operation, ought to have been able to achieve better communication and acquired a better overview of the disaster. The Norwegian rescue service is based on the assumption that RCC Sola has the personnel and technical capacity to coordinate major rescue operations. The Committee thus sees no reason to criticize the heads of RCC Sola and MRCC Göteborg for not transferring the responsibility for coordination until 1200 hours.

The team that was mobilized at RCC Sola on the night of the disaster was in some ways deficient. First, it lacked medical expertise. This would have enabled the centre to evaluate information from the scene of the disaster in order to assess the need for further medical resources and to advise the OSC/CSS concerning the deployment of available medical resources. In the event of a disaster medical expertise is supposed to be available to RCC Sola, but on this particular night the relevant persons could not be contacted. The Committee has noted that at the meeting at RCC Sola on 22 August the representative from the Directorate of Health stated that the emergency routines have been reviewed and improved, and that it is now possible for RCC Sola to reach a doctor at all times.

In the Committee's opinion the team at RCC Sola should have included an expert in fire fighting. This type of expertise was not on the check list at RCC Sola before the *Scandinavian Star* disaster, but this has been remedied. Such experts have been called in by RCC Sola in at least one case of fire on board ship since the *Scandinavian Star* disaster.

Under 11.5.5 the Committee deals in more detail with the duties of the rescue forces in the event of fire on board ship.

11.4.3 The mobilized rescue forces

11.4.3.1 Which forces were available and when

11.4.3.1.1 General remarks

On receipt of the distress signal, a considerable rescue force was mobilized by the Norwegian, Swedish, and Danish centres. As mentioned above, rescue vessels, pilot boats, coast guard vessels, naval vessels, helicopters, and planes were scrambled. They transported doctors and medical personnel and equipment, and also smoke divers. The course of events, including the times when these resources arrived at the scene of disaster, is described below.

11.4.3.1.2 Helicopters

According to the reports from RCC Sola a total of eight helicopters participated during the period RCC Sola was responsible for coordination. The first helicopter to arrive at the *Scandinavian Star* was a Super Puma stationed at Torp air base (near Sandefjord, Norway), which arrived at 0335 hours. The Danish helicopter Rescue 278 arrived shortly after-

wards, at 0345 hours. The first helicopters arrived on the scene one hour and five minutes after RCC Sola had been alerted.

11.4.3.1.3 Vessels

A large number of vessels took part in the rescue operation, including both specialized rescue units and other ships. The first to arrive on the scene was the *Stena Saga*, at about 0250 hours, but she was rapidly followed by other ships. Some of the other ships that participated were the merchant ships *Stena Nordica*, *Dana Regina*, *Radnes*, *Fritzis Rozin*, *Backafoss*, and *Peter Wessel*.

11.4.3.1.4 Medical assistance

All the Danish helicopters had a doctor on board. The first one arrived at 0345 hours. The Norwegian Sea King helicopter also had a doctor on board, and so did many of the rescue boats, such as the *Nanki Bergesen*. There was sufficient medical assistance at the scene of action to take care of injuries, and help arrived within an hour and fifteen minutes of the distress signal.

11.4.3.1.5 Smoke divers and fire-extinguishing personnel and equipment

One hundred and fifty-eight people died in the *Scandinavian Star* disaster. The causes and times of death are treated under 8.5.1. The Committee has had to consider the question of whether any of the deceased could have been rescued from the ship alive. Under 9.4.5.2 the Committee discusses whether more people could have been saved by the crew. But the question of whether more people could have been saved with external assistance also has to be considered, and it will be dealt with in more detail under 11.4.3.2.2. Here the time at which smoke divers became available for assistance on the *Scandinavian Star* will be examined.

In an examination of the availability of smoke divers from outside, a distinction must be made between smoke divers in the form of personnel with smoke-diving equipment on the ships that came alongside and smoke divers from fire services on shore. The *Dana Regina* ordered its smoke divers to prepare for action and reported this to the CSS at 0340 hours. The offer of smoke divers from the *Dana Regina* was later repeated. Several of the other ships, including the *Stena Saga*, also had teams of personnel with equipment and a certain amount of experience in smoke diving. The CSS decided not to make use of this resource. The reasons for this decision and the Committee's evaluation of it are treated under 11.4.6.

Norway and Sweden both sent out professional smoke divers. At 0338 hours the CSS requested Tjøme Radio to try to obtain smoke divers, and Tjøme Radio immediately referred the request to the *Nanki Bergesen*, which contacted the Larvik fire brigade. The Larvik fire brigade's reaction was immediate and positive, and before 0400 hours the *Nanki Bergesen* was on its way with a senior fire officer and five smoke divers on board.

RCC Sola alerted, directly and via the police, the Tønsberg and Sandefjord fire brigades at 0340 and 0347 hours, and requested voluntary assistance from smoke divers. At 0425 hours four smoke divers from Sandefjord were sent to Torp air base. At 0525 hours they turned back again in response to a report that they were no longer needed. At 0647 hours the Sandefjord fire brigade again received a request for smoke divers. The four smoke divers were again sent to Torp air base, and at 0745 hours they left for the scene of disaster in a helicopter.

The Tønsberg fire brigade supplied three smoke divers. On their arrival at the airport, they were told that they were no longer needed. They chose to remain there, however, and were later flown from Torp to the *Scandinavian Star* at 0649 hours.

The first Norwegian smoke divers to arrive at the scene of the disaster were from Larvik. They were lifted from the *Nanki Bergesen* by a Sea King helicopter, and arrived on the scene at 0505 hours. They were put down on the *Stena Saga* at 0525 hours. Somewhat later, at around 0600 hours or a little earlier, these smoke divers were transferred to the *Scandinavian Star*. The next group of smoke divers from Norway to be put down on the *Scandinavian Star* were those from Tønsberg, at about 0710 hours.

The Göteborg fire brigade was notified of the fire by a helicopter pilot from Säve airport at 0338 hours. After conferring with MRCC Göteborg it was decided to send out smoke divers. A team consisting of a fire engineer, two senior fire officers, and six firemen left by helicopter from Säve at 0400 hours, and began to be lowered to the *Scandinavian Star* at about 0530 hours. A further team from Göteborg fire brigade were sent from Säve at 0745 hours, arriving at the *Scandinavian Star* at 0830 hours.

At 0400 hours the rescue service at Sotenäs was asked by the relevant authorities in Göteborg to supply smoke divers. A team of six fully equipped men were sent from Kungshamn by the coast guard vessel KB 242 at 0430 hours. They had arrived and were ready to start a little after 0700 hours.

The Committee sees no point in giving fur-

ther details about the supply of smoke divers. The first smoke divers were lowered to the *Scandinavian Star* at about 0530. The smoke diving team from Göteborg, who were the first smoke divers to arrive at the *Scandinavian Star*, were all present on board and ready to start work at about 0555 hours.

11.4.3.2 Evaluation of the calling up of the rescue forces

11.4.3.2.1 General remarks

The rescue coordination centres were quick to sound the alarm after Tjøme Radio's Mayday signal. Within a short time a large number of merchant and other vessels had arrived at the scene of action. The *Stena Saga* was alongside about half an hour after receiving the distress signal. The rescue coordination centres scrambled helicopters, rescue vessels, etc. immediately after receiving Mayday, and medical and other assistance was also summoned. As a general rule these rescue reinforcements seem to have arrived at the scene of disaster within a reasonably short time after being alerted.

11.4.3.2.2 Smoke divers and fire fighters and equipment

Smoke divers were not called in until some time after the other rescue units had been scrambled.

One hundred and fifty-eight people were left on board the *Scandinavian Star*. There is no doubt that had this been known the rescue services would have done everything in their power to supply a large number of smoke divers as rapidly as possible. When the rescue operation was begun, no one was aware that there would be people left on board after the ship had been evacuated. The question is whether this possibility should have been taken into account. It is obviously easy to give the right answer with hindsight, and the situation should be judged in the context of conditions at the time of the disaster.

The rescue coordinator on duty has stated that in the light of what they knew at the time, it did not occur to the coordination team that smoke divers would be needed. Nor did this thought occur to MRCC Göteborg, and no initiative in this direction was taken there either. The initiative finally came from the CSS.

The Committee finds it surprising that the possible need for smoke divers was not thought of at once. The distress signal stated that the *Scandinavian Star* was on fire, and that there were 500 to 600 people on board who were going to have to abandon ship. It was the middle of the night. It is difficult for the Committee to accept that no one thought of the possibility of there being people left on board after evacuation.

It has been pointed out that a request is required from the commander of the vessel in distress specifying the resources needed for the rescue. The Committee agrees that this is a valid point of departure. The *Scandinavian Star* should have reported at once that the crew were not managing to search the ship. When the ship was evacuated the fact that there was no overview of how many people had been saved and thus no information as to whether there was anyone left behind, should also have been reported. Such reports would have clarified the need for smoke divers. Under 11.4.5.1 the Committee will examine in detail the information received by RCC Sola concerning the extent to which the ship had been evacuated. But the fact that Captain Larsen did not request smoke divers from the *Scandinavian Star* does not excuse the fact that neither the responsible RCC nor the CSS considered the possibility that they might be needed.

The Committee's conclusion is that the smoke divers should have been mobilized at the same time as the other rescue units, in other words an hour earlier than actually occurred. This would have been justified by the possibility that there were people left on board.

However, it must be emphasized that it is very doubtful whether more lives could have been saved even if there had been a rapid and massive mobilization of smoke divers from the mainland. The evidence indicates that those who died did so fairly soon after the second fire had broken out. The reason for examining the question of smoke divers in such detail is that rescue operations should have as a fundamental premise that reinforcements should always be mobilized to rescue people on board unless it is quite certain that no one is left alive on a ship. In the Committee's opinion there was no such certainty at any time during this rescue operation. Just as we cannot base our criticism of the late mobilization of smoke divers on the fact that we now know that there were over 160 people still on the ship, so we cannot refrain from criticism because it is now known that the 158 people who died had probably done so at an early stage of the disaster.

This criticism is addressed to RCC Sola. The conduct of the CSS as regards the summoning of smoke divers is evaluated under 11.4.6.

11.4.4. The rescue operation at the scene of action

11.4.4.1 The evacuation

Most of those evacuated from the *Scandina-*

vian Star abandoned ship in the ship's own lifeboats, cf. 9.4.6. A few persons were rescued by lifeboats sent out to the *Scandinavian Star*, and a small number by helicopter. As mentioned above, smoke divers began to be lowered to the ship at 0530 hours, and the search of the ship began at about 0600 hours. The search of the ship revealed five people, at least two of whom may have been saved by the efforts of the smoke divers.

11.4.4.2 Medical assistance

Few people were injured in the disaster, and only a limited amount of medical help was required. The Committee finds no reason to go into details here. A doctor was lowered to the *Scandinavian Star* at 0725 hours, and remained on board until 0845 hours. The Committee has understood that he and the smoke divers were examining the bodies for signs of life.

11.4.4.3 Extinguishing the fire

The crew of the *Scandinavian Star* did not make any real attempts to put out the fire. The first smoke divers were lowered onto the ship between 0530 and 0555 hours. They concentrated at first on searching the ship for survivors and to form an idea of the whereabouts of the dead bodies. The work of putting out the fire was started shortly after the smoke diving had begun. The fire boats that had come alongside began using water canons shortly after 0710 hours. The extinguishing went on until the towing to Lysekil had begun, and continued during the towing and after the ship had been docked. The fire was finally extinguished at about 1600 hours on Sunday 8 April, but the damping down and turning over activities continued for some time after this.

Extinguishing the fire created serious difficulties with the stability of the ship. Instead of draining away, the enormous quantities of water that were being poured into the ship remained in the upper parts. The *Scandinavian Star*'s chief engineer and electrician were returned to the ship at the request of the senior fire fighters to start pumping off some of the water, but the effect was limited by the lack of adequate drainage. The stability problems continued until the ship was docked at Lysekil, where on Sunday morning a hole was bored in the upper part of the ship's side, releasing tons of water.

The Committee wishes to point out that it is aware of the doubts voiced about the method used to extinguish the fire. It has been claimed that with this method large parts of the ship were burnt out that might otherwise have been saved. The Committee considers it obvious that the method chosen had no consequences for the loss of life on board, and therefore has no grounds for making further judgments on the subject. But the Committee wishes to add the following. The fire fighting and search of the ship represented a very great physical and mental strain on the fire fighting personnel. It is the Committee's impression that at a personal level the efforts made by the firemen on board the *Scandinavian Star* were outstanding. This also applies, as the Committee has mentioned in a different context, to the other personnel from the police and other services who took part in the difficult and distressing work on board the ship after the accident.

11.4.5 The conduct of the rescue operation by the responsible RCC

11.4.5.1 RCC Sola

RCC Sola acted as responsible RCC until 1200 hours on 7 April. Except that smoke divers should have been called up earlier (cf. 11.4.3.2.2), and that the centre lacked fire fighting and medical expertise (cf. 11.4.2.5), the initial phase of the rescue work seems to have gone well. During the succeeding phase of the rescue operation, however, RCC Sola was not kept informed of the situation at the scene of action. There were considerable problems of communication between RCC Sola and the CSS and between RCC Sola and OCS-Air. Further details are given under 11.4.8.

The Committee wishes to point out that RCC Sola was not able to listen in to and communicate directly with the *Stena Saga* on channel 16. Thus, in spite of being the responsible RCC, RCC Sola was cut off from the important flow of information represented by the messages passing back and forth to the CSS. This also made it impossible for RCC Sola to know when to request important information. It was forced to communicate with the CSS via Tjøme Radio.

The Committee also wishes to point out that during the initial and most critical phase of the operation, Captain Nordgren thought that Tjøme Radio was the responsible RCC and that it was keeping abreast of developments by listening in to channel 16. Even after he became aware that RCC Sola was the responsible RCC, Captain Nordgren assumed that those responsible for coordination at Sola were able to listen in to channel 16.

When RCC Sola realized that it was having difficulty in keeping abreast of events, it should have given the CSS, if necessary via MRCC Göteborg, clear notification that it was the responsible RCC, that it had to be kept informed of developments, and that, if possi-

ble, it should be consulted before important decisions were made about rescue work. No such notification was given, and, probably because of the inadequacy of its information, RCC Sola seems to have played a much more passive role in the rescue operation than its position as responsible RCC would indicate. After the initial phase RCC Sola hardly participated in any important decisions at all. A modest role like this might have been natural if there had been an OSC to command the operation in the form of a large naval vessel. But it cannot be said to be the normal role of a CSS to be so supremely in charge of an operation as was the case here (cf. 11.2.4.1). As mentioned above, RCC Sola should have tried to clarify the situation. If this proved to be unsuccessful, an appropriate solution would have been to have sent out a coordinator or adviser to assist the CSS, or to have requested MRCC Göteborg to do so. The reader is also referred to 11.5.8.

There is one central issue that the Committee feels the need to treat separately. It seems to have rapidly become accepted at RCC Sola that everyone on board the *Scandinavian Star* had embarked in the lifeboats and been rescued, in other words that there was no one left on board. The question of whether or not Captain Nordgren reported that there was no one left on board is discussed under 11.4.6, and the reader is referred to this discussion and to the quotations from the recorded dialogues with the *Stena Saga*. The Committee concludes that Captain Nordgren's statements taken as a whole gave no grounds for assuming that the ship had been completely evacuated. Captain Nordgren's reports were transmitted on channel 16, to which both Tjøme Radio and MRCC Göteborg were listening in, so that both these stations were aware of all the information being exchanged. RCC Sola, on the other hand, was unable to listen in to channel 16, cf. 11.4.8.

The Committee has investigated the information transmitted to RCC Sola concerning whether or not there were people still on board. All communication during the rescue operation was recorded on tape. Thirty-one tracks were recorded altogether, and the Committee has listened to all 31 at the centre. The following reports, recorded between 0325 hours and 0400 hours, are of interest here.

0331 hours from Tjøme Radio:
- "They have all entered the lifeboats, so they have abandoned ship, says *Stena Saga*" (Pos. 3)

0334 hours RCC Sola (the naval representative in the coordinating team) reports to Defence Command South Norway, that everyone had entered the lifeboats (Pos. 5).

0336 hours from Tjøme Radio, in response to a question from RCC Sola (Norwegian Telecom representative) (Pos. 1):
- "*Stena Saga* now says that all of them have left the ship, including all crew and passengers, and are on their way in lifeboats and are being taken on board by *Stena Saga* and *Dana Regina* plus a lot of other boats lying alongside ..."
- "You haven't any figures for how many have already been taken on board?" (Borvik)
- "No we haven't any figures. They are finding out whether everyone has been taken on board a ship, but the captain, he's at any rate on his way to board the *Stena Saga*."

0338 hours, RCC Sola (rescue inspector) reports to the Norwegian Broadcasting Company's news team that everyone had left the ship. (Press telephone)

0340 hours from Tjøme Radio (Pos. 2):
Tjøme Radio reports that smoke divers were needed. *Stena Saga* had made this request in order to check whether there was anyone left on board. Tjøme Radio ended this report as follows:
- "Everyone has left the ship, but just to check this."

0341 hours, Tjøme Radio reports that *Dana Regina* had smoke divers (Pos. 4).

0342 hours, Tjøme Radio reports that he (Nordgren) wanted professional smoke divers. (Pos. 2).

0344 hours, RCC Sola (Defence Command South Norway representative) reports to officer on watch at Defence Command South Norway that everyone had abandoned ship. (Pos. 8).

0347 hours, RCC Sola (police representative) reports to Stavanger police that all on board had been rescued. (Pos. 4).

0350 hours, contact between Tjøme Radio and RCC Sola concerning smoke divers. (Pos. 3).

0350 hours, RCC Sola (press representative) reports to *Ekstrabladet* newspaper, Copenhagen, that 495 people have entered the lifeboats (Press telephone).

0353 hours, RCC Sola (Defence Command South Norway representative) reports to watch at Måkerøy radar station that around 490 people have left the ship and that everything is under control. (Pos. 8).

0356 hours, RCC Sola (press representative)

informs NRK (Norwegian Broadcasting) Telemark that everyone has left in lifeboats. (Press telephone).

0357 hours, Göteborg Radio asks whether Yngve 67 is to bring smoke divers (Pos. 4).

If these messages are compared with those quoted under 11.4.6, it is clear that only part of the information from the scene of action was passed on to RCC Sola. Obviously, Tjøme Radio had to be selective in passing on information. Irrelevant messages and information obviously had to be sifted out. But on the very important point of whether everyone had left the ship, the information supplied was insufficient. Tjøme Radio deserves criticism for this.

The Committee notes in this connection that the tape recordings from Tjøme Radio on the night of the disaster show that all communication on channel 16 in the disaster area could be overheard by Tjøme Radio, but not the communication between the lifeboats, etc. and the *Stena Saga*. Thus the conversation reported under 11.4.6 between Captain Larsen and Captain Nordgren was not overheard by Tjøme Radio. All the other conversations quoted, however, were overheard by the radio station.

However, the Committee does not see that the information passed on to RCC Sola gave grounds for acting on the assumption that everyone had been saved. It is true that the information from Tjøme Radio indicated that everyone had been rescued, but in rescue operations like this all information must be definite and confirmed before it can be relied on. The number of survivors must be established by comparing the exact, confirmed figures for the number of rescued persons with the exact, confirmed figures for the number of people involved. Only when such information is available it be concluded that all the victims of an accident have survived. No such definite, confirmed figures were presented at any time during the rescue operation (cf. also 11.5.1).

The impression that all the victims had been rescued continued to prevail at RCC Sola for a long time during the rescue operation. One of the consequences of this was that a little after 0500 hours RCC Sola informed Torp air base that the smoke divers from Sandefjord and Tønsberg were no longer needed, cf. 11.4.3.1.5. Before giving this message, RCC Sola had tried unsuccessfully to contact the CSS. Other ships in the area had informed RCC Sola that no survivors were thought to be left on board. The Committee cannot see that the information at this point was so definite and confirmed that it was possible to act on the assumption that all the survivors had been rescued.

11.4.5.2 MRCC Göteborg

MRCC Göteborg took over as responsible RCC at 1200 hours on Saturday. The critical phase of the rescue operation was over by this time, so that the Committee has not considered it necessary to examine the efforts of MRCC Göteborg in this respect.

11.4.6 CSS and coordination of the operation at the scene of action

The *Stena Saga* acted as CSS until 1200 hours on Saturday, when the rescue ship *Nord-Jylland* took over as OSC. The *Stena Saga* coordinated the rescue work at the scene of action during the critical phase of the operation. The Committee has not considered it necessary to examine the conduct of the *Nord-Jylland* as OSC.

The duties of a CSS are described under 11.2.3.3. The Committee considers that the captain of the *Stena Saga* performed his duties as CSS very well on the whole. However, some aspects of the conduct of the operation by the CSS need to be examined more closely. Under 11.4.5.1 the Committee mentioned that the CSS made decisions on the spot without informing or trying to consult RCC Sola. However, the Committee finds it difficult to blame Captain Nordgren for this. He was not given any instructions concerning the conduct of the operation, nor was he notified that RCC Sola had to be kept informed and when possible consulted.

As mentioned under 11.4.5.1, Captain Nordgren was under the impression in any case that the responsible RCC was following the operation by listening in to channel 16. He also had a great deal of communication with Tjøme radio, which he thought for a long time was the responsible RCC. This is not surprising. In Sweden the rescue coordination centres are at the coast radio stations. The Committee will return to the communication problems under 11.4.8.

The question has been raised whether Captain Nordgren reported correctly on the state of evacuation of the ship, or whether incorrect information on his part was the reason why the impression that all the victims had been rescued became as widespread as it did. The Committee has therefore decided to reproduce the communication between Captain Larsen and Captain Nordgren, and the latter's communication with the external rescue forces. The quotations are taken from the recorded messages on VHF on the night of the disaster.

0328 hours, dialogue between Captain Larsen and Captain Nordgren:

"Have both passengers and crew abandoned ship?"
- "Yes, all of them. Everybody off the ship."
- "Even the crew? Confirm even the crew."
- "Yes, even the crew, yes."
- "Is there no one left on board the ship?"
- "Well, no one that we know of, so if there is anyone left on board, it's quite impossible to know, we've taken with us everyone we know of and think ..."

0331 hours, Captain Nordgren to Danish rescue helicopter:

"All crew and passengers have abandoned the ship, are in lifeboats some of them have been taken on board here, and some of them have been taken on board other ships, and to the best of my knowledge there is nobody left on board."

0334 hours, Captain Nordgren to Rescue helicopter 278:

"... the captain of the *Scandinavian Star* has reported to me that there is nobody left on board. They are all in lifeboats or taken on board other ships. But I have other information saying that there are people left on board the *Scandinavian Star* which is on fire, and are investigating now."

0335 hours, Captain Nordgren to Danish helicopter:

"Helicopter *Stena Saga* reports that everyone has left the *Scandinavian Star*, but I think there are people left on board, and I am investigating this."
"Will you confirm that they are in liferafts all the passengers."
"No that is uncertain at this time. I am investigating if there is anybody left on board."

0338 hours, *Stena Saga* to Tjøme Radio:

"We have enough resources here right now. What we need are smoke divers who can go on board the ship and search it for survivors."
- "OK, I shall try and get hold of them."

0347 hours, *Stena Saga* to Göteborg Radio:

"There are obviously people still on board. We don't know how many."

0352 hours, Tjøme Radio to *Stena Saga*:

"Are there any more people on board now?"
- "We don't know yet. We took the last ones here by helicopter, but you know it's difficult to answer that."
- "OK, very well. Now, we're going to send in smoke divers, they'll be fetched from Sandefjord and Tønsberg, so they'll be there some time soon."
- "OK, that's fine."

Furthermore, people had been observed on board the *Scandinavian Star*. This is mentioned in a dialogue between the *Stena Saga* and the rescue units. Reports began coming in rapidly of people observed on board.

If the message at 0331 hours is seen in isolation, it may be interpreted to mean that there was no one left on board the ship, apart from the rather significant addition of "to the best of my knowledge". Within three minutes, however, this message was followed by a different one, as shown above. Considering the above conversations, the Committee cannot see that there is any basis for the allegation that the CSS reported from the scene that there was no one left on the ship. On the contrary, in his reports Captain Nordgren clearly indicated that there might have been people left on board.

It has been claimed that Captain Nordgren must be criticized to some extent for reporting that the captain of the *Scandinavian Star* had said that there was no one left on the ship. The Committee considers that such criticism is only justified if this sentence is seen out of context. In the conversation that took place at 0328 hours, Captain Larsen says first that everyone has left the ship. Captain Nordgren asks for confirmation that this also applies to the crew. Captain Nordgren receives confirmation. However, he does not accept this, and asks again whether there is anyone left on board. Not until then is the answer qualified by a reservation. It is to Captain Nordgren's credit that the reservation was expressed, and if the succeeding reports are seen as a whole, they show that Captain Nordgren passed on the reservation. The fact that these messages were not correctly conveyed to RCC Sola is not Captain Nordgren's fault. The Committee concludes that Captain Nordgren cannot be criticized for his reports concerning whether or not there were people left on the ship.

The Committee wishes to make the following point.

Captain Larsen's reservation could not reasonably be interpreted as implying that there might have been many people left on board. As pointed out under 11.4.3.2.2, Captain Larsen can be criticized for not mentioning that he had no overview of how many people had been rescued from the ship and therefore no idea of how many might still have been on board. It should be noted in this connection that no counting of survivors was done either on the *Scandinavian Star* or in the lifeboats, cf. 9.4.6.2.

The question has been raised whether the CSS should have requisitioned smoke divers at an earlier stage, and whether the available smoke divers should have been sent out to the *Scandinavian Star* at an earlier stage.

It is important to distinguish here between two types of smoke divers. One type consists of members of ships' crews with certificates in smoke diving and the limited experience that lies behind such certificates. The other type consists of professional smoke divers from fire brigades on shore. Smoke divers of the first type were available from the time the *Stena Saga* came alongside the *Scandinavian Star*, both from the *Stena Saga* and from many of the other ships in the area. The *Dana Regina* mustered a team of such smoke divers and reported this to the CSS at 0341 hours. The CSS decided not to send these smoke divers in to search the burning ship.

Captain Nordgren has explained to the Committee that there were several reasons for this decision. First, he had assumed that the crew of the *Scandinavian Star* had already made use of the smoke-diving equipment on board to search the ship as thoroughly as possible. Further, he had no information indicating that there were a lot of people still on board, even though he was aware that there might be some. Another significant factor was that at this time the fire on board was extremely fierce. Well-trained seamen are in many ways highly suitable for smoke-diving on board their own ship. They know it well, in contrast to, for example, smoke divers from shore, and this would in many cases outweigh the handicap of their limited training. But to send in seamen as smoke divers on ships they are not familiar with, is quite a different matter. They would run a high risk of being seriously injured. In the light of the factors Captain Nordgren has pointed out, the Committee cannot see that he can be blamed for deciding not to use the crew of the surrounding ships for smoke diving on board the *Scandinavian Star*.

At 0338 hours the CSS requested Tjøme Radio to get hold of smoke divers. Tjøme Radio passed the request on to the *Nanki Bergesen*, which passed it on to the Larvik fire brigade. The request for smoke divers to the Göteborg fire brigade came from a Swedish helicopter captain at Säve airport.

The Committee does not feel that Captain Nordgren can be blamed for not having considered the question of smoke divers from the mainland any earlier. It was a natural assumption on his part that the crew of the *Scandinavian Star* had searched the ship themselves, since he had not received any information to the contrary. On this point the criteria for judging Captain Nordgren's conduct are not the same as those that apply to RCC Sola, cf. 11.4.3.2.2. The Committee also wishes to point out that during the initial phase of the rescue operation Captain Nordgren was very hard-pressed and in a difficult working situation.

Captain Nordgren has been criticized for not sending smoke divers to the *Scandinavian Star* as soon as they were available. The Sea King helicopter with smoke divers from Larvik on board notified the CSS at 0459 hours that it was coming in with six smoke divers and a doctor. The CSS requested it to land on the *Stena Saga* and wait. The helicopter was over the *Stena Saga* at 0505 hours, but at this time there was a great deal of helicopter traffic and the Sea King helicopter had to take its place in the queue, where it was third in line. After hovering for 20 minutes, the Sea King landed on the *Stena Saga* and requested permission from the CSS to land the smoke divers on the *Scandinavian Star*. It was told to await orders. The senior smoke diver then went up to the bridge of the *Stena Saga*. It took some time before the decision was reached to land smoke divers on the *Scandinavian Star*. This was then done, after the Sea King had had to return to Torp air base to refuel. The smoke divers from Larvik were lowered to the *Scandinavian Star* around or a little before 0600 hours.

The senior fire officer in the group of smoke divers, Mr. Bjørn Olsen, has told the Committee that he wished to land on the *Stena Saga* to confer with crew members who had been on board about conditions on the *Scandinavian Star*. The Committee finds this perfectly natural. Considering that it was at the fire officer's request that the smoke divers were first put down on the *Stena Saga*, the Committee does not feel that the CSS can be blamed for not having the smoke divers transferred immediately to the *Scandinavian Star*. The fact that the smoke divers should have been given priority, and that the helicopter carrying smoke divers should have been allowed to land much sooner on the *Stena Saga*, are a different matter. But this cannot be laid at Captain Nordgren's door. He had not been notified that RCC Sola had appointed an OSC-Air to coordinate the air traffic.

At 0522 hours the CSS had contact with the Swedish helicopter Y68, with the first team of smoke divers from Göteborg on board. The CSS gave permission to land smoke divers on the burning ship, and they were lowered between 0530 and 0555 hours. It may seem difficult at first to see why these were sent straight to the *Scandinavian Star* while the other team from Larvik was diverted to the *Stena Saga*. What happened, however, was that the senior officer in the group from Göteborg was landed on the *Stena Saga* for briefing, while the rest of the group was put down on the *Scandinavian Star*. This was made possible by the fact that

there were several senior officers in the Göteborg group.

There are aspects of the deployment of the smoke divers that it has not been possible to clarify in detail, but on the whole there seems no reason to criticize Captain Nordgren for his deployment of the smoke diving forces. A different issue is that, in his capacity as CSS, Captain Nordgren obviously needed expert advice in coordinating the massive operation involving smoke divers and fire fighters and their equipment that became necessary. The disaster illustrates a point the Committee will return to under 11.5.2, that in a disaster on the scale of that of the *Scandinavian Star*, a CSS should whenever possible be able to consult a team of experts.

The question has been raised whether a doctor was sent out too late to the *Scandinavian Star*. At the meeting on 22 August to review the rescue operation, the representative of the Danish air rescue service explained that there had been a doctor on board the *Scandinavian Star* from 0725 hours. This was not so very long after the smoke divers had started searching the ship, so that there are no grounds for the claim that a doctor was sent out too late to the ship. Under 11.5.2 the Committee will return to the point that the lack of a doctor to advise Captain Nordgren was a weakness of the rescue operation.

The Committee concludes that the CSS cannot be criticized for his conduct of the operation under the prevailing conditions.

11.4.7 The OSC-Air and coordination of efforts at the scene of action

A major criticism of the conduct of the OSC-Air was that no priorities were assigned in the helicopter traffic. The captain of the Sea King helicopter objected particularly strongly to this, cf. 11.4.6. The Committee agrees that priority needs to be assigned in such cases, and considers that this should be done by an on-scene rescue coordinator. Priorities that affect the conduct of operations at the scene of action must be decided by the CSS, but those affecting air traffic must be communicated to the OSC-Air. This did not take place at all here. The CSS has stated that it was not until the rescue operation was over that he became aware of the existence of an OSC-Air. This should have been made clear to him by RCC Sola and by the OSC-Air units themselves. It should be noted that one of the OSC-Air units did not have the equipment to communicate with the CSS.

11.4.8 Communication and problems of communication between the various coordinators

Communication, and cooperation generally, between RCC Sola, MRCC Göteborg, and MRCC Aarhus seem to have functioned well during the rescue operation. But communication between the other coordinators was poor. For RCC Sola, in particular, the lack of communication represented a serious problem during the rescue work. Because of its inability to communicate with the CSS, RCC Sola was unable to form a proper picture of the situation, which it needed in order to be able to carry out its functions as coordinator in a satisfactory way. The main problem for RCC Sola was the lack of contact with the *Stena Saga*.

It has been established that RCC Sola tried to communicate several times with the *Stena Saga* via Tjøme Radio in order to be brought up to date on the situation, and the *Stena Saga* refused these requests on the grounds that it had no time. On a couple of occasions the CSS agreed to talk to RCC Sola on a different channel. However, it took so long to obtain contact that the *Stena Saga* returned to communicating on channel 16.

The records of the *Stena Saga*'s communication over VHF and the video film where some of these conversations have been incorporated, show clearly that during much of the most critical phase of the rescue operation the *Stena Saga* had more than enough to do maintaining communication with the rescue units at the scene of action. There was heavy traffic. There were an unlimited number of questions, large and small, that had to be resolved at once. At 0323 hours, after a conversation with the *Stena Saga*, Göteborg radio logged the following comment: "*Stena Saga* under great stress and connection short."

Although it was very unfortunate that RCC Sola did not receive continual reports from the CSS, the Committee does not consider that Captain Nordgren can be blamed for this. As mentioned above, he was under very great stress, and it is understandable that he chose to give priority to communication with the rescue units at the scene of action.

Furthermore, as pointed out under 11.4.6, during the most critical phase of the operation Captain Nordgren thought that Tjøme Radio, with which he was in constant communication, was the responsible RCC. And during the whole operation he was under the impression that the responsible RCC was listening in to channel 16.

The Committee also wishes to point out that, when Captain Nordgren was requested to take

on the office of CSS, he was not informed either about his duties or his relations with the responsible RCC during the operation. The responsible RCC should have taken the initiative and notified the CSS, if necessary over Göteborg Radio, that more information was required from the scene of action.

As regards the technical possibilities for communication between RCC Sola and the *Stena Saga*, it should be noted that direct communication was possible all the time over the VHF maritime frequencies. But it was difficult for the CSS to communicate with RCC Sola on these frequencies because all the rest of the communication from the scene of disaster was transmitted on channel 16. RCC Sola was unable to communicate with the *Stena Saga* on channel 16. This is a simplex channel, which cannot be operated by the main rescue coordination centres over the coast radio stations without expanding the network linking them.

RCC Sola did not have the equipment to listen in to channel 16. When the Committee raised this question with RCC Sola, the latter explained that listening in to channel 16 during a rescue operation would mean taking on new staff and changing the organization plan for the rescue services.

RCC Sola had the necessary technical equipment to communicate with the first OSC-Air, the Danish helicopter Rescue 278. The frequency they employed, however, was not suitable for use at night, so that much of the communication between RCC Sola and OSC-Air had to go through RCC Karup. RCC Sola was unable to communicate directly with the other OSC-Air, the Danish plane C-130 Rescue 680.

The Committee finds it difficult to regard as anything but a weakness the fact that RCC Sola lacks the equipment to listen in to and communicate with a CSS or OSC on channel 16 during a crisis. This makes it difficult for the rescue centre to follow developments, and prevents efficient communication between the responsible RCC and the CSS and/or OSC. Direct communication with OSC-Air is also an important part of the efficient coordination of a rescue operation.

In practice, the ability to keep abreast of events and to communicate is essential if a rescue coordination centre is to be able to perform its functions adequately in an operation like the present one. If the new equipment necessitates changes in staffing arrangements, this is something that in the Committee's opinion will have to be accepted.

The Committee wishes to add and to emphasize the following.

The Committee does not wish to suggest that the rescue coordination centres should take over the coast radio station's task of listening in to the distress frequencies. The Committee's point is that a rescue coordination centre must have the capacity, when necessary during a rescue operation, to listen in on distress frequencies and if necessary to communicate on them. This is probably mainly required in major rescue operations at sea.

It has been objected that in many rescue operations such equipment is not necessary, and that situations can arise where it is inexpedient for a rescue coordination centre to listen in and communicate in this way. The Committee does not see the force of this objection. A rescue coordination centre must be in a position to make its own decisions as to when and when not to use such equipment. And the *Scandinavian Star* disaster showed with all possible clarity that in some crises it may be essential for a rescue coordination centre to be able to communicate on the distress frequency and to follow the communication between the other actors on the scene.

11.4.9 Assistance to survivors on board ship and on the mainland

11.4.9.1 On board ship

The evacuated crew and passengers were taken on board by the ships in the vicinity, the *Radnes*, *Fritzis Rozin*, *Backafoss*, *Stena Saga*, and *Stena Nordica*. A very small number were transported to the mainland by helicopter for medical treatment. The remainder were taken by ship to Sandefjord and Fredrikstad in Norway, to Lysekil in Sweden, and to Fredrikshavn in Denmark.

According to the Committee's information, the survivors taken on board the ships were given the best possible treatment under the circumstances. The only shortcomings were in the registration, cf. 11.4.10.

11.4.9.2 On the mainland

As mentioned above, the survivors were landed at Sandefjord and Fredrikstad in Norway, Lysekil in Sweden, and Fredrikshavn in Denmark. At the first three of these places arrangements had to be organized within a few hours in the middle of the night to receive large numbers of survivors. Hospitals were alerted; doctors, psychiatrists, psychologists, and other medical personnel were transported to the reception station. Accommodation, food, clothes, opportunities to telephone relations, further transport, etc. had to be organized. The Committee has gone through many reports dealing with this part of the rescue work, and has had meetings with the coordinators at

Lysekil. The reception arrangements on shore were also discussed at the meeting on 22 August.

The Committee does not consider it necessary to discuss this part of the rescue work in detail. The Committee's general comment is that this part of the rescue operation was well organized, and that some aspects of it, which demanded considerable feats of organization within a very short time, were extremely impressive. The only feature that was not up to standard was the registration of survivors, cf. 11.4.10.

11.4.10 Registration of survivors

It took a very long time to find out the names of the survivors and those who were missing after the disaster. As mentioned above, there was no counting of survivors on the *Scandinavian Star* or in the lifeboats.

In many cases the numbers of survivors taken on board the various ships were not reported for a long time. The figures for the *Stena Saga* were only completed at 0710, and not until then did it become clear how many people altogether had been picked up by the various ships. This figure was needed in order to calculate how many were still missing. Thus it took four and a half hours from the time the distress signal was sent, and several hours after the survivors had been taken on board other ships, to obtain the final figures. Even though conditions must have been hectic on board the ships that were picking up survivors, the registration took far too long. The disaster has provided a useful lesson by showing the importance of giving registration maximum priority. This is because registration is the only way to find out whether there are any victims that still have to be rescued.

The police had great difficulty in registering survivors and missing persons. First of all, it was very hard to find out exactly how many people had been on board and what their names were. The Oslo police force (Assistant Chief of Police Bjørn Gran) has written to the Committee that:

"There were at no time complete lists of the passengers. At 1300 hours on Saturday 7 April we received from the shipping company a hand-written note listing the ticket orders, which was neither complete nor accurate. Later the "list" was typed out.

"We made our own passenger list from the list of survivors and missing/deceased/identified persons. The list was not completed until Kripos (the National Bureau of Crime Investigation) had finished the identification work. The crew list was completed on Sunday 8 April (91 crew + 4 respectively 7 orchestra members). We received the same list from several sources (the shipping company, Kripos, Lysekil, and England). The problem was that all the lists had to be regarded as incomplete. This was confirmed by our overview dated 22 April, in which the number of crew members was rather higher. The first "reliable" list of survivors was made on Sunday 8 April by us in cooperation with Police Officer Kallelid of the Stavanger police force (338 survivors). On Thursday 12 April the figure was adjusted to 344."

The registration of missing persons also caused problems. The following written comments were received from the Oslo police force:

"For registering enquiries about missing persons, we had to make up a system as we went along. The preliminary stage was rather hectic and unsystematic, but conditions became organized when we brought in data processing specialists from the Criminal Intelligence Section. On Saturday afternoon a new registration form was prepared, and this was used during the rest of the disaster period."

There were also difficulties with the registration of survivors at the reception stations at Sandefjord, Fredrikstad, Lysekil, and Fredrikshavn. Reports kept coming in from these stations all through the day on Saturday, and according to the Olso police, the figures changed with each report, apart from Fredrikstad, whose figures were at all times consistent and correct. The stations did not employ a standardized system of registration, and this created a number of problems when the survivors were gathered together at the Royal Christiania Hotel in Oslo and re-registered. It was discovered that names had been misspelled, first names and surnames had been reversed, etc.

It is obvious that the uncertainty surrounding the question of who had been on board the *Scandinavian Star*, and who had been rescued, was a source of great anxiety and strain for many people. As has been emphasized, it was essential to find out how many had been rescued in order to find out whether anyone, and if so, how many, remained to be rescued. The Committee considers it especially important that registration routines in the event of a disaster be reviewed in the light of the experiences from the *Scandinavian Star* case, and considerably improved. For further details, see 11.5.6.

11.4.11 Information

11.4.11.1 To family members

Most of the passengers on the *Scandinavian Star* were Norwegian. The majority of inquir-

ies were thus addressed to RCC Sola and the Norwegian police. RCC Sola received the first inquiries at 0500 hours, and as the day advanced the stream increased enormously. Television and radio published a telephone number at RCC Sola that family members could ring for information. Eleven telephones were manned by eight police officers and three priests. From a technical and personnel point of view the system was well organized, but the weakness lay in the poor registration routines, cf. 11.4.10. The primary problems were that the list of survivors was not available for a long time, and that there was no proper list of passengers sailing with the *Scandinavian Star*. Many of those who rang up did not know whether the people they were inquiring about had sailed on the *Scandinavian Star* or on one of the other passenger ferries to Denmark.

At the reception stations, the survivors were given the opportunity to telephone home, and most of the information to family members went through this channel. The embassies of the non-Norwegian crew members helped them to contact family members. The embassies had personnel at the Royal Christiania Hotel from the time the survivors arrived there on Saturday, 7 April.

11.4.11.2 To the media and the authorities

From the time the disaster became known, the rescue coordination centres and the reception stations for survivors and for the ship itself were naturally the focus of an overwhelming amount of attention from the media. By 0330 hours the first reporters had already arrived at RCC Sola. Four journalists were permanently stationed at RCC Sola from the morning of the disaster. The Committee finds it unnecessary to describe the press coverage in detail. RCC Sola seems to have handled the technical side of providing information well, but the difficulty was, as mentioned above, that there was no information to provide. MRCC Göteborg took over as responsible RCC at 1200 hours on 7 April, but RCC Sola continued to be deluged by inquiries, and arrangements for dealing with the press remained in force until midday on Sunday.

According to MRCC Göteborg, the centre had no time to provide information to the press during the first part of the rescue operation. The Committee has understood this to mean that at first no personnel were called in to deal with the press. This may be related to the fact that RCC Sola was the responsible RCC. However, this function should also have been taken care of by Göteborg. Arrangements for the press were made from the early morning onwards, and press conferences were held.

There was a considerable influx of press at Lysekil, initially in connection with the reception of the survivors brought in by the *Fritzis Rozin*, and later when the *Scandinavian Star* was towed into port and the work of extinguishing the fire and bringing out the dead was in progress. A press centre was set up in Lysekil with telephones, faxes, etc. and a number of press conferences were held. The Committee sees no reason to go into detail here, but wishes to state that the information to the press in Lysekil seems to have been handled very well.

At the meeting on 22 August, representatives from the police in Sandefjord and Fredrikstad explained that at the reception stations they had found it necessary to protect the survivors from contact with the press, which would have aggravated the strain they were under. Physical barriers were set up, and these were respected by the press. At both stations a few survivors who were willing to talk to the press were sought out in cooperation with a psychologist. The task of informing the press seems to have been tackled very well at these two stations too.

The Committee has been informed from several quarters that relations with the press were good, with a special emphasis on the fact that the press in general did not overstep the boundaries that had been set up, and had, for example, respected the feelings of the survivors, as mentioned above. Anders Bang Andersen, who was in charge of information at RCC Sola, mentioned at the meeting on 22 August that the Committee should "publicly praise the press [for their restraint]". The Committee's response to this is that it is not part of its mandate to evaluate the behaviour or role of the press. The Committee has noted Mr. Bang Andersen's statement and similar statements from other quarters. What the Committee considers to be relevant about these statements is that they show that the various services involved were efficient in the performance of their duty to inform the public.

11.4.12 Removal of the bodies from the *Scandinavian Star*. Identification

The Committee has received information from many quarters, including the police, the Swedish rescue services, and the Department of Forensic Medicine, concerning the removal of the bodies from the *Scandinavian Star*, the work of identification, and the preliminary investigations carried out on board before the bodies were taken on shore. The Committee does not consider it necessary to go into detail on this subject, but wishes to mention that the cooperation between the Norwegian and Dan-

ish police, the Swedish police and rescue services, and others involved in this work seems to have been extremely good, and that the officers involved are to be commended for their efforts under extremely difficult conditions. The Committee also wishes to mention that some of the identification work was very difficult, but that in spite of this all the bodies were finally identified.

11.5 RECOMMENDATIONS

11.5.1 Information about rescued persons and survivors

For a long period during the rescue operation, the responsible RCC, RCC Sola, assumed that everyone had been evacuated from the ship. On the basis of the information in the centre's possession at the time, the Committee does not consider that it had grounds for drawing this conclusion. One of the lessons to be learnt from this disaster is in the Committee's opinion that in a rescue operation it should never be assumed that everyone has been saved without definite and confirmed information. Such information would consist of a complete list of names of the rescued persons that has been checked against a list of passengers and crew that is indisputably correct. An alternative would be a confirmed report that the whole ship has been searched.

The Committee proposes that instructions be drawn up for rescue coordinators specifying the type of information required as a basis for concluding that all the victims of a disaster have been rescued.

11.5.2 Organization and coordination of efforts on the scene of disaster

Being in charge of rescue work at the scene of a disaster like that of the *Scandinavian Star* is a very difficult and demanding task. A merchant ship will not normally have the resources necessary to coordinate a large rescue operation. Such a task involves making quick decisions concerning rescue work and coordinating the efforts of a large number of rescue units, calling up reinforcements, etc. This is recognized in the instruction manuals, etc. for use in rescue operations, and a merchant ship cannot be designated OSC, only CSS.

The disaster of the *Scandinavian Star* represents a good opportunity to review the functions and duties of a CSS and to consider how these tasks can best be carried out. The Committee wishes to emphasize that a re-examination of these questions in no way implies any criticism of Captain Nordgren's conduct as CSS. As mentioned above, Captain Nordgren carried out his duties in an exemplary way. The Committee wishes to re-evaluate, not his conduct, but the system itself.

The task faced by the CSS in this case was to coordinate the rescue operation on the scene in a situation involving a large passenger ferry that was on fire and reported in the distress signal to be carrying 500 to 600 passengers. When the alarm was sounded, it was not clear whether it was going to be possible to get the passengers and crew safely off the ship. The situation might well have called for massive rescue efforts by helicopter, for large numbers of medical and fire fighting experts, or similar emergency reinforcements.

A useful measure would be to offer courses and seminars for captains of ferries in regular traffic in Nordic waters, to inform them of the duties and functions of a CSS. Topical subjects would be the structure of rescue services, the accessibility and deployment of the various types of rescue forces, practical emergency drills, etc. The Committee wishes to point out that Captain Nordgren has strongly emphasized the need for such training. The company Stena Line has informed the Committee that it would be interested in such courses for its navigators. The Committee wishes to add that the Swedish maritime authorities are in the process of launching a series of such courses, arrangements for which have been in progress since 1989.

Another method of strengthening the on-scene coordinator's position is to supply extra resources from outside. There are several possible models for this. One is to have a professional rescue coordinator, if necessary with a supporting team, flown out by helicopter to assist the CSS and if necessary take over as OSC. The point is that the necessary expertise must be supplied to the scene of disaster within a short time so that the right decisions can be made at the right time. The composition of a team like this would of course vary according to the nature of the disaster. In cases of fire it would have to include fire experts and a doctor. The team would also have to include personnel who could be in charge of supplying information to the responsible RCC.

Obviously, many rescue operations, probably most of them, would not need to be supplied with a special rescue coordinator and team, such as disasters so far out at sea that the main operation would have been over by the time a rescue coordinator arrived. In other cases it will obviously be too late to save lives by the time such a team has been assembled and shipped out. Often the necessary rescue functions are easy to define, for example, where a small vessel is sinking and another vessel arrives and takes the survivors on

board. Situations requiring a rescue coordinator with a team at the scene of action are major rescue operations where the efforts of a large number of different rescue units have to be coordinated, or where there is doubt as to how the rescue forces should be deployed.

The Committee is aware that the above suggestions are open to many objections. For example, helicopter transport is difficult enough in itself, and if a rescue coordinator and a team of experts have to be transported into the field, this may be at the expense of other transport needs. The Committee's reply to this is that if in a particular situation helicopter transport cannot be mobilized within a reasonable time, naturally nothing can be done about this. However, the present disaster certainly did not constitute such an example. The available helicopter capacity was considerable. The Committee also wishes to add that a rescue coordinator and team do not necessarily have to be flown out from the country with the responsible RCC. In the present case, for example, a rescue coordinator and team could have been sent out from Sweden. Whether this would have meant transferring the main responsibility for coordinating the rescue operation to the rescue coordination centre in Göteborg is another, and in this context irrelevant, question.

It has also been pointed out that a rescue coordinator cannot be allowed to take command of a ship. This is true, but in the Committee's opinion it is beside the point. No captain of a merchant ship can claim to have the right to coordinate a large rescue operation. This function is not in any way linked to his position as captain. A viable solution would be that the captain retained command of the ship while from the bridge the rescue coordinator and his team coordinated the activities of the helicopters and other units taking part in the rescue work. In theory it is difficult to imagine a situation where it would not be an advantage to send out a rescue coordinator and a team of experts to assist the CSS. The Committee considers that Captain Nordgren was voicing a general wish when at the meeting at RCC Sola on 22 August he stated that it would have been useful to have had a team of experts available, especially experts in fire fighting, stability, and communication. He stated that he himself would have had no difficulty in working with such a team.

11.5.3 Communication equipment, etc. at rescue coordination centres

The Committee considers it essential to provide rescue coordination centres with the opportunity to listen in to and communicate on the distress frequencies. The rescue coordination centres must organize their work in such a way as to make this possible. The reader is referred to 11.4.8.

11.5.4 The international rules governing the actors in rescue operations

The rules governing the duties and to some extent the sphere of authority of the rescue coordination centre, OSC, and CSS are laid down in the Maritime Rescue Convention and MERSAR. The *Scandinavian Star* disaster has shown that the rules need to be re-examined and in some cases supplemented. The question of authority needs to be clarified. The Committee draws particular attention to weaknesses in the rules concerning the CSS. According to these rules, the CSS is to be designated by agreement between the ships in the area, and there is no provision stating that the rescue coordination centre can designate a CSS. The Committee considers that, in spite of the way the rules are formulated, this interpretation needs to be incorporated. There is no doubt that the rescue coordination centre *ought to* have such authority. The relations between the rescue coordination centre and the CSS are quite inadequately treated in the rules, as shown e.g. under 11.2.4.1. The rules need to be changed and added to in order to clarify the sphere of authority and division of responsibility of the coordinating agents.

The duties and authority of an OSC-Air are not specified in the international rules, and this omission should be remedied.

These questions should be taken up in the IMO as soon as possible.

11.5.5 Smoke divers, etc. and extinguishing fires at sea

The primary responsibility for extinguishing a fire at sea lies with the ship. Ships must be equipped and crews must be trained to be able to put out any fires that occur. However, experience shows that fires can get out of control, and if smoke divers, etc. have to be summoned in order to save lives, it must be the task of the rescue services to make sure that such reinforcements are supplied.

In Sweden it is considered the task of the fire services to turn out at the request of the rescue coordinator to fight fires on board ship. This situation does not apply in Norway or Denmark. The Committee is aware that there is a strong conflict of opinion concerning the competent authority for extinguishing fires on board ship and concerning the nature of the emergency fire service that would have to be available for such work. For example, should the task be given to the nearest fire brigade on

shore? Should special emergency groups be trained? Should a few special brigades be designated for the whole country? The Committee is aware that the Directorate for Fire and Explosion Prevention has commissioned a report on this subject, and the Committee has no grounds for recommending one solution rather than another. What the Committee considers essential is that fire fighting at sea that is necessary to save lives must become an integrated part of the rescue services. The Committee considers that this problem needs to be solved in the near future.

11.5.6 Registration, etc.

The reader is referred to 11.4.10. The registration of survivors on board the ships took too long and had too many weaknesses. This also applied to the registration on shore; at any rate it took much too long to compile a complete list of all the rescued persons. The Committee is aware that the police in all the Scandinavian countries are reviewing the question of registration, and that forms, computer programmes, regulations, etc. are being designed on an inter-Scandinavian basis to make the work of registration in such cases more efficient.

The Committee recommends that the routines for registering survivors on board ship be reviewed. The objective should be to be able to register all rescued survivors at once, by name, and to send the complete list of names within a short time to the responsible RCC or to a designated police force. The Committee proposes that drafts for regulations, forms, etc. be discussed between the maritime authorities and the police and rescue services in the Scandinavian countries. The question of submitting proposals for such reforms to the IMO should be considered. The present rules, such as MERSAR 1.4.5 (f), are obviously not good enough.

11.5.7 Establishment of search and rescue regions

Pursuant to the Maritime Rescue Convention, countries should agree on the establishment of search and rescue regions. The borders of such regions have not been fixed between Norway and Sweden or between Norway and Denmark. This did not cause problems during the rescue operation, but as pointed out by RCC Sola in a report to the Ministry of Justice, such regions should now be established.

Chapter 12. The Payment of Compensation to Injured Passengers and Survivors

12.1 INTRODUCTION

One hundred and fifty-eight people, of all ages, died on board the *Scandinavian Star*. In addition to the human suffering this entailed, the tragedy resulted in economic losses for many of the survivors.

Many of the victims have also suffered economic losses as a result of the disaster.

The question of compensation for the survivors and bereaved families has been discussed between the organization formed by the families of the survivors after the disaster and the shipowners' underwriter, Assuranseforeningen Skuld. An agreement has now been concluded that has been accepted by the survivors and by practically all the bereaved families. Under the terms of the agreement, standard payments are to be made for all the main categories of injured persons, without adjustments for any other payments the injured persons may receive in connection with the disaster. Thus, individual assessments pursuant to ordinary Norwegian or other Nordic provisions governing compensation are not to be made. On the other hand, the amounts established in the present case appear to be somewhat larger than those usually awarded under the rules governing compensation, and compensation is also to be paid in cases where there are no real sizable economic losses.

It would be outside the Committee's mandate to give a detailed description and evaluation of the compensation settlement after the disaster. On this point the Committee will confine itself to pointing out that the settlement appears to ensure that the victims of the disaster will receive payments that are at least as high as they would receive under individual assessments pursuant to Norwegian or other Nordic regulations. The magnitude of the disaster and the fact that the shipowners had adequate insurance, are assumed to have had a significant influence on the settlement.

However, the disaster has provided an opportunity to examine the rules applicable in such cases, to see whether the existing provisions do in fact ensure that injured passengers and survivors are compensated in cases where satisfactory amicable settlements cannot be reached.

The following presentation is not exhaustive. The Committee's objective is to point out certain main characteristics and to identify areas that need in the Committee's opinion to be re-evaluated in the context of disasters like that of the *Scandinavian Star*.

12.2 THE MAIN FEATURES OF LIABILITY INSURANCE

Chapter 6 of the Maritime Act (of 20 July 1893, with amendments) contains provisions relating to liability for losses incurred when a passenger on a ship dies or is injured during the voyage. These provisions apply to all transport of passengers to and from Norway, Denmark, Finland, and Sweden, whether or not the transport is otherwise subject to foreign law. The country of registration of the passenger ship is thus irrelevant in this context.

The liability for loss due to injury or death of a passenger rests with the *carrier*. The carrier is defined as a person who "by contract, commercially or for remuneration undertakes to carry passengers or passengers and their luggage by ship" (section 171 of the Maritime Act). The carrier may be the person owning or leasing the ship, or another. The point is that the carrier is the person with whom the passenger has made a contract for transport. If the actual transport is carried out by a person other than the carrier, the *person performing the carriage* is responsible under the same rules as apply to the carrier. These two are then jointly responsible with regard to the victims.

In order for the carrier (or the person performing the carriage) to be held liable, the damage must be shown to be due to fault or negligence. If no one can be blamed for the incident causing the damage, the claim for compensation cannot be based on these provisions. In principle liability could be based on other grounds. But in practice it is generally assumed that the unwritten rules governing objective liability (liability without fault) have little application under maritime conditions.

A further condition for liability is that the negligence concerned has been shown by the carrier (or the person performing the carriage) himself or by someone for whom he is responsible. This means, in a very general way, that the victim can submit a claim pursuant to these provisions when damage is due to fault

or negligence by someone who works on board the ship or who works in the service of the shipowners (or of the carrier, in cases where they are not the same).

The victim has the burden of proving the extent of the damage and that the damage occurred as a result of an incident during the transport. In principle the victim must also prove that negligence has been shown. However, if the damage has arisen because of or in connection with "shipwreck, stranding, explosion, fire, or a defect of the ship", the carrier has the burden of proving that the fault or negligence has *not* occurred.

Assessment of the amount of the damage is in principle regulated by the ordinary provisions governing compensation, cf. chapters 3 and 4 of the Act relating to compensation (Act No. 26 of 1969). However, the Maritime Act contains provisions concerning the limitation of liability. The limits are defined in terms of Special Drawing Rights (SDR) established by the International Monetary Fund. According to section 373 of the Maritime Act, SDR are to be "converted into Norwegian currency according to the value of the Norwegian Krone expressed in SDR on the day upon which payment is made" (or a "limitation fund" is set up in accordance with the rules contained in Chapter 10 of the Maritime Act, see below). On 30 November 1990 the value of 1 SDR was NOK 8.36307. The liability for each passenger in respect of personal injury is not to exceed 100,000 SDR (or about NOK 836,000) (cf. section 192 of the Act). There are also limitations on the liability for damage to luggage, valuables, etc.

The right to limit liability is lost if the person responsible has himself caused the damage with intent or "recklessly and with knowledge that such damage would probably result" (cf. section 194 of the Act). It is thus not sufficient that such conditions prevail at a lower level in the operation. The right to limitation is only lost if the damage is caused with intent, etc. on the part of a person whom the carrier, owner, etc. must be identified with, i.e. in practice a person who is acting on their behalf under company law.

If the combined liability under these rules exceeds a certain limit, the person responsible can invoke "global limitation". This means in certain cases that the total amount of liability for each passenger is proportionately reduced from the above-mentioned 100,000 SDR. Global limitation of liability for personal injury incurred by the ship's own passengers is 46,666 SDR (about NOK 390,000) multiplied by the number of passengers the ship is allowed to carry according to its certificate (cf. section 238 of the Maritime Act). The amount may not, however, exceed 25 million SDR (about NOK 209 million). This means that if the ship can carry up to 250 passengers, the carrier's liability in the event of personal injury is limited to 100,000 SDR per injured passenger. If it is entitled to carry between 250 and 532 passengers, the liability per injured passenger may be reduced by stages from 100,000 SDR (about NOK 836,000) to 46,666 SDR (about NOK 390,000) if the combined liability exceeds 25 million SDR. And if the ship is entitled to carry over 532 passengers, the liability per injured passenger may be further reduced if the combined liability exceeds 25 million SDR. Thus, the amount that each victim is entitled to claim depends on how many passengers the ship is entitled to carry, how many of the passengers were injured or killed, and on the extent of the damages involved in each case.

These limitations may be invoked by anyone who can be held to be liable under the provisions of the Maritime Act relating to passenger liability. Global limitation can also be invoked by anyone who has insured against liability for damages that are subject to limitation.

The provisions of the Maritime Act relating to liability are mainly based on international conventions that have been ratified by most of the maritime nations. The provisions relating to passenger liability in chapter 6 of the Act are based on the Athens Convention of 1974. None of the Nordic countries has signed this convention because they considered the limitation amounts fixed by the convention to be too low. The convention is being revised and it appears that the amount of liability will be raised to about the level stipulated in the Maritime Act. All the Nordic countries, however, have signed the conventions on which the global limitation provisions are based.

Sweden and Denmark have maritime acts containing provisions that in this respect correspond closely to those of Norway.

12.3 MAIN CHARACTERISTICS OF THE INSURANCE SYSTEMS

Sea-going passenger ships normally have an insurance that covers any liability the owner might incur in relation to the ship's passengers pursuant to the rules described under 12.2. This is partly because it is in the owner's interest to have insurance coverage, and partly because the contractual holders of a mortgage on the ship usually require such insurance. This type of insurance is known as protection and indemnity (P & I) insurance.

As shown under 12.2, the owner is not the only person who may be held responsible for

injured passengers. The carrier and the person who performs the carriage may also be held responsible. In practice the owner may fufil all these functions, or they may be spread over two or more companies. It is unnecessary to go into detail concerning all the possible permutations of responsibility this could lead to. For the purposes of 12.3-12.5 of this chapter, it is sufficient to state that in practice the shipowner is liable (perhaps together with others) pursuant to the rules under 12.2, and that the P&I insurance is taken out in his name.

In principle P&I insurance covers the total liability that the owner may incur in connection with injuries to the ship's passengers. However, even if a P&I insurance policy has been taken out, it does not follow that the insurance covers the whole of such passenger liability. First, there is no guarantee that the insurance is still in force and has not been discontinued for some reason. Secondly, the conditions of the insurance may have left a number of "holes" in the coverage.

12.3.1 Conditions for P&I coverage

For all practical purposes the parties are free to agree between themselves on the conditions of a P&I insurance policy. The conditions are in general exempted from compulsory legislation, although this situation differs somewhat between the Nordic countries at the moment. Thus the legislature abstains from any intervention and does not, for example, ensure that the insurance meets the needs of the victims.

At an international level the conditions of P&I insurance policies are fairly similar, primarily because of the cooperation between the major P&I underwriters. The following presentation is based on the conditions laid down by one of the major underwriters.

A fundamental condition for the liability of the P&I underwriter is that the shipowner is liable for damages pursuant to the legal provisions applicable to the relation between him and his passengers. Thus there is no separate liability in respect of victims apart from this. The insurance only means that where there is already a subject of liability (the shipowner), the insurance provides greater security that claims will be covered. However, this is subject to alteration under certain conditions:

a) Normally there is no guarantee that a P&I insurance policy will be kept up. If a ship is mortgaged under a contract, the holder of the mortgage will normally insist on its maintenance. If the holder has notified the underwriter of the mortgage, the former will also ensure that he is notified by the underwriter of any alterations, increases, or discontinuation of the insurance. In practice this also protects the victim, in the event of his receiving a claim that would normally be covered by the insurance.

   The insurance can be discontinued if notice is given. The main rules governing this can be summarized as follows.

   An insurance policy normally runs for a year at a time, and the underwriter must give notification within a certain time limit if he does not wish to renew the policy. During the insurance year the underwriter can discontinue the policy without giving reasons at 60 days' notice at any time, at 14 days' notice in the event of e.g. a change of ownership, and at 7 days' notice in the event of unseaworthiness, a breach of safety regulations, or negligence in providing important information. Only 3 days' notice is required in the event of failure to pay the premium, a gross breach of the safety regulations, or deliberate induction of the insurance event. The policy ceases to be valid without notice if the shipowner goes bankrupt or the ship loses its class.

b) A shipowner can lose his P&I insurance coverage if he fails to fulfil his duties as regards information and risk in relation to the underwriter. The main rules governing this can be summarized as follows.

   If the shipowner, at the time of taking out the policy, does not supply complete and accurate information of relevance to the insurance, this may affect the validity of the insurance. The maintenance of the ship's class is also necessary if the policy is to remain valid. Further, the underwriter is not responsible if the shipowner for no good reason fails to notify him concerning changes of risk, and if it can be assumed that the underwriter would not have underwritten the policy if he had known about the altered risk.

   In practice, a more important condition is probably that the underwriter is not responsible if the damage is deliberate or due to gross negligence, and also in certain cases of ordinary negligence. He is also not responsible if the shipowner inadvertently infringes the safety regulations (in the broadest sense), and if there is a causal connection between this and the damage. Finally, the underwriter is not responsible for damage caused by the ship being unseaworthy, provided that the unseaworthiness is due to negligence on the part of the shipowner.

12.3.2 The position of the victims

Even when the P&I insurance policy is

valid, and the P&I underwriter has no objections to raise against fulfilling his obligations, the victims cannot normally address claims directly to the underwriter. Normally the only circumstances in which this can be done is if the shipowner is insolvent. (There are some small differences between the Nordic countries in this regard.) And even then the position of the victims is no stronger than the former position of the shipowner. If for some reason the shipowner has lost his claim against the underwriter, the victims have usually also lost theirs.

Thus, P&I insurance does not represent a satisfactory guarantee that the victims will be compensated for their economic losses. There is no general obligation to take out such a policy; there is no guarantee that it is in force at the time of damage; there are a number of objections that the underwriter can raise against meeting the claims; and normally the victims' only access to the insurance sum is through the shipowner. There are therefore a large number of situations in which the victims' only recourse is to the shipowner. In such cases the victims' position is often weak, since the company structure in passenger ship traffic is often such that the company formally responsible for the carriage or ownership may have little substance.

This raises the question of whether compulsory liability insurance would improve the position of the victims, and perhaps whether there are other, better forms of insurance available. Such alternatives might also counteract any objections concerning the existing provisions governing the shipowner's liability as regards injury to passengers.

12.4 COMPULSORY LIABILITY INSURANCE

Section 202 of the Maritime Act authorizes the authorities to issue requirements that ships used for the carriage of passengers inter alia between Norway and foreign countries must have insurance covering passenger liability in accordance with the provisions of the Act. The other Nordic countries have no such authorization. One of the reasons for the rule is that smaller vessels were taking on passengers without proper insurance coverage. However, the provision is general, and applies, for example, to the ferry traffic between Norway and Denmark irrespective of the country of registration of the ferry. The authorization has so far not been implemented, and no regulations have been issued concerning the content or scope of the duty to insure.

Compulsory liability insurance would only partly compensate for the shortcomings of the present system. The condition for covering the losses of the victims is still that the shipowner himself is liable pursuant to the pertinent provisions.

However, compulsory liability insurance would still make it possible to ensure that an insurance policy had in fact been taken out and maintained, and that the relevant authorities were given reasonable notice that it was to be discontinued. This would of course mean that an official body would have to be established to make sure that insurance obligations were carried out.

The introduction of compulsory insurance would make it appropriate to consider restricting the scope of the objections that may be raised by the underwriter, cf. 12.3.1. In practice it would be especially appropriate to abolish the clause concerning breach of the shipowner's information and risk obligations, e.g. cases where damage has been caused by the shipowner inadvertently infringing safety regulations or making the ship unseaworthy. A reservation must be made here, however. It is possible that the insurance market would not permit compulsory insurance that covered the shopowner's own (in contrast to for example his employees') deliberate or grossly negligent provocation of the insurance incident (the damage). In such cases there would still be a "hole" in the coverage.

Compulsory liability insurance would make it possible to ensure that victims would be entitled to approach the underwriter directly, without having to go through the shipowner.

12.5 ALTERNATIVE INSURANCE SYSTEMS

The main problem as regards compulsory insurance is the link created between the (shipowner's) liability and the insurance coverage. In principle there are two ways of solving this problem.

One would be to alter the rules governing insurance, e.g. by making liability objective and removing the possibility of limitation. Such a solution would have an impact on general questions of liability in maritime affairs, and the international implications cannot be ignored. The Committee will not discuss this alternative in detail.

The second solution would be to introduce new forms of insurance that do not assume that anyone can be held responsible pursuant to the underlying rules on compensation. A possible variation would be to make the shipowner, or perhaps the registered owner, take out compulsory collective accident insurance

in favour of the victims in the event of passenger injuries.

The advantage of such a system is that it would solve the problem of the link between the shipowner's liability and the insurance coverage. The accident insurance would be paid out as soon as an "accident" had been established under the conditions of the policy, whether or not the shipowner was responsible for the accident. In this way the limitation of liability contained in the present rules governing liability could also be avoided. A maximum amount could be fixed at what was considered to be a "correct" level, or the coverage could be unlimited in principle.

Another advantage of accident insurance is that it would operate even in cases where the accident is caused deliberately or by gross negligence on the part of the shipowner.

There would still, however, be a link with the shipowner as the holder of the policy. In principle incomplete or incorrect information provided by the shipowner in connection with the policy would rebound on the victims. This problem should not, however, be insoluble.

A disadvantage of accident insurance is perhaps that it is normally associated with medical and not with occupational invalidity. The insurance payments are therefore fixed independently of the real economic loss. Thus there is a risk that some victims receive "too much" compensation, while others are not fully compensated for their economic losses.

This disadvantage might be compensated if some of the elements of accident insurance are combined with elements of liability insurance. This has already been done in a certain type of comprehensive insurance ("tryghetsforsikring") that preceded the Norwegian Act relating to industrial injury insurance of 1989. This Act is based on a similar principle. Compensation is in these cases assessed according to the normal rules governing compensation, rather like the system for automobile insurance policies that are compulsory for car owners in the Nordic countries.

The Committee wishes to point out that accident insurance has been used in petroleum operations on the Norwegian continental shelf to meet the requirements laid down by the authorities for insurance coverage in case of injury or death in respect of employees. In such cases the insurance sum is linked with the National Insurance basic amount (G). A normal rate would be 40 G (about NOK 1,360,000 in October 1990) in the event of death or 100 per cent invalidity.

The *Scandinavian Star* disaster has provided an opportunity to discuss and re-examine these and other questions in connection with the economic compensation of victims and survivors of disasters involving passenger ships. The Committee's recommendations on this subject are given under 13.3.10.4.

13. Recommendations

13.1 INTRODUCTION

13.1.1 Main defects and weaknesses forming the background for the Committee's recommendations

The *Scandinavian Star* disaster revealed a number of defects and weaknesses in both the ship and her crew. Some of these defects and weaknesses had or could have had an effect on the course of the disaster, while others probably did not influence this particular disaster but under different circumstances could have had negative consequences.

The disaster revealed various forms of human error. The most serious of these was that the clearance given to the ship by the owners and by some of the senior management on board the ship itself, took little or not enough account of the safety of the passengers and crew or of the working environment on board. It should not be difficult to correct this lack in the future, simply by virtue of the fact that all shipowners and senior officers should learn from the accident and be aware that running a passenger ship involves a considerable responsibility for the lives and safety of human beings. However, experience has unfortunately shown that a single disaster cannot in itself be counted on to result in such a change of thinking. Safety has to be ensured by rules, backed up by verification for compliance. The Committee will return to this below.

The disaster also revealed a number of other defects and weaknesses on the part of the ship and the crew, some of them affecting the crew's qualifications, etc., and the safety equipment and other equipment of the ship. Many of these weaknesses need to be corrected by means of new requirements for ships and crews, and the Committee will return to this point below.

The disaster also revealed weaknesses and defects in factors that were not directly connected with the ship, the crew, or the owners. Such factors were for example deficiencies in the inspection of the ship and crew, weak points in the rescue services, and omissions in the provisions governing the economic insurance of injured persons and survivors after ship accidents. The Committee presents below a number of proposals for correcting these weaknesses and defects.

13.1.2 Should the necessary amendments be implemented at a national or an international level?

A separate discussion is called for as regards the principles involved in whether amendments in the provisions, etc. governing ships, crew, systems of inspection, rescue services, etc. should be implemented at an international level, or whether it would be better to concentrate on amending national or regional legislation. The usual reaction to such questions is that shipping is an international industry, and if the amendments are to have the desired effect, they will have to have international rather than national or regional application. An important consideration from the Norwegian and Danish points of view is that by far the majority of their shipping revenues are derived from transport between third countries. They therefore maintain that it is important not to burden their national shipping industry with requirements that are not applicable to others.

In this connection the Committee wishes to point out that it would obviously under normal circumstances be an advantage if new rules and requirements could be implemented internationally, at any rate when this can be done within a short time. However, where international implementation is not possible, or will take a long time, the Committee is of the opinion that national or possibly regional amendments should be considered instead. This alternative should be weighed in relation to each individual requirement that is to be introduced.

The Committee wishes to emphasize that it is primarily concerned with passenger ships in service between Scandinavian ports, whatever their flag. The Committee has therefore not dealt with the question of requirements for passenger ships with Scandinavian registration in service outside Scandinavia. It is possible both in principle and in practice to make a distinction here, especially if the primary considerations behind the more stringent rules are the interests of the "passenger state". As will be seen below, the Committee regards this consideration as being of primary importance.

As a general comment in this connection, the Committee wishes to point out that the international aspect is not as prominent in the service under consideration here – regular pas-

senger traffic between Scandinavian ports – as it is for example in international bulk and cargo traffic. These passenger ships are normally permanently attached to a particular region for relatively long periods. It therefore does not affect international competition in the region if such ships are subjected to stricter requirements than corresponding ships in regular service in other regions, providing the requirements apply irrespective of the ship's flag. More stringent requirements in one region may lead to a similar practice on the part of other "passenger states", which in turn may mean that it becomes difficult to make use of passenger ships that do not come up to the regional standards. If it is kept in mind that the increased stringency is imposed to ensure an acceptable standard of safety, it is difficult to regard such a development as being other than favourable. The regional rules would then represent necessary, although in principle undesirable, alternatives where it appeared temporarily impossible to implement such developments internationally.

A more serious objection is that stricter requirements would influence the practical possibilities for the provisional use of ships from other places in this region, for shorter or longer periods. Correspondingly, this may reduce the second-hand value of such ships, since if they cannot satisfy the stricter requirements their area of use is limited, which lowers their resale value. Although the Committee acknowledges the validity of this objection, it considers the objection to be overruled by the interests of the "passenger states" in ensuring the safety of their passengers during a voyage.

In the context of international law, these "passenger state interests" have a parallel in the interests of continental shelf states in enforcing safety rules on the part of all ships engaged in petroleum operations on their continental shelf, whatever the ship's flag. The regulation and control exercised by continental shelf states have been implemented in spite of the fact that the shipping traffic involved in petroleum operations has a far more international character than regular passenger services.

The Committee emphasizes that it would be natural and desirable that its proposals be implemented by means of Scandinavian or Nordic cooperation.

The Committee is aware that in many cases at least one of the Scandinavian countries has already begun implementing measures that are partly or completely in accord with several of the Committee's recommendations.

13.1.3 Advantages and disadvantages of regulation by means of international conventions

In connection with what has been said under 4.2, it should be pointed out that in the field of shipping a great deal has already been done to improve the standard of safety by means of international conventions. Examples of this are the Safety of Life at Sea (SOLAS) conventions, which lay down minimum standards for ship construction, etc., and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention), which contains minimum requirements for training, watchkeeping, etc. for seamen. The SOLAS regulations are under continual revision. All in all, the work of the International Maritime Organization (IMO), or the Inter-Governmental Maritime Consultative Organization (IMCO), as it was previously called, has been impressive.

As a result of the existing conventions, many countries, including Norway, Sweden and Denmark, have abolished a number of special national provisions that had previously been enforced in addition to the convention rules. These national standards have now to a large extent been overtaken by the provisions of the new conventions, and it has not been regarded as good form to lay down new ones. The international nature of the shipping industry has been the main reason for this attitude.

However, it is important to be aware that when particular national provisions are repealed in a large number of areas, much of the impetus for improving the standards laid down by international conventions disappears. There are no longer "competing" national requirements against which to measure the standards established by the conventions. In the same way, if countries are cautious in their application of discretionary provisions, and take other countries' less strict practices into account, the system will become increasingly static. This is supported by the Committee's observations as regards port state control (see 10.4.3).

13.1.4 Sectoral approach

In many ways the development of rules and systems of inspection for ships and crews has been characterized by parochial thinking. The Committee is aware that this can also be said of its own report, since the Committee has to a large extent confined itself to the rules, recommendations, etc. applicable to passenger ships. The main reason for this lies in the Committee's mandate, which was to investigate a particular event.

However, the Committee feels that its rec-

ommendations, etc. are also applicable to the shipping industry in general. However, it considers it to be the national maritime authorities' responsibility to decide whether the recommendations should be extended to apply to other types of ships. In the same way, it is the decision of the fire inspection authorities whether the Committee's proposals regarding fire protection should be made applicable to hotels, etc.

In the Committee's opinion the tendency towards a sectoral approach in the shipping industry has had a number of undesirable consequences.

One such consequence is that safety issues in shipping have been dealt with without regard to similar issues in other sectors, such as the petroleum operations on the continental shelf. Thus large sections of the crew of a passenger ship, like the catering staff, are allowed to sail without having had to undergo any form of safety training before they go on board. This is in strong contrast to the requirements for corresponding personnel employed on oil rigs on the Norwegian continental shelf, where attendance at a two-week safety course is compulsory for every employee before they start. In so far as there is any difference in the need for such a course, the Committee wishes to stress that a ship's crew is not only responsible for their own safety but also for that of their passengers, while the crew of an oil rig have no passengers to consider. The Committee therefore presents proposals below for requirements for safety training for everyone employed on passenger ships.

Another example of the sectoral approach is that each state has considered only its own interests in the sphere of safety in shipping. This was illustrated by the comments made to the Committee by representatives of the British marine administration. They said that they felt that the experiences they had gained from the *Herald of Free Enterprise* disaster were largely regarded by other countries as being only applicable to the UK. The Committee has not considered this question in depth, but wishes to point out that after the *Herald of Free Enterprise* disaster the UK undertook a considerable reorganization of its inspection routines for passenger ships. This seems to have been followed up by other countries to a very limited extent.

A last example of the sectoral approach is where a narrow focus on safety considerations in one area leads to reduced safety measures in another.

13.1.5 The ships to which the Committee's recommendations apply

The Committee wishes to specify briefly which ships the following recommendations are intended to apply to.

The recommendations apply to ships in regular traffic between Scandinavian ports, irrespective of whether the ship calls at ports in more than one state, but assuming that the ship is to take on board passengers from a Scandinavian port. The ship is assumed to be over a certain size, which is specified by a minimum number of cabin places for passengers or by a minimum number of passengers. The numbers should be determined on the basis of practical considerations and of the extent of the need for regulation and control. The Committee does not wish to recommend a particular number. As a basis for comparison, the USA's extensive port state control applies to passenger ships with cabin places for more than 50 passengers.

13.1.6 The need for resources of the maritime administrations

The Committee's recommendations for new measures as a result of the disaster are extensive. A number of them will make considerable demands on the maritime administrations in the three countries. The Committee considers it important that the maritime administrations be given the necessary resources to evaluate and implement the Committee's recommendations.

13.2 THE PRINCIPAL RECOMMENDATIONS OF THE COMMITTEE

13.2.1 Background

On the basis of the circumstances revealed by its investigation of the fire on board the *Scandinavian Star*, the Committee has discussed numerous proposals for measures that may reduce the risk of a similar disaster in the future. The Committee has concentrated on areas where the fire showed up weaknesses, and of these, it has focussed only on circumstances that have a wider application than that of the fire in question. Finally, the proposals have been limited to what the Committee considers to be practically and financially feasible when the probable gains in safety are weighed against the costs. Even with these limitations, the list of relevant measures is relatively long.

There are four principal areas where in the Committee's opinion the fire showed up the need for improvements. Thus the Committee proposes a reorganization of the inspection of passenger ships, and new requirements for

sprinkler systems, smoke detectors, and general crew training in safety routines. The Committee considers that if appropriate measures are introduced in accordance with its recommendations on these points, this will considerably reduce the risk of similar disasters in the future. Although a number of other measures are proposed (see 13.3), the Committee wishes to emphasize most strongly the fundamental importance of the following principal recommendations.

The Committee considers that if the recommendations proposed under 13.2 are followed for passenger ships in regular traffic to Scandinavian ports, a great improvement in safety standards on board these ships will have been achieved. As regards the recommendations made under 13.3, the Committee regards them as important, but wishes to point out that even if all the recommendations proposed under 13.3 were to be implemented, this would not achieve the desired safety standards on board passenger ships unless they are backed up by the measures proposed under 13.2.

13.2.2 Technical features

13.2.2.1 Sprinkler systems

It is possible even today to build passenger ships without sprinkler systems in the accommodation part of the ship. The *Scandinavian Star* had a sprinkler system on the car deck, but nowhere else. A sprinkler system in the corridors and stairways would probably have stopped the fire before any great damage had been done.

The most important recommendation proposed by the Committee is therefore that all ships in regular passenger service to Scandinavian ports must be equipped with sprinkler systems.

Under the present rules a sprinkler system is required on the car deck. The Committee considers that sprinkler systems should be installed in all accommodation areas in such passenger ships.

If whole of the accommodation area is not furnished with sprinkler systems, the fire may have spread so far before the sprinklers are activated that it cannot be stopped.

Such sprinkler systems should be automatically triggered by heat, acting on any individual sprinkler head. It should also be possible to activate and stop the system manually, section by section. A system that can be activated section by section will need to be developed.

The Committee points out that to ensure stability a separate drainage system may be required in connection with the sprinkler systems, especially for large, interconnected spaces situated high up in the ship's superstructure. On the other hand, evidence appears to show that a fire in a ship with a complete sprinkler system is unlikely to spread so far and so fast that the amounts of water from the sprinklers represent a significant stability risk.

On these grounds, the Committee recommends that all ships in regular passenger service to Scandinavian ports should be required to have a sprinkler system covering the whole accommodation area.

13.2.2.2 Smoke detectors

A thermally controlled sprinkler system will function to a large extent as an automatic heat-activated fire alarm, as well as as a fire extinguisher. It does not, however, constitute an adequate detection system.

Fires often begin by smouldering, during which time they do not give off enough heat to trigger a thermally controlled sprinkler system. A long period of smouldering may produce considerable amounts of smoke, as shown fairly recently by the fire on board the passenger ferry *Tor Scandinavia*, which occurred off Esbjerg, Denmark, on 25 Septemberr 1989. It is thought that the fire smouldered for about half an hour before it was discovered, during which time large areas of the passenger accommodation became filled with toxic smoke.

The fire on board the *Scandinavian Star* may have burned for several minutes before attaining a high enough temperature to have activated a sprinkler system. Neither this ship nor the *Tor Scandinavia* were equipped with smoke detectors. The deaths on board the *Scandinavian Star* were mainly caused by the smoke, which spread much faster than the flames.

In the Committee's opinion the evidence of these fires demonstrates that the installation of smoke detectors in the accommodation areas of passenger ships should be compulsory. In the Committee's opinion neither the cost nor the practical difficulties of installing them are so great as to prevent the requirement being applied to all such ships, whatever their age. Nor can the Committee see any reason to wait for an international implementation of such a requirement.

Smoke detectors must initiate a signal on the bridge and at the detector in question. The detectors must be numerous enough and so placed that they are able to detect possible sources of smoke as soon as possible and provide the bridge with adequate indications of the spread of smoke in the accommodation areas.

On these grounds the Committee recommends that all ships in regular passenger ser-

vice to Scandinavian ports should be required to have smoke detectors throughout the entire accommodation area.

13.2.3 Operational features: Safety training

A certain amount of training in safety routines is one of the conditions for issuing the certificates of many of the crew members. This is laid down both in the STCW Convention and in national legislation, in the Scandinavian countries among others (see 10.3 for details). These provisions, however, do not require safety training for all members of the crew, so that at any time there may be any number of crew on board a particular vessel who have not received organized training in safety procedures, either in general or in relation to the vessel in question. Most of these are usually catering staff, who numbered, for example, almost 60 out of a total of 99 crew on board the *Scandinavian Star*.

The question of safety training of all crew members was taken up by the Danish ad-hoc committee appointed by the Shipping Inspection Council (Skibstilsynsrådet) after the fire on the *Scandinavian Star* to review the safety routines on board passenger ships and ferries. This committee recommended that all crew members should have a minimum of training before starting service, but for practical reasons it approved a system whereby the shipowner provides further training for groups of new employees within a short time after they have started work.

The committee appointed by the Norwegian Maritime Directorate after the fire on the *Scandinavian Star* to review safety on board passenger ships (the Jansen Committee) also discussed the question of safety training, and concluded that emergency situations on board passenger ships are so unique that special courses and training programmes should be designed for the separate categories of personnel serving on passenger ships. The Jansen Committee also specified that the responsibility for seeing that the crew received adequate and appropriate safety training lay with the shipping company, "pursuant to the regulations appurtenant to IMO Resolution A.647 (16)" concerning the sound and responsible management of shipping companies as regards safe operation, etc.

In this connection the Committee wishes to point to the safety training given to the cabin crew on board aircraft. Safety is the cabin crew's main preoccupation, and all crew members are put through a comprehensive training course for this purpose.

Another good basis for comparison is the petroleum operations on the Norwegian continental shelf. In this regard the safety regulations laid down in the Royal Decree of 23 June 1985 stipulate that the responsible oil company shall ensure that "every person who spends time on installations or vessels taking part in the operations has sufficient training and practice as regards emergency situations" (section 24, third paragraph). For Norwegian drilling vessels, in particular, there is a requirement that, before entering service on board, all crew members must have attended a basic two-week training course in safety procedures at an approved safety training establishment (regulations laid down by the Maritime Directorate on 23 March 1982 pursuant to the Seaworthiness Act). These requirements have been followed up by guidelines and curricula for safety training courses established by the petroleum industry and approved by the Norwegian Petroleum Directorate and based on the recommendations of the "Leiro Committee" (Norwegian Official Report 1978:10). The courses last two weeks and cover areas like fire, safety precautions, rescue work and equipment, and first aid. The courses have to be taken by everyone who works on such installations and vessels, whatever their function on board. While it is true that petroleum operations entail different and often higher risks than those of ferry traffic, they do not include helping passengers in an emergency. Thus the Committee considers that the philosophy behind safety training in the petroleum industry is also relevant to passenger ships.

The evidence from the *Scandinavian Star*, as well as more general considerations, indicates how unsatisfactory it is that a large proportion of the crew, such as the catering staff, are permitted to have no other preparation for the type of action required in emergencies than the experience gained from fire and evacuation drills carried out on board. In such circumstances their knowledge and experience may easily be haphazard and unreliable, with the result that an essential condition for effective cooperation among the crew is missing. The Committee points out in this connection that emergency plans often assign crucial functions, especially with respect to evacuation, to catering personnel, many of whom may never have been to sea before, or if they have, under different circumstances.

In the opinion of the Committee there is no question that safety training for the crews of passenger ships must be improved. It must be emphasized that safety is one of the main preoccupations of the crew as a whole. The first requirement is that every individual listed on the emergency plan is trained to carry out the task he has been assigned. The Committee

will return to the question of the training of fire personnel under 13.3.7.1. Even personnel whose functions under the emergency plan are not directly related to fire fighting or evacuation, should also have attended a basic safety course. Because of the need for temporary replacements, it has to be accepted that a small proportion of this latter class of personnel, amounting to not more than 10 per cent of the whole crew, may lack safety training. However, this must not be allowed to apply to crew members who have been assigned tasks that are important for the safety of passengers and ship in an emergency. The requirement for a refresher course, for example every five years, should also be evaluated.

The contents of a basic safety course as proposed above should be decided by the maritime administrations in the Scandinavian countries, preferably in cooperation. The course should not be held in connection with normal work or at the workplace. It should include topics like an introduction to emergency planning, basic fire fighting and evacuation techniques, handling of fire extinguishers, lifeboats and liferafts, and a run-through of signalling and alarm procedures.

The Committee recommends that the crews of passenger ships should be required to attend safety training courses approved by the maritime administration. The requirement should apply to all ships in regular passenger service to Scandinavian ports.

13.2.4 Inspection and control

13.2.4.1 Port state control and inspection of own ships by Scandinavian countries

Under 10.4.3 the Committee discussed port state control in its present form and compared it among other things with the control exercised by the USA and to a great extent by the UK. The conclusion was that the port state control exercised by the Scandinavian countries is in many ways inadequate (see 10.4.3.2.7).

Like the Jansen Committee, the Committee considers that port state control and inspection by the Scandinavian countries of their own ships should be reorganized so that it takes place before passenger ships in service to Scandinavian ports have taken on board passengers in Scandinavia. This will ensure that the service cannot be started at all until the above-mentioned conditions are fulfilled. In other words, there is no need to depend on traditional port state control, which takes place at some point after the ship is already in service. This type of introductory control must be followed up systematically by further inspections, with and without prior notification.

The inspection of operating practices will have to form an important part of this port state control. The authorities need to verify that the crew are able to perform satisfactorily in the interests of safety on board. Essential features that should be checked are the satisfactory performance of boat and fire drills, that the crew are familiar with the ship, and that they are able to cooperate in an emergency. This includes checking that the crew members have sufficient command of a common language to be able to communicate adequately with each other and with the passengers.

The Committee does not consider that the introduction of the above changes in the Scandinavian countries would need to be dependent on a corresponding reorganization at an international level.

The Committee recommends that control of ships in regular passenger service to Scandinavian ports should include prior inspection before the ship is allowed to take passengers on board in Scandinavian ports, followed by systematic follow-up inspections, and that the inspection of such ships should be extended to cover operating practices.

13.2.4.2 Organizational requirements for shipowners as regards safe operation of ships

As a result of among other things the *Herald of Free Enterprise* disaster, the International Maritime Organization (IMO) issued in 1989 "Guidelines on management for the safe operation of ships and for pollution prevention" (Resolution A.647 (16)). The Resolution is not binding for IMO's member states. It contains relatively unspecific recommendations that the shipowner should have a system for ensuring sound and responsible management, among other things to make sure of the safe operation of the ships owned by the company. The objective is to ensure effective compliance with the international conventions relevant to maritime safety. The main point of the Resolution is that shipping companies should be organized in such a way as to actively promote compliance with these conventions on board their ships. The Resolution points out that while the captain has the overall responsibility for the safe running of the ship, the owner is responsible for making sure that the captain has the necessary support and authority for implementing safety procedures on board.

In the Committee's opinion the *Scandinavian Star* disaster revealed deficiencies in the ability of the ship's owner and the ship's command to ensure the safety of ship and passengers. The deficiency on the part of the owner would have been unlikely to occur if the pri-

orities and organization of the work had been based on the principles of the IMO Resolution. The Committee therefore feels that the disaster is an example of how this type of requirement may serve a useful function. This confirms the views expressed repeatedly above, that maritime safety is clearly not only a question of technical factors, and that the operational aspects of shipping traffic also need to be subjected to better regulation and especially control. "Operational aspects" in this context refers primarily to the crew's own qualifications for safe running of the ship. However, this aspect cannot be seen outside the context of the land-based organization – the owner. The crew's ability to run the ship safely depends to a large extent on whether the owner has an organization that actively promotes this. The *Scandinavian Star* disaster illustrates how this may fail.

On these grounds, the Committee considers that the application of the principles laid down in IMO Resolution A. 647 (16) should be made compulsory for the owners of passenger ships in service to Scandinavian ports. The port state has to make certain that the ship is being run by an organization that satisfies these requirements. Verification of this point should be incorporated in the inspection recommended by the Committee under 13.2.4.1. Such control would make it possible in practice to ensure that shipowners complied with the requirements for a system of sound and responsible management with regard to safety.

On these grounds the Committee recommends that regulations be laid down governing the duty of a shipowner to establish a system for safe operation of ships in accordance with the principles laid down in the IMO Resolution, and that these regulations be made applicable to all owners of ships in passenger service to Scandinavian ports. The Committee further recommends that the governments of the Scandinavian countries make efforts to ensure that compliance with Resolution A. 647 (16) becomes compulsory for the owners of passenger ships in international service.

13.2.4.3 A licensing system?

In its report the Jansen Committee discusses whether regular passenger services to Norwegian ports should be made subject to licensing. The Jansen Committee was unable to agree on the subject, however, and the report therefore contains no proposals.

A licensing system in this area would mean that regular passenger services to Norwegian ports would be prohibited without a prior licence from the Norwegian authorities.

From the point of view of safety, the main point of a licensing system would be to allow prior verification that the management organization, the ship, and the operating conditions on board satisfied certain standards that had been established to ensure the safety of those on board. Furthermore, more stringent conditions may be laid down for the retention of a licence for the service than those usually employed by the port state control, e.g. regular, thorough, and relatively frequent inspections of essential technical and operational features.

The Committee considers that the needs that would be catered for by a licensing system would be met if the Committee's proposals are adopted as regards prior control and inspection of passenger ships, combined with requirements for general safety training and for high safety standards on the part of the managing organization.

13.3 OTHER RECOMMENDATIONS

13.3.1 Inspection and control

13.3.1.1 Flag state control

After reviewing the provisions governing flag state control, the Committee concludes that compliance with SOLAS probably does not involve a duty on the part of the flag state to verify the ability of the crew to act in the interests of safety. The Scandinavian countries should make efforts to see that SOLAS be amended as soon as possible to incorporate a regulation requiring that the verification of such operational skills be included as part of flag state control.

The Committee refers the reader to the discussion under 10.4.2.6.

13.3.1.2 Inspection by the classification societies

A study of flag state control as carried out on behalf of the Bahamas by Lloyd's Register and to some extent by the country's nautical inspectors revealed that there may be some uncertainty between the Bahamian authorities and Lloyd's Register as to who should verify what. For example, Lloyd's Register did not consider itself responsible for checking the crew's performance in boat and fire drills. The Bahamian authorities, on the other hand, considered this to be part of the flag state control delegated to the classification societies (see 10.4.2.2.2).

The Committee considers it important that when flag state control is delegated, it should be clearly specified what such delegation is expected to comprise, thus ensuring that the most important verification tasks are carried out. The Committee proposes that efforts be made to ensure that such provisions are in-

cluded in the conventions relating to delegation.

When a ship changes class, the previous classification society is not required to transfer to the new one the material in its possession concerning the ship. The new classification society relies on the shipowner's supplying all the relevant plans and information (see 10.4.2.2.2). In the Committee's opinion this is not a satisfactory state of affairs.

The Committee recommends that the Scandinavian countries work towards the establishment of an international system that ensures that, when flag state control is delegated, it is clearly specified what the classification societies are expected to verify. The system should also ensure that in the case of a change of society, all classification societies transfer all material concerning the ship that is necessary in order for the new classification society to perform its survey in a satisfactory way.

13.3.2 Fire detection

The fire detection systems on board passenger ships should fulfil three purposes: They should if possible have a preventive effect as regards arson, they should ensure early and efficient warning, and they should permit a rapid and detailed overview of the spread of smoke and flames.

Smoke- and heat-triggered fire detection in the form of sprinkler systems is treated under the Committee's principal recommendations under 13.2.2.

According to the existing provisions, all manual fire alarms in a particular fire zone may be connected to the same indicator on the bridge. This makes it impossible to find out which alarm has been activated. It should be a requirement that each manual alarm should have its own circuit.

Another detection system is *monitoring by closed-circuit television*, which also has a preventive effect. In case of fire such a monitor would indicate the spread of smoke and flames and enable the effective deployment and organization of the crew. It would also enable the escape routes to be effectively monitored. The television would have to be monitored from the reception desk or other suitable place, which would have to be manned continually day and night by a sufficiently qualified person. It would also have to be directly coupled to the bridge.

After the *Scandinavian Star* fire the Nordic maritime authorities agreed that until further notice passenger ships are required to have *fire patrols* making the rounds every half hour.

On board the *Scandinavian Star* the fire was discovered and the bridge was alerted only a few minutes after it had been started (see the description of the course of the fire in Chapter 8). The fire watch was not involved in the discovery or signalling of the fire. More frequent patrols will increase the likelihood of a fire being discovered by the watch, and may also reduce the chances of arson. But the Committee feels impelled to point out that even fire patrols every half hour, i.e. twice as often as on board the *Scandinavian Star*, are no guarantee that a fire will be discovered any earlier than the fire on the *Scandinavian Star*. This measure is inadequate, and must be supplemented by automatic fire detection systems.

The Committee still feels, however, that relatively frequent fire patrols will increase the probability of early discovery of a fire and, provided the patrol is in uniform, may reduce the likelihood of arson.

The Committee therefore recommends that the present stricter requirement for fire patrols be made permanent. The Committee also recommends that each manual fire alarm have its own circuit, and that passenger ships should have television monitoring of all saloons, passages, corridors, and stairways.

The Committee would prefer these measures to be implemented internationally, but considers that there is no reason for individual countries to defer their implementation in expectation of this.

13.3.3 Warning systems

13.3.3.1 Main alarm system

As pointed out under 4.7, it is essential that the passengers and crew receive warning of a fire as early as possible. Prompt evacuation of the cabins before the corridors become filled with smoke depends on early warning.

On board the *Scandinavian Star* the alarm was triggered from the bridge. Thus in order to warn the passengers the bridge had to be aware of the fire.

One way of triggering a fire alarm is to connect it to detectors that trigger the alarm in the appropriate fire zone. Under 13.2.2 the Committee recommends the installation of an automatic signalling system to the bridge triggered by smoke and heat detectors. An automatically triggered signal to the passengers has the advantage of providing an early warning, but would cause problems in the case of false alarms. This could to some extent be counteracted by a programmed delay period before the main alarm system became activated. In the opinion of the Committee the question of automatic alarm signals to the

passengers should be studied in more detail before any requirement is laid down.

On board the *Scandinavian Star* the alarm button on the bridge had to be operated manually. The alarm only sounded when the button was held in. This meant that this task required the complete attention of one person, and that this person had to be familiar with the signals. The Committee considers this system to be unnecessarily impractical.

The technical design of this alarm system does not contravene any international or applicable national provision.

The Committee recommends that a requirement be laid down that an alarm should continue to function, by means of the activated signals, after it has been triggered until it is manually turned off or is temporarily interrupted by messages on the public address system. The requirement should apply to vessels engaged in passenger service to Scandinavian ports. The Scandinavian maritime authorities should also be requested to review the possibility of making automatically activated fire alarms compulsory.

13.3.3.2 Sound level

As the Committee pointed out under 4.7.1, there are no specific rules governing the decibel level of alarms or loudspeakers in public address systems.

The investigation made at the Committee's request of the sound level of the alarms (see 4.8.4) suggests that the loudness had some influence on whether or not the passengers vacated their cabins. Cabins where the sound level was low were vacated to a lesser extent than cabins where it was high.

Calculations have shown that the sound level of an alarm must be at least 75 decibels and at least 10-15 decibels over the background noise level in order to wake 90 per cent of sleepers. However, 75 decibels is not loud enough to wake sleepers in deeper sleep phases at once. It is therefore important that an alarm be repetitive and of a certain duration, irrespective of how it is activated.

Loudspeakers in the public address system should also satisfy minumum requirements as to sound level.

The Committee recommends that all ships in passenger service to Scandinavian ports should be required to have an alarm system with a strength in every cabin of at least 75 decibels and at least 10 decibels above the background noise. Further, the alarm shall continue to sound at intervals, only interrupted by the public address system. The Committee also recommends that the Scandinavian maritime authorities should be given the task of discussing the requirements for minimum sound level of public address systems on passenger ships and of implementing this requirement for all ships in passenger service to Scandinavian ports.

13.3.4 Escape routes

13.3.4.1 Layout of cabins, saloons, corridors, and stairways

The time available to passengers for finding their way about a ship between two Scandinavian ports is often short. Furthermore, in an emergency they may have to escape through smoke-filled areas with poor visibility. It is therefore important to ensure that passengers can find their way easily around a ship.

Passengers may be in a physical condition that makes it difficult for them to escape even over short distances and that in any case makes it difficult for them to climb several sets of stairs and cross several decks.

On these grounds the Committee recommends that the following requirements be made applicable to new ships in regular passenger service to Scandinavian ports:

All decks with passenger cabins on a particular ship should have the same design. Cabins and corridors should all be in the same position in relation to one another. The route from the cabins along the corridors to escape stairways or open decks should be the same on all decks.

All stairways should as far as practically possible follow the same design. The direction should be the same on all decks, and so should the number of stairs between each deck.

The escape route from cabin door to exit to sheltered escape stairway or open deck should not involve more than one change of direction. There should be escape routes on both sides of the ship so that passengers do not have to cross over to the other side of the ship to reach an escape route.

The number of stairs to be climbed during an escape should be limited, for example to at most two stairways up or down to the nearest muster station or open deck.

Stairways and corridors should have a constant or increasing width in the main direction of the escape route.

Stairways used as escape routes should be continuous from deck to deck, interrupted only by landings, as far as the nearest muster station, open deck, or lifeboat. On the inside of the stairway there should be a continuous bannister running from top to bottom of the stairway.

Dead-end corridors should not be allowed.

To avoid stairwells becoming filled with smoke, they should be fitted with a system

directing the smoke out through ventilators before it can reach the stairwells.

Systems should be installed preventing smoke that has arisen in or got into stairwells from seeping out through doors or person exits.

Exits, muster stations, and lifeboats should be placed in such a way that smoke seeping out of openings does not make it impossible to remain at the muster station or enter the lifeboat.

13.3.4.2 Ventilation system

The investigation carried out by the fire experts after the disaster has shown that the recommended practice of closing off all ventilation to the accommodation areas and all fire dampers as soon as fire breaks out, does not necessarily produce the best results (see 8.4.3, 9.4.2.2.4, 9.4.4.2). A number of conflicting considerations, including the spread of the smoke, the escape of air from the area of the fire, and the supply of air to the flames and to people in the area, make it difficult to know which procedure is the best in a particular situation, especially because in practice there is always a good deal of relevant information missing. Serious moral conflicts may arise in the case of a choice between cutting off the ventilation supply in order to fight the fire and risking that this may cause anyone remaining in the cabins to suffocate from smoke.

These factors demonstrate weaknesses both in the usual design of ventilation systems on board passenger ships and in the existing practice recommended in case of fire.

The Committee considers that the disaster should be regarded as a good opportunity for reviewing the possibility of guidelines for the operation of ventilation systems during a fire. If such guidelines are found to need adaptation to conditions on each individual ship, methods should be considered for incorporating such guidelines into the ship's emergency plan.

The Committee also wishes to propose that the requirements for the design of ventilation systems on board passenger ships be altered. The basic functional requirement should be that the ventilation of each section of the accommodation areas should be able to be regulated separately. In this way fresh air could be supplied to the cabins while the outlets in corridors and stairwells in the smoke-filled area can be closed. If the fire doors are shut this would lead to a higher pressure of relatively fresh air in the cabins, as long as the doors are kept shut, while keeping the draught in the corridors to a minimum. This would increase the possibility of evacuating the cabins (see 13.3.4.4) without feeding too much air to the fire.

This finding should result in a requirement for new ships that ventilation ducts should not run through vertical fire partitions. This is because in practice the automatic fire dampers in such installations do not close quickly or efficiently enough when the temperature rises to prevent the ventilation system from helping to spread smoke and flames. Further, the ventilation sections should be designed in such a way that the outlets from each section should be able to be controlled separately from those of any other section and separately from the air supply. There should be a panel on the bridge and in the control room for machinery showing the current status of the ventilation system.

As regards existing ships, the Committee considers that it would be going too far to require alterations involving the rerouting of all ventilation ducts away from vertical fire partitions. The Committee does feel, however, that it is possible to lay down the requirement that the ventilation outlets for each section should have separate sets of controls on the bridge, even though nowadays such outlets are usually operated as a single unit for all or large sections of the accommodation areas. The system must also be designed in such a way that recirculated air from the ship is prevented from entering the air supply in case of fire. Otherwise the ventilation will help to spread the smoke. The air recirculation system should be stopped automatically by the activation of the smoke detectors, fire alarm, or fire doors.

Manual fire dampers are often distributed in many places all over the ship, usually the upper decks. This means that it requires time and manpower to close them in case of fire, and it may be difficult to find them all. Such dampers should be arranged so that they can all be operated from a limited number of control points.

The ventilation of stairways poses a separate set of technical problems. Persons escaping from fire and smoke are supposed to feel safe when they enter a stairwell. Thus these wells must be prevented from acting as chimneys. Smoke should be prevented as far as possible from passing from corridors into stairwells, and any smoke that does enter should be removed by separate ventilation outlets in the stairwells.

The Committee recommends that requirements be laid down for changes in the installation of ventilation systems as described above, and that the Scandinavian maritime administrations be given the task of reviewing the recommended practice for the operation of

ventilation systems in case of fire on passenger ships in regular service to Scandinavian ports.

13.3.4.3 Signposting, etc.

The fire on board the *Scandinavian Star* developed very rapidly. During the intense initial phase of the fire large amounts of greyish black smoke were produced that obscured visibility in the escape routes (see 8.4). The materials used in the walls and ceilings in the *Scandinavian Star* had been approved as regards inflammability. It must be assumed that in the foreseeable future there will continue to be materials in the accommodation areas of ships that produce large quantities of smoke during a fire.

The traditional system for directing passengers during evacuation is by visual signposting. If there is a lot of smoke, however, sight is considerably reduced, and even brightly lit signs can be invisible at a distance of one metre. Since hearing is not affected by smoke, the visual signs should be supplemented by audible signals, for example by sound signals placed near the exit doors of escape routes. The sound signals would have to be audible above the noise of the alarm bells, and would need to be activated at the same time as the fire alarm.

The Committee recommends that a requirement be introduced that audible signals with a sound that clearly distinguishes them from the alarm bells be installed by the exit doors in escape routes on board passenger ships, as directions for escape in conditions of reduced visibility. The requirement should apply to all vessels involved in passenger service to Scandinavian ports.

Many people have difficulty in finding their way around a large passenger ferry. It may be hard to discover which part of the ship the cabin is in and how to proceed as quickly as possible from the cabin to the muster station. The *Scandinavian Star* disaster showed that safety in an emergency depends on finding the muster station rapidly. It is therefore important that the signs indicating the escape routes are clear and easy to understand. Clarity also implies that they must be able to be read in the dark.

There are probably many different opinions on the best way of displaying and designing signs for use on board a ship, and it is not the Committee's task to make detailed recommendations on this subject. However, the Committee considers it of interest to outline certain principles for the position and content of signs on board ship, so as to make it as simple as possible for passengers to find their way around.

Hotel rooms normally contain small posters showing the position of the room in relation to the rest of the building and the appropriate escape routes. In the Committee's opinion such notices should obviously be set up on passenger ships, which is not always the case today.

Passengers ought always to be aware of where they are in the ship. Without help, however, it is easy for them to lose their way, especially since many of them may be unfamiliar with ships.

The first requirement for good signposting is that it should follow a single standard, which should be based on symbols and use as little text as possible. If text is used it should be in a language that is understood in all ports at which the ship calls.

The signs should be placed at frequent intervals, so that it is not necessary to move far in order to find one.

The Committee considers that a good solution would be to number the decks consecutively, starting with the lowest. The fire zones should be labelled A, B, C, etc., with A denoting those farthest aft. All the lounges and corridors running fore and aft should be supplied with signs at regular and frequent intervals clearly showing the deck number and fire zone. The signs should be placed on both sides of the ship. Those on the starboard side should have green backgrounds, and those on the port side red backgrounds. The cabin numbers should indicate the deck and the zone. Plans of the ship should be positioned correctly in relation to the place where they are posted.

As mentioned above, the emergency exit signs, at least, should be illuminated strongly enough to be visible through smoke. These signs should be placed at both ankle and eye level. In the corridors, as in an aircraft, there should be illuminated stripes along the floor or at ankle height along the walls showing the direction to the nearest escape route, preferably with arrow-heads indicating the direction. The stripe should be activated automatically at the same time as the fire alarm, and should be capable of being turned on and off from the bridge.

All signs should be arranged in such a way that they can resist fire for a reasonable time.

The Committee recommends that a uniform system of signs be introduced as a requirement for passenger ships. This requirement should apply to all ships in passenger service to Scandinavian ports.

13.3.4.4 Evacuation of passengers from their cabins

Experience has shown that about 45 per cent of passengers who are in their cabins at

the time of an emergency remain there. These passengers cannot leave their cabins without help.

If the corridors are full of smoke and toxic gases, passengers will need protection in the form of masks or devices for supplying fresh air. The Committee is aware that there are many kinds of devices like this, but has not evaluated the choice of equipment.

The Committee recommends that further efforts be made in this area to find a suitable mask or other device that could be either placed in cabins or carried by search and ambulance teams evacuating passengers through smoke-filled corridors.

If escape masks or devices are placed in cabins, this may result in more passengers attempting to leave their cabins without assistance, which would facilitate the work of the search teams. The Committee is aware that it is a requirement for Danish ships that about half of the smoke-diving equipment on board be supplied with escape devices.

The Committee recommends that efforts to find suitable masks or devices be started immediately, so that all passenger ships in service to Scandinavian ports can be equipped with such devices as soon as possible.

13.3.4.5 Evacuation and safety analysis

Under 4.6.1, the Committee pointed out that the escape possibilities are of decisive importance for the safety of passengers and crew in an emergency. This means that the majority must be able to escape without assistance from areas of danger. Escape with the aid of specially trained crew members is too time-consuming, at any rate if it involves more than a limited number of persons.

One of the conditions for approving an aircraft for passenger traffic is that an evacuation drill has been held, which involves evacuating from the aircraft the number of people it has been certified to carry. If this has not been carried out within the time limit fixed by the authorities, approval is not granted.

There is no such system for passenger ships.

The Committee has, within the terms of its mandate, commissioned A/S Quasar Consultants to carry out an evacuation analysis, which is described in more detail under 4.7 and in Annex 6. The aims of the analysis were to establish how the evacuation was actually carried out on the *Scandinavian Star*, and to assess the evacuation possibilities on board the ship in case of a full complement of passengers.

In the Committee's opinion the evacuation analysis has demonstrated a number of weaknesses in the escape routes, many of which could have been improved relatively easily. The Committee concludes that an evacuation analysis is such a valuable tool for improving evacuation measures that they should be performed for all passenger ships.

The Committee recommends that evacuation analyses should be carried out on all passenger ships. This requirement should apply to all ships in passenger service to Scandinavian ports.

13.3.4.6 Safety requirements for handicapped people

The Jansen Committee discussed the question of improving the safety conditions for people with reduced functional capacity. The Jansen Committee proposed a number of measures, for example, that wheelchair-users should be given cabins on lifeboat decks, and that people in need of extra help in an emergency should be asked to mention this fact when booking their tickets.

The Committee recommends that the Jansen Committee's proposals in this area should be adopted.

13.3.5 Fire fighting, fire limitation

13.3.5.1 Fire doors, ceiling panels

The fire on board the *Scandinavian Star* spread rapidly because several of the fire doors were not closed (cf. 8.4.2) and because the combustible panels in the corridor ceilings caused the whole cross-section of the corridor to catch alight (see 8.4.1).

The Committee considers that the fire would have followed a more moderate course, and at any rate would not have caused so many deaths, if the ceiling panels had been non-combustible and if the fire doors near the source of the fire had been closed at an early stage. The Committee will return to its recommendations as regards ceiling panels under 13.3.6.

The Committee considers that if the smoke and flames had been contained from the start, it would have effectively limited the spread of fire and smoke. An early containment of smoke and flames requires, in the Committee's opinion, that fire and smoke-proof doors are closed without human intervention. This can be done by causing the smoke detectors to automatically release the fire and smoke-proof doors when smoke is registered. Thus the doors in the same fire zone as the smoke detector would be automatically closed when the detector is activated. The closing speed must be such that people passing through the door are not injured. In addition the fire doors must be able to be operated manually, as they are today, on the spot and from the bridge. This

could be implemented on both existing and new ships.

The Committee is aware that on Swedish ships smoke-proof doors are required in addition to the fire doors required by SOLAS regulations. Smoke-proof doors are installed in corridors to limit the amount of corridor that is filled with smoke. The Committee acknowledges that extra smoke-proof doors represent an extra safety precaution preventing the rapid spread of smoke, but considers that connecting the closing mechanisms of fire doors to smoke detectors as described above is a more effective precaution. The Committee does consider, however, that smoke-proof doors should be installed in corridors that do not have non-combustible ceiling panels. This should apply to new and existing ships.

The Committee considers that it would be an advantage if fire limitation could be made a permanent state, i.e. not dependent on a particular door being closed. This could be achieved by keeping fire and smoke-proof doors permanently closed, with an automatic opening mechanism to allow people to pass through. The Committee has not been able to investigate whether this is a possibility, but makes the point that on shore many buildings with a large amount of public traffic have doors that are permanently closed, but open automatically when approached.

The Committee feels it would be an advantage if fire and smoke-proof doors had panels of fireproof glass or some other transparent fireproof material at eye and ankle level. The Committee proposes that this possibility be investigated, if necessary experimentally. The Committee assumes that automatically opening sliding fire and smoke-proof doors would have to have such panels.

Irrespective of the type of fire or smoke-proof doors installed, the Committee considers it essential that the fire panel on the bridge indicates whether they are open or shut.

The Committee makes the following recommendations.

The regulations governing compulsory smoke detectors for new and existing ships should be amended to include a provision that smoke detectors should be connected to the closing mechanism of fire and smoke-proof doors in such a way that the doors are automatically closed when smoke is produced.

Regulations should be laid down stipulating that new and existing ships should have indicators showing whether the fire and smoke-proof doors are open or closed.

Smoke-proof doors should be installed on new and existing ships between the fire doors in corridors that do not have non-combustible ceiling panels.

Fire and smoke-proof doors on new ships should have transparent panels at eye and ankle levels if a suitable material can be found for such panels.

The question of a self-closing fire door that would normally remain closed for use on board passenger ships should be investigated. The Committee assumes that such a door would need to be a sliding door with transparent panels as described above.

The above requirements and considerations should apply to all passenger ships in service to Scandinavian ports.

13.3.5.2 Smoke-diving equipment

On board the *Scandinavian Star* there were, in accordance with the regulations, seven complete sets of smoke-diving equipment. These were not enough to equip all those who according to the emergency plan were assigned to the fire fighting, fire limitation, and evacuation groups, nor was this intended in the emergency plan. For this reason alone, it would have been impossible, even under otherwise optimal conditions, to have carried out a thorough search of the accommodation areas within a reasonable time under the conditions of smoke that actually prevailed (see 4.7.4). This problem needs to be considered in the context of the number of crew with smoke-diving training a ship is required to have.

The Committee considers that passenger ships in service to Scandinavian ports should be required to have a larger number of sets of smoke-diving equipment on board, and should also be required to have a certain number of breathing appliances for use in smoke-filled areas that are not on fire. The actual number must be specified, for example, in terms of a certain number per 100 cabin bunks.

The Committee has considered the question of whether devices for recirculating air can be used instead of other types of breathing apparatus, but has had no opportunity to make a thorough assessment of the alternatives. The Committee assumes, however, that at least in some cases recirculating air devices would be preferable, for example for crew members who have to remain at their posts on the bridge, in the engine room, or manning the radio as long as possible in spite of smoke.

The smoke-diving equipment in general use at present does not allow direct radio communication between the smoke diver and the operational command or the emergency group leader. This lack may result in delays or ob-

struct operations in an emergency, and should be corrected.

Prolonged immersion of smoke divers with breathing apparatus requires a system for refilling the air cylinders. The compressor system must have a sufficient capacity so that smoke diving operations are not interrupted more than necessary for changing the cylinders. The Committee maintains that this requirement is not sufficiently taken into consideration in the existing rules. The question of capacity is related to the working pressure allowed for such cylinders (normally 200 bars). This question was taken up by the Danish ad-hoc committee, which recommended that it be evaluated by the Danish Teknisk Udvalg (Technical Committee). The Committee is aware that the present Danish rules stipulate a much higher number of breathing apparatuses than SOLAS does, and that the compressor system for the filling of air cylinders is also subject to rules.

The Committee recommends that a considerably larger number of breathing apparatuses and smoke diving outfits be required on board passenger ships in service to Scandinavian ports. Furthermore it recommends that all breathing apparatuses be equipped with radio communication devices, and that the requirements for compressor capacity be reconsidered.

13.3.5.3 Sprinkler systems

The recommendations on sprinkler systems are among the most important made by the Committee. See 13.2.2.1.

13.3.5.4 Training, drills, etc.

The training and drilling of the crew are important fire precautions. This question is discussed in connection with the other questions concerning training and qualifications, under 13.3.7.

13.3.6 Materials

The fire on board the *Scandinavian Star* revealed that the materials used to line bulkheads, ceilings, and decks in corridors and stairways caused the fire to spread rapidly and produced large amounts of toxic smoke. As a result of this the Committee has evaluated the need for altered standards for the materials that may be used in the accommodation spaces of passenger ships.

It would not be unreasonably difficult in the Committee's opinion to establish stricter standards as regards the combustibility of the materials used on *new ships*. Such materials are available, their use would not conflict with any other significant practical or constructional considerations, and expense should not be allowed to constitute a hindrance. There is thus no reason why efforts should not be made to achieve greater safety by requiring the use of less combustible materials in accommodation areas.

On the basis of the evidence from the disaster, the Committee recommends that new ships be required to have ceilings in corridors and stairwells constructed of completely non-combustible materials, such as steel. However, a calorific value not exceeding 6 MJ/m^2 would be permitted to allow for the application of a coat of paint. The Committee also recommends that the linings of bulkheads in corridors and stairways shall have a calorific value not exceeding 25 MJ/m^2. The fire showed that the maximum limit of 45 MJ/m^2 now required by IMO is too high. The capacity of surface linings to generate toxic gases during a fire should also be subject to maximum values. The Committee wishes to point out that today there are no standardized tests or methods for measuring such factors, nor are there criteria for acceptance. Such criteria and tests should be developed, if possible at an international level.

The Committee has considered the question of whether similar requirements should be applied to *existing ships*. The cost would be considerable, since bulkheads and ceilings in accommodation areas would in many cases have to be completely replaced. A more important consideration in the Committee's opinion is that such changes in the choice of materials would not be sufficient, either separately or in combination, to ensure that a catastrophe like that of the *Scandinavian Star* would not happen again. Such precautions would in any case have to be accompanied by others, in particular the installation of sprinkler systems and smoke detectors, which taken together would have helped to limit considerably, and probably even prevented, the fires on the *Scandinavian Star* and the *Tor Scandinavia*. The Committee thus decided to reaffirm its recommendation that the most important measure to be implemented on existing ships is the installation of sprinkler systems and smoke detectors (see 13.2.1). If ceiling panels are replaced in connection with the installation of sprinklers, the new panels should be non-combustible.

The Committee therefore recommends the introduction of more stringent requirements for the use of non-combustible materials in new ships, and to a limited extent in existing ships. In addition the capacity of surface linings to generate toxic gases during a fire should be subject to maximum values.

These recommendations by the Committee as regards the choice of materials should be ap-

plied to all passenger ships in service to Scandinavian ports. Efforts should be made to have the recommendations adopted by IMO, but the Committee feels that this is not something that can be assumed.

13.3.7 Training. Qualifications

In one of its principal recommendations, under 13.2.3, the Committee has emphasized the necessity for a general training in safety procedures for all categories of crew. The need for training in fire fighting and for frequent drills is examined below.

13.3.7.1 Training in fire fighting

Both the Jansen Committee and the Danish ad-hoc committee have discussed the question of training in fire fighting and smoke diving. They have emphasized that owing to the special nature of emergency situations on board passenger ships, special courses and training programmes should be designed for each of the categories of personnel serving on such ships. The Danish committee recommends that certificates in smoke-diving should be valid for up to five years, and that smoke divers should undergo training on board, with equipment, at least once a month.

The *Scandinavian Star* disaster showed that in the event of fire on board ship it is essential that the fire be tackled immediately and that passengers be evacuated from their cabins as rapidly as possible. Outside help usually arrives too late, so that it is the crew who have to carry out these tasks. Fighting a ship's fire requires a good deal of knowledge and practical training. It is therefore essential that the members of the crew who are assigned by the emergency plan to limit and extinguish the fire, and to search smoke-filled areas (those assigned to the "Mobile Fire Group" on the *Scandinavian Star*) should be required to document their knowledge of fire fighting and smoke diving. Officers should have at least the same level of training.

The maritime administrations should lay down rules for the type of training required. A good guideline would be the training received by corresponding personnel on offshore installations. The training should be undertaken at an institution with the necessary experience in the training of personnel for fire fighting. The certificate or corresponding document should not be valid for more than five years.

The Committee recommends that in addition to the requirements stipulated in the STCW convention, officers and crew members who are assigned to fire groups should be required to have an approved training in fire fighting. This requirement should be applied to all passenger ships in service to Scandinavian ports.

13.3.7.2 Drills

The Committee has discussed the requirements for lifeboat and fire drills under 7.8.

According to Chapter III R 18 of SOLAS, abandon ship and fire drills have to be held within 24 hours of the ship leaving port "if more than 25 per cent of the crew have not participated in abandon ship and fire drills on board that particular ship in the previous month".

In the Committee's view this requirement should be amended to specify that such drills should be held *before* the ship leaves port.

Chapter II R 25 of SOLAS requires that abandon ship and fire drills should take place weekly on passenger ships. These drills are organized by the ship's own junior officers. These officers therefore receive little training in making quick decisions in emergencies. Nor are these drills comprehensive enough to constitute a sufficient test of the officers' abilities.

The Committee therefore considers that extensive fire and lifeboat drills should be carried out at least twice a year, organized by persons who are not serving on board the ship and involving a sufficient number of artificial victims. The drill should be staged without prior notice of the time or details of the accident, which should involve artificial smoke, victims, etc. It is essential that the evacuation teams receive proper training during the drill. The possibility of incorporating this type of drill into surveys of passenger ships and thus ensuring that they are arranged by maritime administrations should be considered here.

The Committee recommends that the Scandinavian countries promote efforts to amend Chapter III R 18 of SOLAS as proposed above, and that the requirement be introduced for extensive fire and lifeboat drills to be carried out on passenger ships in accordance with the principles outlined above. The requirement should be made applicable to all passenger ships in regular traffic to Scandinavian ports, without waiting for international implementation.

13.3.8 Standardization

In the foregoing, the Committee has recommended that a number of existing requirements for operational and technical arrangements should be altered or reconsidered in the light of the disaster on the *Scandinavian Star*. It would be extremely desirable if most of these recommendations were to be adopted internationally, although the Committee does not consider this to be a necessary condition for

implementing these changes. One of the reasons why international implementation would be desirable is that regulation by means of international agreements ensures that requirements are standardized. In addition to its effect on competition, standardization often has a significant effect on safety, quite apart from the material solutions actually required by new standards.

In the following the Committee will discuss an area, the ship's emergency plan, in which the disaster has shown that standardization would have had especially significant effects irrespective of the material requirements. The Committee has also, however, made recommendations in this regard elsewhere.

The Jansen Committee compared the SOLAS regulations concerning emergency arrangements, including emergency instructions, life-saving appliances, etc. with the corresponding Norwegian provisions. It found that the Norwegian regulations contain a number of supplementary provisions with more stringent requirements than those of the convention, particularly as regards the state of preparedness on board, the extent of emergency instructions, and detailed requirements for drills. In addition the Norwegian provisions require that all prescribed instructions, including the emergency plan, have to be approved.

The Jansen Committee pointed out that the Norwegian regulations are being revised, with the intention of repealing provisions containing more stringent requirements than those laid down in international conventions. The Jansen Committee has proposed that the Norwegian regulations for passenger ships be retained. It emphasized that the emergency plan, etc. should continue to be subject to approval, that the specifications for emergency instructions and arrangements contribute to the desired aim of standardization, and that the supplementary provisions concerning the content and performance of fire drills ensure that such drills are carried out with the greatest possible realism and variety.

The Jansen Committee also considers that Norway should take the initiative to promote a greater degree of international standardization of emergency arrangements on board ships. In this connection it referred to a draft proposal for a new SOLAS provision specifying the type and extent of fire drills on board on similar lines to the Norwegian provisions. The Jansen Committee emphasized the need for international rules that were detailed enough to avoid differing interpretations on the part of different administrations, but that did not prevent the development of improved safety systems. The Jansen Committee concluded by saying that the present international rules do not apppear to be sufficiently detailed, and that the Norwegian Maritime Administration should take the necessary initiative with respect to IMO to promote a greater degree of international standardization of emergency arrangements on board ships.

The present Committee agrees with the Jansen Committee's comments and conclusions as described above. The Committee points out further that a standardization of the emergency arrangements on board passenger ships would also allow passengers a better opportunity to become familiar with such fundamentally important arrangements.

The Committee therefore recommends that the maritime administrations in the Scandinavian countries be given the task of standardizing the emergency arrangements on passenger ships in regular service to Scandinavian ports. Furthermore, the administrations should make efforts through IMO to have corresponding requirements applied to passenger ships in international service.

13.3.9 The rescue operation

13.3.9.1 Registration

One of the difficulties during the rescue operation was to find out exactly how many had been rescued, and the names of those who had been rescued and those who were still missing (see 11.4.1, 11.4.10, 11.5.1, 11.5.6).

The *Scandinavian Star* disaster showed that during a rescue operation passengers need to be registered several times. First, the vessels must have a list of the numbers and if possible the names of all the persons on board. There should also be a system for registering the number of people who board lifeboats and rafts. At the initial receiving station for lifeboats and rafts, a list should be compiled of the name, birth date, and address of each rescued person. If persons are taken on board some other vessel, a list should be made there and a copy should be delivered to the police or other authorities on arrival in port. Directions should also be prepared informing the leaders of rescue operations what sort of information they need in order to conclude that all possible persons have been rescued.

The Committee recommends that representatives of the maritime administrations and the police authorities in the Scandinavian countries be given the task of deciding on a system of registration and of deciding whether this should be presented in IMO, and that instructions should be given to the leaders of rescue operations concerning what kind of information should be used to decide whether all persons in a rescue operation have been rescued.

13.3.9.2 Command of the rescue operation at the scene of disaster

Commanding operations at the scene of the disaster is difficult and demanding. A merchant vessel normally does not have the resources necessary to command an extensive rescue operation (see 11.5.2). This is why a merchant vessel cannot be assigned the role of On Scene Commander (OSC). However, in practice many rescue operations will be led by merchant vessels acting as Coordinator Surface Search (CSS). It is therefore necessary that as many captains as possible be *trained to act in the capacity of CSS*. Captains of passenger ships sailing in Nordic waters have especially suitable experience for acting as CSS, on condition that they are trained for the job. The training should include participation in the disaster drills that are arranged at intervals by the maritime rescue coordination centres.

The Committee was informed that the Swedish maritime administration has established courses in rescue work for junior officers in the merchant fleet.

The Committee recommends that the maritime administrations in the Scandinavian countries be given the task of organizing a system to train navigators to act as CSS.

One way of strengthening command at the scene of the disaster is to supply extra resources from outside. The Committee discusses this under 11.5.2. One of the models proposed under 11.5.2 is that a professional rescue coordinator, if necessary with a team, is flown out by helicopter to assist the CSS, and if necessary take over as OSC. Extra support for the commander at the scene of the disaster is usually only necessary in more extensive disasters.

The Committee recommends that each main maritime rescue coordination centre prepare a plan for sending out a rescue coordinator with a team to lead the rescue operation at the scene of the disaster in case of extensive disasters.

13.3.9.3 Communication equipment, etc. at maritime rescue coordination centres

All evidence shows that the leader of an operation of any kind, whether military, police, or rescue, needs to have access to all available information at all times. During the rescue operation involving the *Scandinavian Star*, poor communication with the CSS meant that the main maritime rescue coordination centre at Sola was unable to obtain the overview of the situation that was needed for the optimal exercise of its leadership functions (see 11.4.8). The centre at Sola is not equipped to receive or transmit on the international distress frequencies. The Committee considers this to be a defect.

The Committee recommends that measures be implemented to supply Scandinavian main maritime rescue coordination centres that still lack communication equipment and organization enabling them to communicate on distress frequencies with the resources necessary for such communication.

13.3.9.4 The international rules governing the actors in a rescue operation

The Committee took up this question under 11.5.4 and pointed out there that the tasks of, and to some extent the distribution of competence between the coordinating rescue unit, the OSC, and the CSS are not sufficiently regulated in the International Convention on Maritime Search and Rescue or in MERSAR.

The Committee recommends that the Scandinavian countries cooperate to ensure that the rules are amended and supplemented as proposed by the Committee.

13.3.9.5 Fire extinguishing reinforcements supplied from shore in case of ship fires

The primary responsibility for extinguishing fires at sea lies with the ship's crew. Experience has shown, however, that fires may get beyond the crew's control. If the efforts of smoke divers and other fire fighting personnel are necessary in order to save life, it is the responsibility of the rescue service to ensure that these services are provided. The Committee has discussed this issue under 11.5.5, and concluded that when fire fighting at sea may result in saving lives, such fire fighting should be a natural task for the rescue services.

The Jansen Committee has discussed the question of how to organize the supply of this type of aid from on shore, and has concluded that professional firemen belonging to the municipal fire brigades would be the most suitable way of helping a ship's crew during a large fire at sea or off the coast. The Jansen Committee points out that these firemen are trained, that there is a 24-hour duty roster, and that there are sufficient numbers of them. Furthermore, it is more advantageous from a socioeconomic point of view to utilize these already available resources rather than creating a special emergency force.

The Committee has discussed these questions under 11.5.5 above. The Committee has no basis for making recommendations, but wishes to point out that the question needs to be considered and the necessary formal, organizational, and practical arrangements made.

The Committee recommends that the ques-

tion of a suitable organization for supplying aid from on shore to fight fires etc. on board ships should be examined and that such resources should be made available as soon as possible.

13.3.9.6 Limits of operation for sea rescue services

As the Committee has pointed out under 11.5.7, under the International Convention on Maritime Search and Rescue (item 2.2.4 of the Annex), agreements shall be made between the countries involved concerning the limits of sea rescue regions between the countries. No such agreements have been made between the Scandinavian countries.

The Committee recommends that the Scandinavian countries conclude such agreements.

13.3.10 Miscellaneous

13.3.10.1 Data registration

The Jansen Committee has discussed the question of installing a voyage recorder on ships in order to facilitate the work of investigating the causes of accidents and learning from these experiences. Previous studies have shown that this is technically possible but that the legal aspects would have to be clarified. A previous proposal to carry out an experimental project for developing the idea was quashed because of strong opposition from parts of the sector involved. The Jansen Committee recommends that the Norwegian Maritime Directorate consider in more detail what sort of data would need to be recorded by such a device in order for it to be useful in establishing the causes of accidents.

The present Committee supports this recommendation. During its work on clarifying the circumstances surrounding the fire on board the *Scandinavian Star* and the way it was handled, the Committee benefitted from the registration on board the *Stena Saga*, including the recorded times of the radar frames, radiocommunications, and other data. Similar records from the *Scandinavian Star* might have been useful. The ideal type of registration in this particular case, however, would have been records of certain essential internal data on board the ship. The most obvious of these is the need for a record of information from the fire panel concerning the times of automatic and manual fire signals and release of the fire doors. It would also have been useful to have registered the sounding of the alarms, the manoeuvring of the ship, and the operation of the ventilation system. In other types of accidents other types of information would be needed.

The Committee recommends that passenger ships in service to Scandinavian ports be required to install voyage recorders for the registration of essential information.

13.3.10.2 Working hours

With reference to the working tempo on the *Scandinavian Star* during the period preceding the accident, the Jansen Committee has recommended that the Norwegian Maritime Directorate remind the respective ship owners of the existing provisions governing working hours and the working environment, and that the Directorate instruct its inspectors to verify these factors during their inspections.

It is obvious that safety on board a ship is reduced if the crew are exhausted and overworked. It could even be questioned whether a ship is seaworthy if it puts out to sea with such a crew. It is therefore important to organize the work on board in such a way that the crew are given opportunities for rest. The Jansen Committee's recommendation assumes that there are rules about working hours and that compliance with these rules can be checked. However, one of the problems in shipping is to find out what rules about working hours are applicable on vessels from different countries, and examples have been known of vessels where the crew have no agreement on working hours. The International Transport Workers' Federation (ITF) has prepared a standard agreement that shows how working hours should be organized on a ship. In order to verify compliance with the rules on working hours a work log has to be kept on board, but this is not required by the provisions of many flag states.

In the Committee's opinion the investigation of the *Scandinavian Star* disaster showed up defects in the rules governing working hours on board ship. These defects should be corrected immediately.

The Committee therefore recommends that all ships in passenger service to Scandinavian ports should be required to have working agreements that ensure that the crew have sufficient rest and sleep to enable them to carry out their work safely. Furthermore, logs should be required to be kept of working hours on board such ships.

13.3.10.3 Safety instructions to the passengers

The Committee, in common with both the Jansen Committee and the Danish ad-hoc committee, considers that shipowners should be required to provide passengers with information and guidance as regards essential aspects of safety on board. Especially important items of information are the way in which emergencies are signalled, what passengers

should do in such cases, and what it is useful to know about the ship beforehand. This information can be provided by means of printed material (which could be issued with the ticket), but the most effective method is probably the use of the public address system or video information in the departure hall or as the passengers arrive on board. Eyecatching posters are another method.

The Danish ad-hoc committee recommends that on large passenger ships information should be provided in at least two different ways, e.g. over the public address system and by handing out printed brochures. The Danish committee also recommends that notices should be posted at strategic points on the ship showing passengers their places in the boats and muster stations.

The Committee therefore recommends that specific rules should be laid down concerning these matters for ships in passenger service to Scandinavian ports.

13.3.10.4 Ensuring the payment of compensation to injured passengers and survivors

The Committee considers that there is a need to review the provisions and insurance schemes that determine the practical possibilities open to injured passengers and survivors of deceased passengers for having their economic losses reimbursed after the injury. A more detailed evaluation of this is given in Chapter 12. A more thorough examination of this matter is outside the mandate of the Committee.

The Committee recommends that these questions be discussed in more detail and that in this context it be evaluated whether the owner or the shipping company should be required to take out accident insurance in favour of the passengers. Compliance with this rule could be verified as part of a prior inspection of the type suggested by the Committee under 13.2.4.1.

13.3.10.5 Late effects

The Committee has treated the question of late effects in survivors of the disaster under 8.6.3.

The Committee recommends that the main health authorities in Norway and Denmark ensure that the survivors of the Scandinavian Star *disaster be offered medical examinations for the purpose of revealing any injuries caused by fire gases. Furthermore, the Norwegian Ministry of Justice is advised to enter into an agreement with the Norwegian Fire Research Laboratory NBL-SINTEF, concerning the storage of material for possible future laboratory examination.*