Final report of the investigation
of a fire on the
the Passenger Cruise Liner

mv *Saga Rose*

whilst undergoing a refit at the
A&P Docks, Southampton
on 14 December 1997

Ref: 2056/97
File No: MAIB 1/2/124

Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1994

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

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

CO_2	Carbon dioxide gas
Hi-fog	Trade name for system using fine droplets of water ie like fog
SCBA sets	Self Contained Breathing Apparatus sets
BA Bottles	Breathing Apparatus air bottles
HSE	Health and Safety Executive
A&P	The name of the company operating the Southampton dry-dock
GPS	Global Positioning System

SYNOPSIS

Saga Rose, a 24,474 gt passenger vessel had been undergoing the second half of an extensive refit in A&P's King George V dry-dock, Southampton. She had been in refit since late October 1997 and at the time of the fire was in the "flooded" dry-dock.

Some 300 shore workers and 350 crew were on board when fire broke out in an electrical locker beneath the master's cabin. The fire was discovered at 1350 on Sunday 14 December 1997. The general alarm was sounded, non-essential persons evacuated and the ship's fire fighting teams mobilised. The shipyard and Hampshire Fire Brigade were informed and their fire teams attended.

Under the general direction of the Hampshire Fire Brigade the fire was eventually extinguished at 2000 and the vessel declared safe.

Fire damage was restricted to cabins and deckhead void spaces on the promenade deck with smoke and heat damage extending up to the officers' deck. Extensive electric cable damage occurred within the locker space, which affected navigational equipment on the bridge.

No injuries were suffered by the crew, although a number of shore personnel suffered from smoke inhalation.

The cause of the fire has not been identified positively, but the most likely cause was a fault on a secondary electric cable connected to one of the transformers in an electrical locker room.

VESSEL PARTICULARS

Name	:	*Saga Rose*
Port of Registry	:	Nassau, Bahamas
Official No	:	399795
Gross tonnage	:	24,474
Deadweight	:	6,353 tonne
Overall length	:	188.88m
Breadth	:	24.49m
Draught	:	8.257m
Year of build	:	1965
Type	:	Passenger Cruise Liner
Owner	:	Saga Shipping Ltd, Folkestone, Kent
Manager	:	Columbia Shipmanagement Ltd, Cyprus
Classification Society	:	Det Norske Veritas
Date & time of incident	:	14 December 1997, 1350 local time
Place of incident	:	King George V Dock, Southampton
Injuries	:	None to crew, minor smoke inhalation to some shore workers
Damage	:	Heat and fire damage to cabling in forward stairwell and electrical locker on promenade deck

SECTION 1 FACTUAL INFORMATION

1.1 BACKGROUND TO INCIDENT

Saga Rose arrived in Southampton from Dover on 22 October 1997 to complete the second stage of an extensive refit in A&P's King George V dry-dock.

This refit involved a major upgrade in passenger cabins, modifications to the hairdressing salon, the installation of a new extensive fire detection system and a new Hi-fog water extinguishing system.

Towards the end of the refit the vessel had been moved into dry-dock for normal hull maintenance work, in preparation for a season of cruising. The first voyage was due to start from Dover on 20 December for a 20 day Christmas cruise to the Canaries.

At the time of the fire, the vessel was in the "flooded" dry-dock with approximately 300 shore workers and 350 crew aboard. The vessel was under the owner's control and was operating under her own power.

1.2 NARRATIVE

1.2.1 On Sunday 14 December at 1350, a smell of burning was reported forward on the officers' deck, in the area of the master's cabin and bridge. Further investigation found smoke in the forward access stairway between the officers' and promenade decks. The smoke was seen to be escaping from a large electrical locker or storage space on the aft side of the stairway on the promenade deck. No attempt was made at this time to gain entry to the locker.

The general alarm was rung over the public address system and the ship's fire parties mustered. Once assembled, a fire team entered the area and opened the door to the locker to assess the extent of the fire. Thick smoke impeded the assessment but it was found that the fire was centred in electrical cabling passing through the space at deckhead level. This fire was attacked locally using a dry powder extinguisher and then a CO_2 extinguisher.

1.2.2 With the fire still generating a considerable volume of smoke and spreading into the space above the deck panelling, fire hoses from the two adjacent fire lockers on both the officers' and promenade decks were laid out and charged. As the extent of the fire became known, all shipyard workers were evacuated from the vessel, followed by all non-essential ship's staff.

The fire brigade was informed at 1401 and was on site at 1407. Firemen were briefed by the ship's staff regarding the seat of the fire, actions taken and what facilities were available aboard. Once the fire brigade teams were ready, they

were accompanied on board and into the area of the fire by the ship's officers. A control centre was established on the promenade deck with search and assessment teams assembled together with senior officers from the ship, A&P, sub-contractors involved in the refitting, and the fire brigade. Ventilation control and smoke extraction procedures were established and put into action.

1.2.3 By this time the fire had spread via the cable trunking into the deckhead space aft of the locker and into adjacent alleyways. With the fire largely hidden from view, deckhead panelling had to be pulled down to gain access for fire fighting. Thick smoke from burning cable insulation continued to make fire fighting difficult.

As a result of the heat generated by burning cable insulation and adjacent material, two local head outlets on the Marioff Hi-fog water system operated in the staircase well: one at the top of the staircase, the other outside the master's cabin.

The fire was contained within the locker on the promenade deck with some transmission down the enclosed cable trunking into the deckhead of the staircase linking all five passenger decks. Varying degrees of heat and smoke damage affected a number of cabins both on the officers' and promenade decks. Fire fighting, using relays of fire teams, continued until 1927 when the fire was considered to be under control. At 2000, the fire was considered to have been extinguished.

None of the ship's crew were injured in the incident although it was reported that a number of shipyard workers and fire personnel suffered slightly from smoke inhalation during the evacuation.

1.2.4 During the subsequent investigation into the fire and its handling, it is understood that a fire door, adjacent to the beauty salon on the main deck, failed to close during the emergency. The reason for the failure has not been identified.

On further investigation, it was found that, during the refit of the beauty salon, the electrical controls for this door had been repositioned but not secured, allowing an electrical fault to develop. The cabling from this area passes through the locker in which the fire originated, and gives rise to the possibility that this defect may have been a contributory factor in the subsequent fire.

1.3 FIRE FIGHTING EQUIPMENT USED

1.3.1 During the course of the fire, the following ship's equipment was used:

Dry powder extinguishers	2
CO_2 extinguishers	5
Fire hose jets	1 (3 hoses rigged and charged)
SCBA sets	11
BA bottles used	32 (used and refilled throughout event)

1.3.2 The fire brigade attendance followed the agreed procedure, with the following equipment being used:

Fire pumping units	16
Control & other units	5
Fire hose jets	4
CO_2 extinguishers	15
Dry powder extinguishers	2
SCBA sets	number not known

1.4 SHIP'S FIRE FIGHTING AND DETECTION SYSTEMS

1.4.1 At the time of the fire, the vessel was in the process of installing improved fire detection and fire extinguishing systems.

The fire detection complex consisted of a Minerva smoke detection system, using, originally, about 250 detector heads. In the process of being upgraded, the number of detector heads was being increased to 1300. This system was in the final phase of being tested and commissioned at the time and was therefore not operational

Detector heads were in place outside the locker in the alleyways, but still had protective covers fitted.

1.4.2 The fixed fire fighting complex consisted of a Marioff Hi-fog water extinguishing system. This system was fully charged and was operational at the time of the fire

The two discharge heads closest to the seat of the fire, those at the top of the stairwell and in the alleyway, activated and during the period that they were operational, discharged 1.8 tonne of water.

1.5 HAMPSHIRE FIRE AND RESCUE SERVICE

1.5.1 The accepted and approved method for instigating an emergency fire plan for vessels under repair, either alongside or in dry-dock, is for a meeting to be held between all interested parties prior to the arrival of the vessel. The object of this meeting is to establish what work is to be carried out, where it is to be done, and what equipment will be used.

From April 1997 until the dry-docking, such meetings were held between A&P and Saga Management. On 4 April a "start-up" meeting was attended by a *Saga Rose* representative. A similar meeting for phase 2 of the project was held, and a presentation made on 2 September 1997 to Saga at their Folkestone offices. At various times both HSE and the fire brigade attended.

1.5.2 The first tender from the Hampshire Fire Brigade arrived on site about six minutes after the initial call was made. The A&P emergency fire procedure was put into practice with fire pump and support units attending as planned. An on-site assessment was made of the extent of the fire, and what progress had been made to contain and/or extinguish it. As a result of that assessment, 16 fire units were called in from 13 fire stations in Southampton and the surrounding area.

A fire control point was established on the forward starboard side of the promenade deck adjacent to the entrance to the forward cabins, where the fire was centred. Fire teams wearing SCBA sets then entered the accommodation from this point, to tackle the fire and also to remove deckhead panelling to allow access for fire fighting.

The fire was considered difficult to bring under control because of its location within ceiling voids and steel trunking. The electric cable trunking acted as a fire conduit. The fire was under control by 1927 and extinguished by 2000.

1.6 DAMAGE

1.6.1 Fire damage was contained largely within the deckhead of the central locker room between frames 139 and 141 and the central portion of the deckhead of the forward stairway between frames 134 to 139.

Considerable fire and heat damage occurred to electric cabling in the immediate area, with smouldering fire damage travelling along the cable insulation causing secondary damage away from the seat of the fire. Other materials within the deckhead space also suffered fire and heat damage.

1.6.2 Smoke and water damage occurred in a number of passenger and crew cabins on the officers' and promenade decks. The bridge also suffered from smoke damage.

Although no major structural damage was sustained, considerable outfitting and furnishing work required replacement, together with extensive electrical cable renewal and testing.

Details of the extent of the fire damage have been requested from the owners but by mid 1999, no information has been released.

1.7 ELECTRIC CABLING PASSING THROUGH LOCKER

1.7.1 The cables passing through the locker space and susceptible to damage were as follows:

DPS - double conductor power supply, armoured.
FPS - four conductor power supply, armoured.

MHFF - multi conductor power supply, armoured.
MS - multi conductor, shielded.
TPU - telephone, portable, unarmoured.
FHFA - four conductor, heat and oil resistant, flexible, armoured.

1.7.2 Ship's equipment served by these cables:

General lighting circuits
General power circuits
Emergency lighting circuits

Navigational bridge equipment:

Radar
Gyro-compass
GPS system
Lighting
Power supplies
Steering equipment
Rudder indication
Echo sounders
Public address system
Promenade deck passenger cabins
Emergency switchboard circuits
Main power and lighting sub-switchboards, officers' deck

1.7.3 During the subsequent investigation and repairs, a considerable number of cables were found to have suffered both local heating and insulation damage in areas remote from the actual seat of the fire. Because the fire was in deckhead void spaces and steel cable trunkings, hot gases were able to penetrate adjacent areas causing local heating and the breakdown of cable insulation etc.

1.8 INCIDENT INVESTIGATION

1.8.1 Immediately after the outbreak of the fire, HSE was advised by A&P Southampton under their agreed safety procedures. An HSE Inspector attended the same day and carried out a brief inspection with A&P Officials and the master of *Saga Rose*. MAIB did not attend at the time as it was assumed that HSE was carrying out an investigation in accordance with the HSE/MCA/MAIB Memorandum of Understanding, chapter 6. This chapter clearly states that HSE are responsible for investigating an accident which occurs as a result of repair works carried out in a wet or dry-dock. However, after this initial visit, HSE declined to pursue the investigation as no shore workers were involved in the actual accident.

1.8.2 With cabling from the defective fire door control, on the main deck, passing through the locker in which the fire started, it was originally thought that there

was a possibility that this defect was a contributory factor in the subsequent fire.

Subsequent investigations by A&P Southampton suggest that the defect in the fire door control system may not have caused the fire for the following reasons:

- Overheating on the door magnet switch and nearby cables was only discovered following the reinstatement and energisation of the circuits.

- There was no evidence of overheating on connected magnet door circuit cables in the locker room. If the circuit had overloaded to such an extent as to cause a fire, signs of such overheating would have been visible.

- If a fault had developed on a door magnet circuit cable, the 32 amp fuse protecting the door is likely to have operated, which was not the case.

In their opinion, the most likely cause of the fire was a fault on a secondary transformer cable connected to one of the floor mounted transformers. Their reasons for advancing this theory are as follows:

- There was extensive electrical arcing damage on transformer cables in the electrical locker room.

- Cables within the transformers were found to have been electrically overloaded for a prolonged period prior to the fire.

- The circuit protection for the transformers was considerably overrated.

SECTION 2 ANALYSIS

2.1 RESPONSE BY SHIP'S CREW

2.1.1 Because the MAIB investigation did not start until two days after the accident, certain details about what had occurred have not been established. The ship's technical management say that the first indication of fire was the smell of smoke by a member of the crew. He reported it to the officer keeping a watch on the bridge who sounded the general alarm to initiate emergency fire procedures. Some 600 shore staff and workmen were successfully evacuated.

The fire was fought successfully by, first, the ship's staff and then, by the Hampshire Fire Brigade.

2.1.2 Although control of the ship had recently been handed back to the owners, work was still being carried out by some 300 shore workers on board, together with their tools and equipment. Under these difficult conditions, the officers and crew appear to have reacted well to the situation and carried out the correct procedures under trying circumstances.

2.2 RESPONSE BY SHORE STAFF

2.2.1 The response by the A&P shore staff followed the agreed procedures for dealing with an incident involving a ship fire. The A&P fire team and the local fire brigade were called, and provision made for the arrival and guidance of incoming fire appliances.

Co-operation between the ship's and A&P staff was good with the ship's staff providing guidance to the incoming fire teams.

2.3 SUPERVISION OF REPAIRS

2.3.1 During the short initial visit paid by HSE to the ship immediately after the fire, the Health and Safety Manager for A&P Southampton, accompanying the HSE inspector, pointed out that expanded polystyrene foam was being used as an insulation material on some of the ventilation pipes being fitted in the deckhead void spaces. As this material has significant flammability characteristics, the master was advised to have it removed prior to sailing.

This observation by a HSE Inspector, raises the question as how well the refit was being controlled, and whether sufficient supervision over contractors had been exercised. It also highlights the need for a detailed and accurate repair specification to be prepared and monitored throughout the refit period.

SECTION 3 CONCLUSIONS

3.1 FINDINGS

3.1.1 The early and prompt action by members of the crew prevented what could have been a serious accommodation fire.
(Ref: 1.2.1)

3.1.2 The extent of the fire was properly evaluated, fire teams assembled, the shore fire brigade informed, and evacuation from the ship of all non-essential staff and shore personnel correctly carried out.
(Ref: 1.2.2)

3.1.3 The Marioff Hi-fog water system was fully charged at the time and functioned correctly when local head outlets were exposed to heat from the fire.
(Ref: 1.2.3 & 1.4.2)

3.1.4 The fire detection system fitted to the vessel was in the final phase of being tested and commissioned at the time of the fire and was operational.
(Ref: 1.4.1)

3.1.5 During the fire, a fire door on the main deck by the beauty salon failed to operate correctly.
(Ref: 1.2.4)

3.1.6 HSE did not investigate the accident as they should have done under the HSE/MCA/MAIB Memorandum of Understanding.
(Ref: 1.8.1)

3.1.7 The low level of supervision exercised by the owners and managers during the refit allowed the fitting of flammable insulation material within a ceiling void space.
(Ref: 2.3.1)

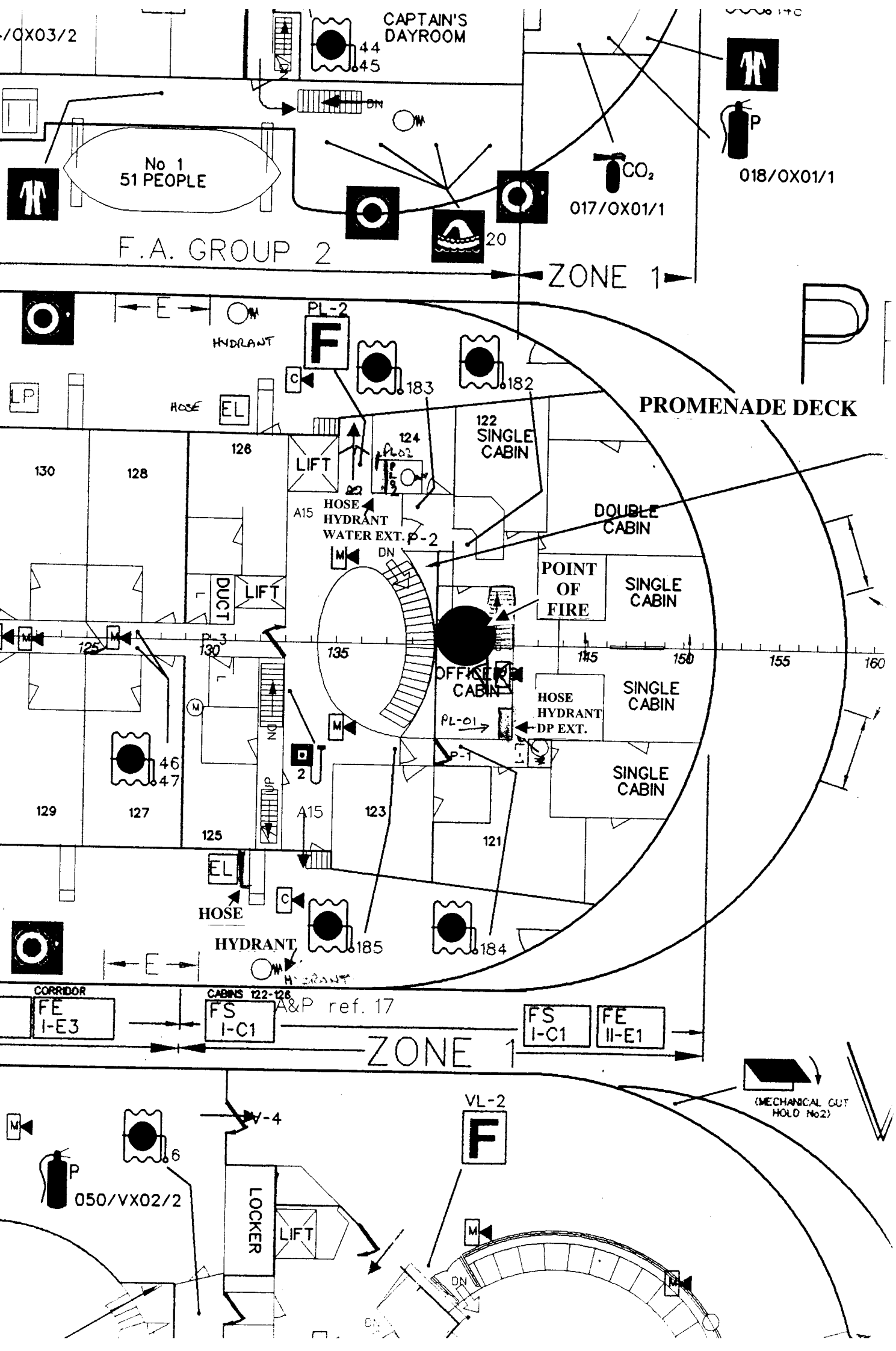
3.2 CAUSES

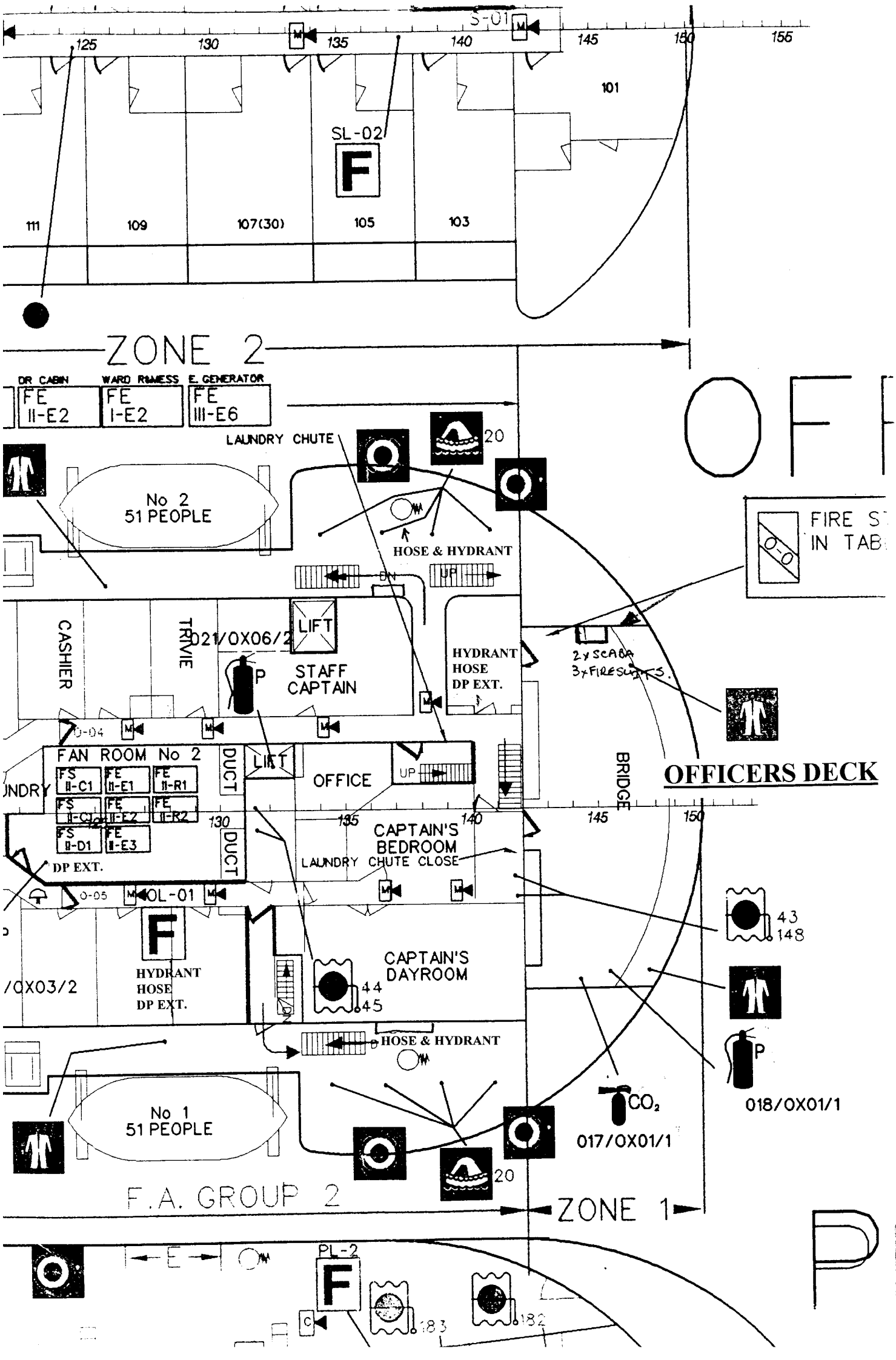
The cause of the fire has not been identified positively. Although damaged cabling linked to the defective fire door control on the main deck was considered to be a contributory factor, subsequent investigation of the damaged equipment suggests the most likely cause to be a fault on a secondary cable connected to one of the mounted transformers.

SECTION 4 RECOMMENDATIONS

No recommendations have been made.

1. Copy of part "Fire Plan"


CAPTAIN'S DAYROOM
44
45
DN
No 1
51 PEOPLE
CO2
017/OX01/1
P
018/OX01/1
20
F.A. GROUP 2
ZONE 1
E
HYDRANT
PL-2
F
C
183
182
LP
HOSE
EL
PROMENADE DECK
126
LIFT
124
122
SINGLE
CABIN
130
128
A15
HOSE
HYDRANT
WATER EXT. P-2
DOUBLE
CABIN
DN
POINT
OF
FIRE
SINGLE
CABIN
DUCT
LIFT
M
125
P-3
130
135
145
150
155
160
OFFICER
CABIN
HOSE
HYDRANT
DP EXT.
SINGLE
CABIN
PL-01
P-1
46
47
2
UP
SINGLE
CABIN
129
127
A15
123
125
121
EL
HOSE
HYDRANT
185
184
E
CORRIDOR
CABINS 122-126
FE
I-E3
FS
I-C1
A&P ref. 17
FS
I-C1
FE
II-E1
ZONE 1
(MECHANICAL CUT
HOLD No2)
VL-2
F
V-4
6
P
050/VX02/2
LOCKER
LIFT
M
DN


S-01
125
130
135
140
145
150
155
101
SL-02
F
111
109
107(30)
105
103
ZONE 2
DR CABIN
FE II-E2
WARD R&MESS
FE I-E2
E. GENERATOR
FE III-E6
LAUNDRY CHUTE
20
No 2
51 PEOPLE
HOSE & HYDRANT
DN
UP
CASHIER
TRAVIE
021/0X06/2
LIFT
P
STAFF CAPTAIN
HYDRANT HOSE DP EXT.
2 x SCABA
3 x FIRESUITS
0-04
FAN ROOM No 2
FS II-C1
FE II-E1
FE II-R1
FS II-C2
FE II-E2
FE II-R2
FS II-D1
FE II-E3
DUCT
LIFT
OFFICE
UP
BRIDGE
OFFICERS DECK
DP EXT.
130
135
140
145
150
CAPTAIN'S BEDROOM
LAUNDRY CHUTE CLOSE
0-05
0L-01
43
148
F
HYDRANT HOSE DP EXT.
/0X03/2
CAPTAIN'S DAYROOM
44
45
HOSE & HYDRANT
P
018/0X01/1
CO_2
017/0X01/1
No 1
51 PEOPLE
20
F.A. GROUP 2
ZONE 1
PL-2
F
183
182

2. Copy of Hampshire Fire & Rescue Service's Report

Hampshire Fire and Rescue Service

Marine Accident Investigation Branch
First Floor
Carlton House
Carlton Place
SOUTHAMPTON
Hampshire
SO15 2DZ
For the attention of: Alan Rushton

Hampshire Fire and Rescue Service HQ
Leigh Road
Eastleigh
Hampshire
SO50 9SJ

Tel: 01703 644000
Fax: 01703 643178

Date: 3 March 1998

Enquiries To: Mr M Stokes *My Reference:* F7/10/1/C/282/97

Extension: 817 *Your Reference:*

Dear Sir

FIRE: SAGA ROSE - VESSEL FIRE AT SOUTHAMPTON - 14 DECEMBER 1997

I refer to your fax dated 19 December 1997 in connection with the fire at the above address. May I first apologise for the delay in forwarding you the copy of the FDR1, this was due to the fact that we have only recently received both the Fire Investigation Report and the Fire Report (FDR1) itself.

I now have pleasure in enclosing a copy of the official Fire Report as requested and as a Fire Investigation was carried out, the Fire Officers concluding comments.

"Due to extensive electrical damage to part of the ships installation I am not able to positively state how this fire started. However taking into consideration the ships age, its installations and equipment I am of the opinion that an electrical fault occurred in cabling within the plant room, possibly due to an overload or breakdown of insulation. This caused a build up of heat sufficient to ignite PVC casing. As heat transferred from one cable to another the fire spread into adjoining areas. Because of its location within ceiling voids and steel trunking it made extinction of the fire extremely difficult and hazardous".

Please also find enclosed our invoice for the sum of £35.00 as payment for this service.

If I can be of any further assistance to you with this matter, please do not hesitate to contact me at the above address.

Yours faithfully

L Mastin

pp **Deputy Chief Fire Officer**
(Operations and Fire Safety)

3. Photographs

Fig 1 General view of fire and water damage to electrical locker deckhead.

Fig 2 Close up view of damaged electrical cabling and deckhead insulation.

Fig 3 General view of fire and water damage to ventilation trunking and insulation.

Fig 4 General view of smoke and water damage to upper parts of electrical locker bulkhead. Note evidence of fire in void space only.