

Report on the investigation of
the fire and subsequent sinking of

Lady Candida

off Corsica

28 July 2007

Marine Accident Investigation Branch
Carlton House
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United Kingdom
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Extract from
The United Kingdom Merchant Shipping
(Accident Reporting and Investigation)
Regulations 2005 – Regulation 5:

“The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame.”

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AB	- Able Bodied seaman
AC	- Alternating Current
AEC	- Approved Engine Course
CO ₂	- Carbon Dioxide
COG	- Course Over Ground
DSC	- Digital Selective Calling
FSS code	- International code for Fire Safety Systems
GRT	- Gross Registered Tonnage
HP	- Horse Power
ISM Code	- International Management Code for the Safe Operation of Ships and for Pollution Prevention
ISPS	- International Ship and Port facility Security Code
kg	- kilogram
kW	- kilowatt
LED	- Light Emitting Diode
m	- metre
“Mayday”	- International distress call
MCA	- Maritime and Coastguard Agency
MHz	- Megahertz
MSN	- Marine Safety Notice
NTSB	- National Transportation Safety Board
RYA	- Royal Yachting Association
SI	- Statutory Instrument
SOG	- Speed Over Ground
SOLAS	- International Convention for the Safety of Life at Sea
STCW	- International Convention on Standards of Training, Certification and Watchkeeping Incorporating the 1995 Amendments
UTC	- Universal Co-ordinated Time
VAT	- Value Added Tax
VHF	- Very High Frequency
VIP	- Very Important Person

All times in this report are UTC+2



Lady Candida

SYNOPSIS

On 28 July 2007, *Lady Candida* was cruising 3 miles off the south west coast of Corsica. On board were a crew of 6 and 11 passengers, 4 of whom were young children. At about 1630, a fire was detected in the yacht's laundry. Despite efforts to extinguish the fire using portable extinguishers, it quickly spread out of control and the passengers and two of the crew were evacuated to the shore in the vessel's open tender. At 1640 the captain broadcast a "Mayday" and soon afterwards he and the remaining crew abandoned the vessel into a liferaft. They were soon recovered by a nearby vessel. The fire was later extinguished by shore-based rescue boats, but *Lady Candida* sank when being towed clear of the Bonifacio nature reserve. There were no casualties. The investigation identified that:

- The fire was almost certainly caused by the ignition of accumulated lint in the air outlet of a tumble dryer.
- The fire detection system did not function correctly.
- The growth of the fire was assisted by the airflow over the deck.
- No water was applied to the fire because the fixed fire pump could not be started and the emergency fire pump was difficult to access.
- There was no regular testing of the fire alarms or the emergency fire pump, and no fire drills were carried out on board.
- No engineer was carried and the captain had not completed mandatory fire-fighting training.
- The captain was probably fatigued.
- There were many departures from the requirements of the Code of Practice for the Safety of Large Commercial Sailing and Motor Vessels (LY1).
- The management of the vessel was left almost entirely to the captain and no safety management system was in place.
- The yacht foundered as a result of the large amount of water that accumulated in her hull during the fire-fighting effort.

To try to prevent a similar accident in the future, Safehaven International Ltd has introduced measures to provide shore-based support for all its clients' vessels and to monitor compliance with applicable codes and regulation. Additionally, the MAIB has circulated a synopsis of this accident, including the lessons learned, to the large yacht industry and media. Recommendations have been made to the MCA with the aim of ensuring that key safety equipment such as fire detection systems are properly maintained and operated, and the effectiveness of its survey regime is improved.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *LADY CANDIDA* AND ACCIDENT

Vessel details

Registered owner	:	Delphinus Marine Limited, Guernsey (Channel Islands)
Port of registry	:	London
Flag	:	United Kingdom
Former names	:	<i>Alicia, Christabel, Star of the Sea, Alinda II</i>
Type	:	Large charter yacht
Built	:	1973, Cantiere Navali Fratelli Benetti
Classification society	:	None
Construction	:	Steel with mainly aluminium superstructure
Length overall	:	29.46m
Load line length	:	25.05m
Gross tonnage	:	143 tonnes
Engine power and/or type	:	352.00 kW, Gardner 8LXB
Service speed	:	9 knots
Other relevant info	:	The vessel was carrying 16 tonnes of gas oil, 30 kg of butane, 80 litres of petrol and 100 litres of lubricating and hydraulic oils.

Accident details

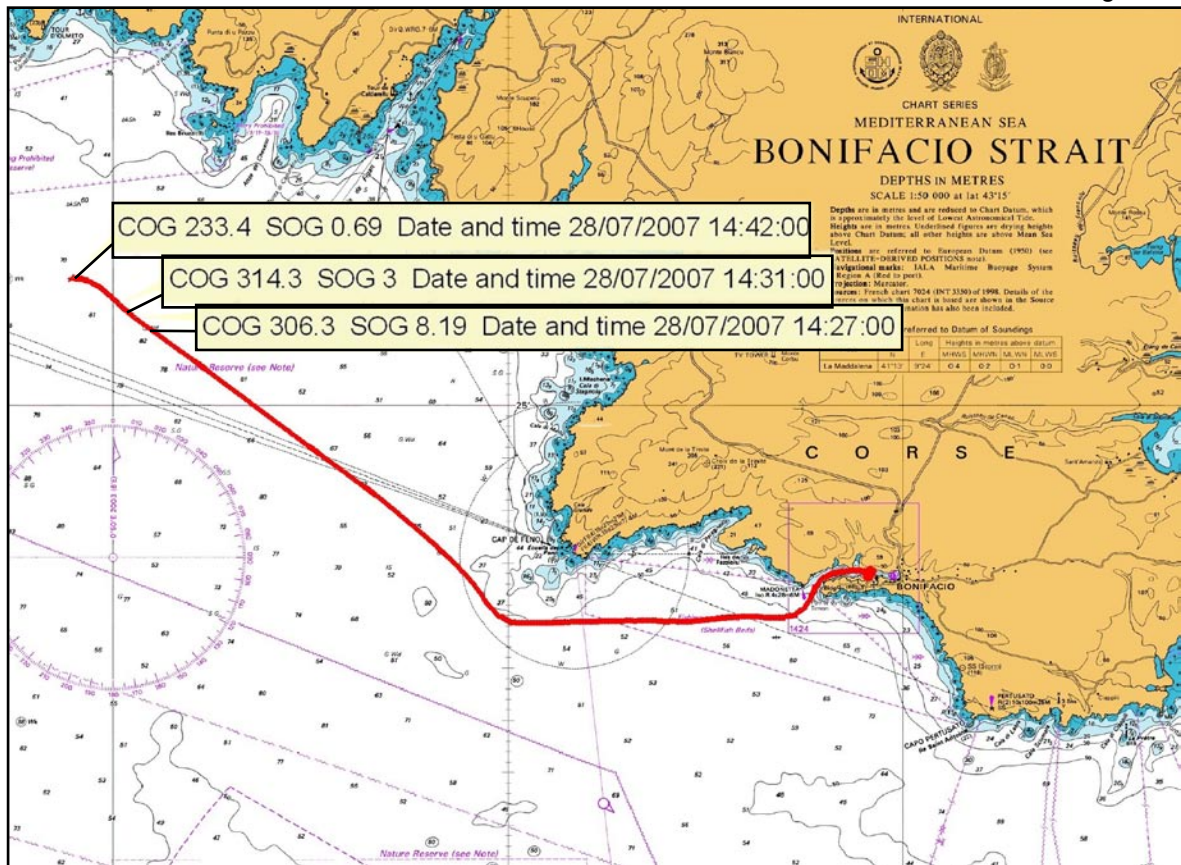
Time and date	:	1630 (UTC + 2) on 28 July 2007
Location of incident	:	41° 25' N, 008 ° 58'E, 275° Cap De Feno Lt, Corsica, 7 miles
Persons on board	:	17 (11 passengers, 6 crew)
Injuries/fatalities	:	None
Damage	:	Vessel lost

1.2 NARRATIVE

1.2.1 The fire

During the afternoon of 28 July 2007, *Lady Candida* was on passage from Bonifacio to Campomoro, Corsica on a north westerly heading at a speed of 8 knots (**Figure 1**). The wind was westerly at 23 knots and the sea was calm. On board were six crew, comprising the captain, a senior deckhand, a junior deckhand, a chef, and two stewardesses. Also on board were 11 passengers from the same family, comprising 7 adults and 4 children between the ages of 6 and 8 years. The adult guests were on the vessel's aft deck and the children were inside the accommodation. The captain and senior deckhand were on the bridge deck.

Figure 1



ECDIS extract taken from the captain's laptop computer

Around 1630 a female guest reported that she smelt something was burning. In response, the captain checked the galley and the engine room while the rest of the crew checked other areas. The junior deckhand went to the foredeck, where he noticed smoke coming out of the laundry room vent. He opened the escape hatch from the laundry (**Figure 2**) and saw thick black smoke inside. The junior deckhand then descended through the escape hatch to see where the smoke was coming from. When searching, he opened a tumble dryer door and saw clothes burning inside. The junior deckhand pulled the clothes from the machine and extinguished the flames using a dry powder extinguisher stowed nearby.

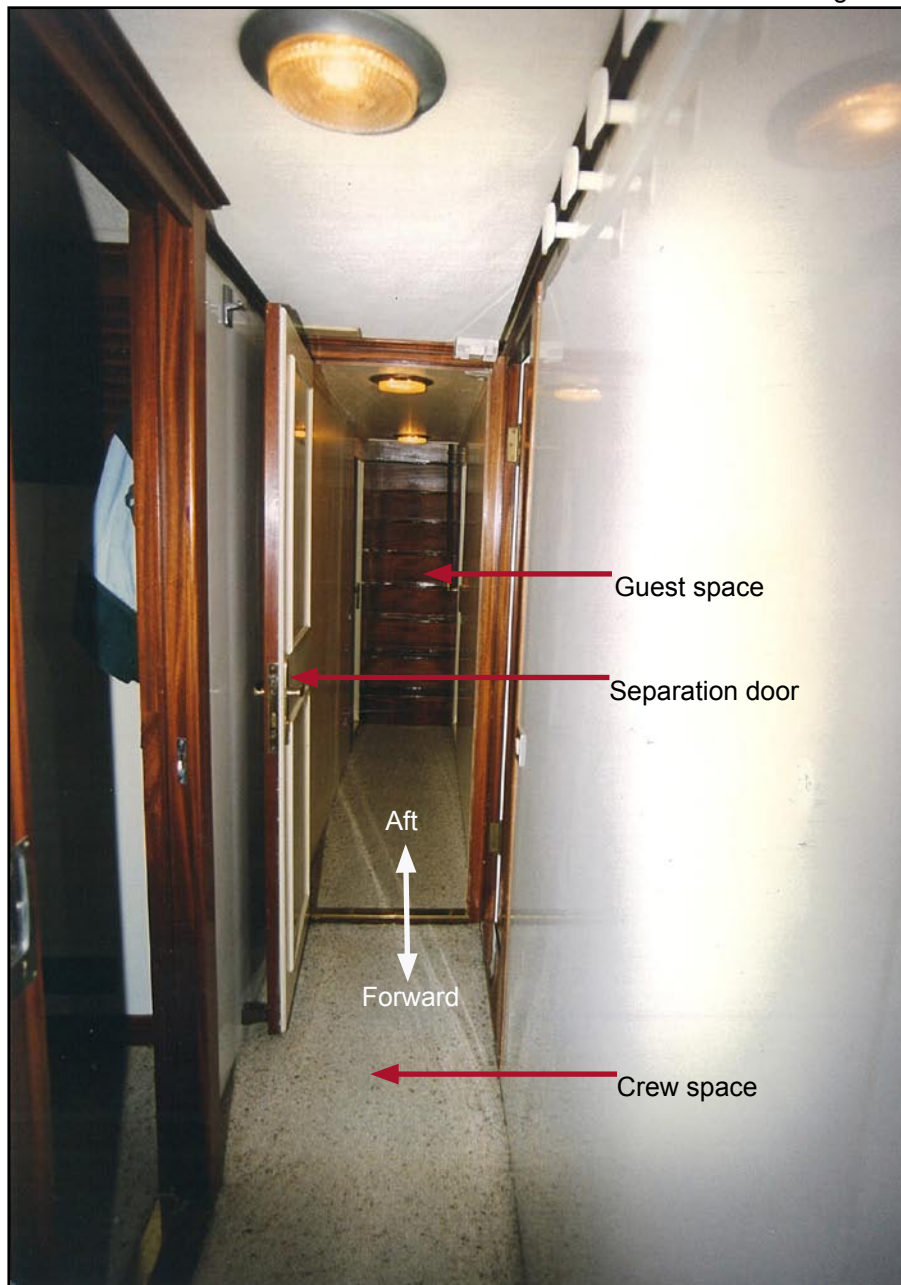


Foredeck, escape hatch and VIP cabin

On his return from the engine room, the captain reduced speed to about 3 knots (**Figure 1**) and was informed by the senior deckhand that there was a fire in the laundry and that the junior deckhand was inside. The captain ran forward via the internal alleyway (**Figure 3**), but when he opened the door between the guest and crew accommodation, he saw the alleyway in the crew accommodation was filled with thick black smoke. After shouting to the junior deckhand and establishing that he was alright, the captain closed the door and went up to the top deck and ordered the rest of the crew to prepare a fire hose. He then went to the foredeck and instructed the junior deckhand to get out of the laundry because he was not wearing breathing apparatus.

Once the junior deckhand was clear, the captain looked through the escape hatch and saw flames at the compartment's deck-head. Flames were also seen coming out of the laundry vent, and the VIP cabin (**Figures 2 and 8**) was beginning to fill with smoke. The captain instructed the senior deckhand to go to the engine room and start the fire pump while he attempted to fight the fire through the open hatch using a portable extinguisher.

Figure 3



Internal alleyway

Shortly after, the senior deckhand returned and reported that the fire pump would not start. The captain went to the engine room and attempted to start the fire pump himself, but noticed that its power supply breaker had tripped. He did not reset the breaker because he assessed that the fire had probably resulted from an electrical fault and if the breaker was reset, the fire might spread further. The captain also assessed that there was not enough time to get the emergency fire pump from the aft lazarette¹. He returned to the foredeck and instructed the chef to bring all available extinguishers. Meanwhile, the senior deckhand donned the only breathing apparatus on board and entered the laundry space to fight the fire. A number of smoke alarms were now audible.

¹ Lazarette: a small storeroom within the hull of a ship

The captain decided to evacuate the guests using the vessel's tender (**Figure 4**), which was being towed. The guests were assembled on the aft deck, where the adults donned lifejackets and the children donned buoyancy aids; no children's lifejackets were carried. Driven by the junior deckhand assisted by one of the stewardesses, the tender transported the guests about 3nm to Chevaneau, Corsica.

Figure 4



Zodiac tender model YL 480 DL

At 1640, the captain initiated a “Mayday” automatically via digital selective calling (DSC) and by voice on VHF radio channel 16. Both the Sardinian and Corsican coastguards responded. The captain then brought the engines to neutral and, as the vessel lost headway, her heading became more westerly (**Figure 1**). He went forward to assist the senior deckhand and again attempted to control the fire by releasing portable extinguishers through the open hatch cover. This had little effect. By now, the VIP cabin was also engulfed in flames and the captain ordered the senior deckhand out of the laundry as he feared that he might get trapped within the fire. The captain then went to the engine room, where he stopped the main and auxiliary engines and isolated the fuel system.

1.2.2 Abandonment

With the fire out of control, the captain decided to abandon the vessel. A 16-person liferaft stowed on the upper bridge deck was launched. The fire had spread to the forward part of the bridge deck and prevented access to the yacht's other liferafts. The liferaft's sea anchor deployed automatically. At 1645, the captain informed the Corsican coastguards, using a hand-held VHF radio, that they were abandoning the vessel. The crew boarded the liferaft from the yacht's port side. The painter was then cut and the crew attempted to paddle the liferaft clear. However, the yacht was now stopped in the water and, with the wind blowing from the starboard side *Lady Candida* was set onto the liferaft. Concerned by the proximity of the fire, which had now spread along the entire vessel and had started to melt the aluminium superstructure, the crew entered the water and pulled the liferaft away from the burning vessel.

The liferaft was 10 metres from *Lady Candida* when a tender from the sailing vessel *Kokomo*, which had responded to the "Mayday", arrived at the scene. With the crew holding on to the liferaft, the tender towed the liferaft clear. The crew were then recovered to *Kokomo* at 1713.

1.2.3 Foundering

The rescue boat *Sant Eramu* arrived at the scene at 1732 and started to extinguish the fire. She was joined by a second rescue boat an hour later. By this time, much of the superstructure had disappeared, the engine room was in flames and the port holes of the cabins were missing (**Figure 5**).

Photograph courtesy of Marine Nationale

Figure 5



Lady Candida on fire

A tow line was connected between *Sant Eramu* and *Lady Candida* at 1917 and the smouldering vessel was towed away from the coast to try and clear the Bonifacio nature reserve. During the tow, water was seen coming out of the vessel's lower deck port holes. *Sant Eramu* was relieved by the tug *Ailette* at 2116, but 5 minutes later the yacht suddenly listed and then foundered in position 41° 24. 577' N, 008° 57, 456'E, in a depth of 71 m.

1.2.4 Crew repatriation

Once ashore, the crew were taken by the local police to the fire station at Pianotolli. They did not have any money or personal belongings except the clothes they were wearing. The captain contacted the legal representative² of the beneficial owner³ of *Lady Candida* for assistance, but was told that he should be capable of looking after himself and his crew. The crew spent the night at the fire station but were assisted the following day by friends of the vessel's beneficial owner who were in the vicinity. The crew were then able to travel to France for onward passage to their respective homes.

1.3 LAUNDRY ROOM

Internal access to the laundry was by an alleyway (**Figure 3**). At the forward end of the alleyway, a flight of three steps led to the laundry room and a crew cabin, which shared a common two-way door (**Figure 6**). The main control panels for the 110V DC windlass (**Figure 7**), which had a history of overheating, were sited behind the stairs.

Inside the laundry, which had a plywood ceiling fitted below its deck head, were two washing machines. Clothes and linen were stored on shelves located along the port side of the compartment, and two clothes dryers were sited at its forward end. One was a newly installed condensing type dryer and the other was an older tumble dryer with an air vent passing out to the forward deck and connected to a gooseneck pipe on deck. The hot air vent pipe was connected to the back of the dryer and was difficult to access.

Previous crew had experienced overheating in the dryers due to lint blocking the air outlet, and re-occurrence had been prevented by regular cleaning. However, this information was not passed over during a short handover between crews in 2006. The stewardesses had occasionally cleared lint from the air outlet but it was not a routine procedure. The dryers were operating all day on 28 July 2007 and were on at the time the fire was detected.

Above and aft of the laundry was the VIP cabin (**Figure 8**), which had been converted from a study. During the conversion, the stepped bulkhead below the cabin's front windows was cut away and a new sloping section, probably made from marine plywood, was inserted (**Figure 9**) to allow a bunk to be fitted as far forward as possible.

² The owner's legal representative was a lawyer based in Paris

³ The person(s) whose capital is invested in the purchase of the yacht is (are) known as the 'beneficial owner(s)'. The company under which the yacht is registered is known as the 'legal owner'

Figure 7

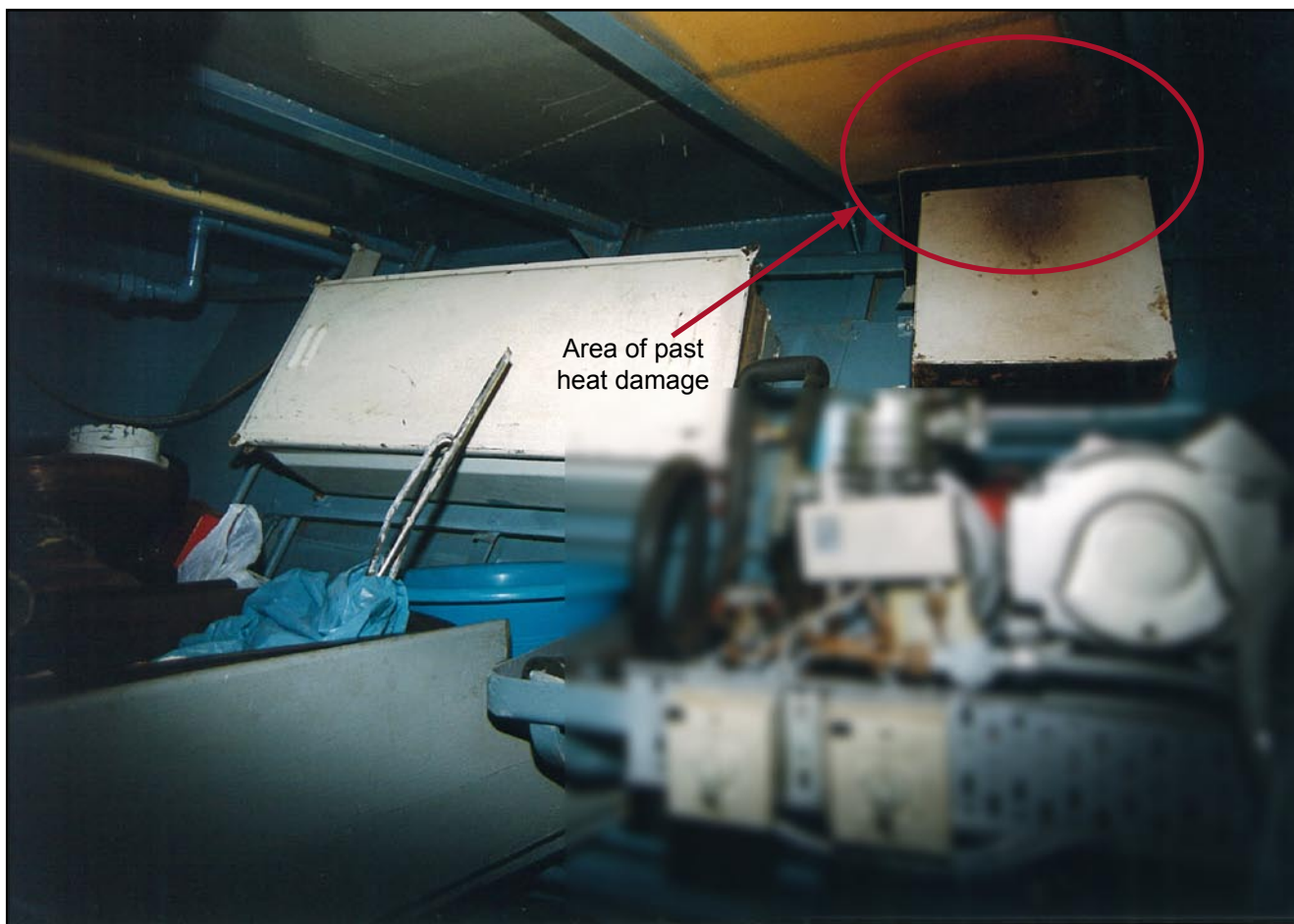
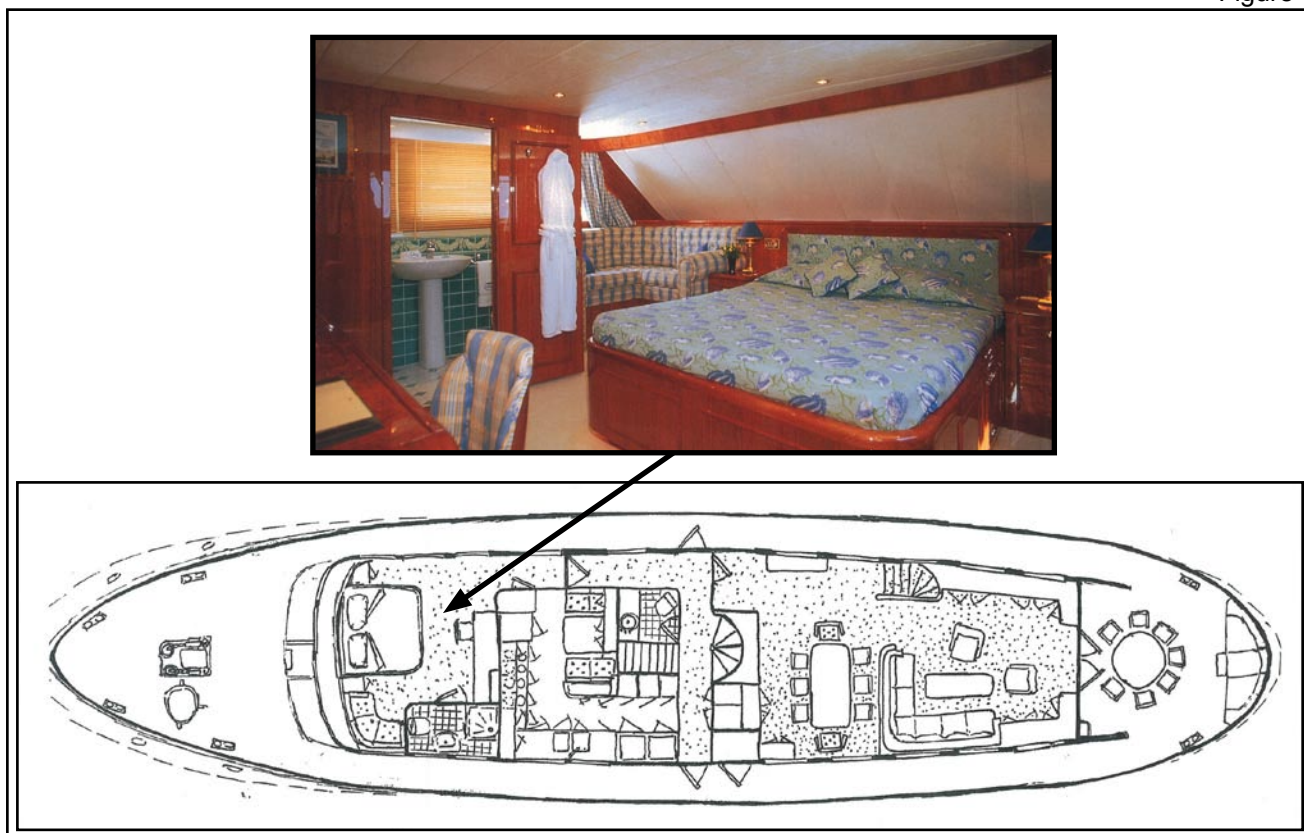
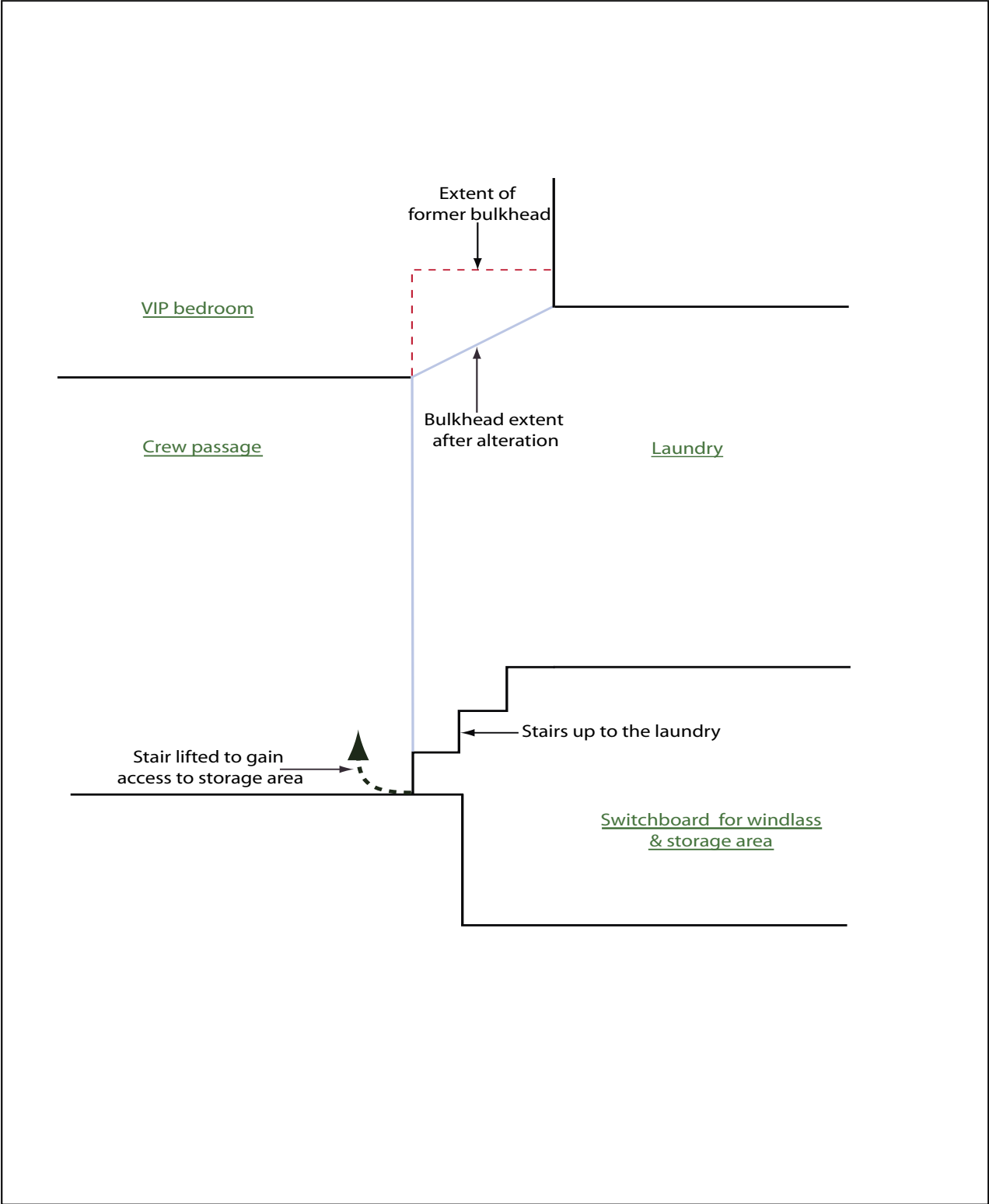


Figure 8



Position of VIP cabin

Figure 9



Internal bulkhead

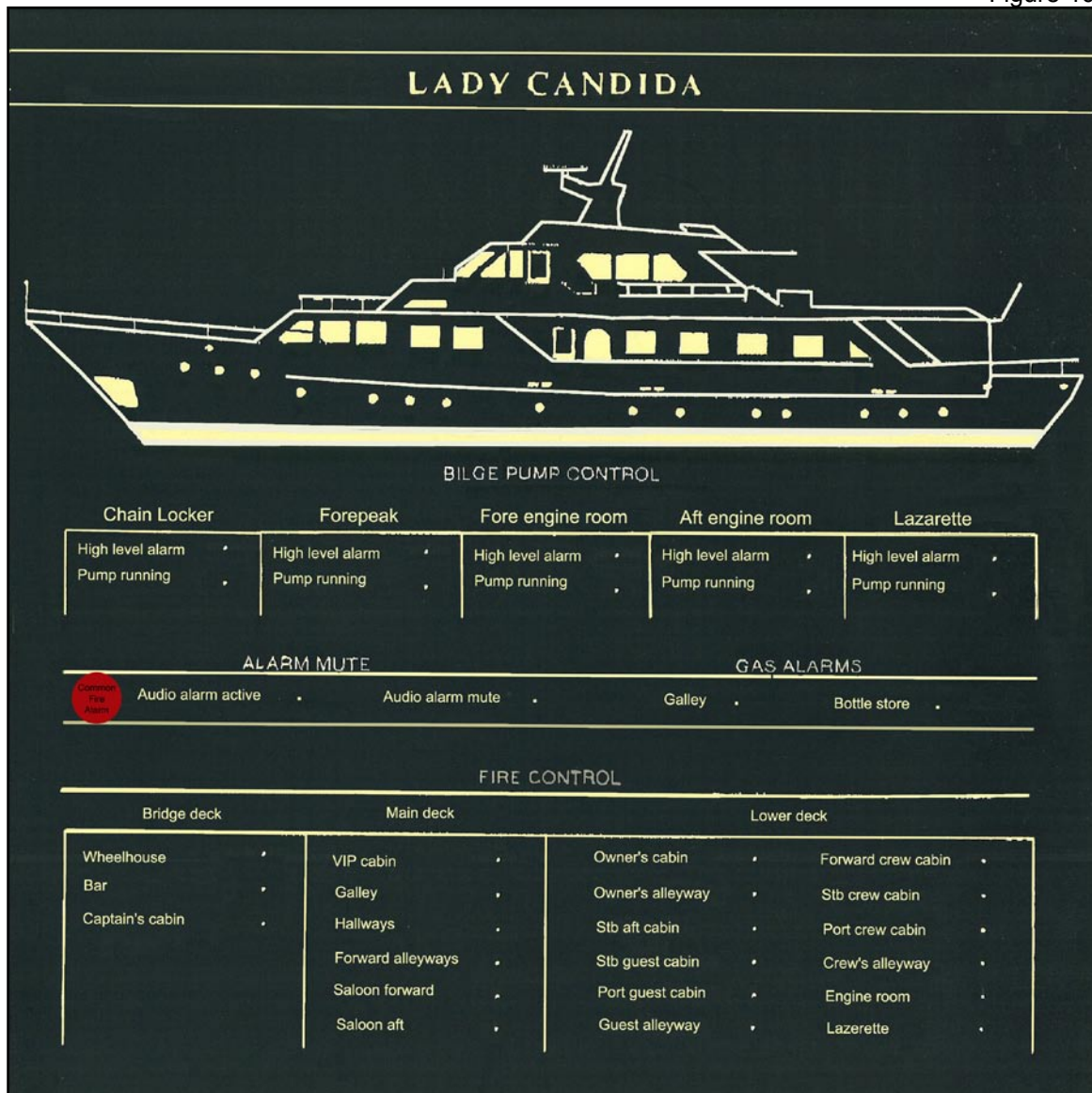
1.4 FIRE DETECTION AND ALARM SYSTEM

1.4.1 Description

The fire detection system was installed in 1998. Nineteen domestic type smoke sensors were fitted in various locations throughout the ship, including the crew alleyway immediately outside the laundry. In addition, heat sensors were sited in the engine room, galley and by the windlass control panel under the laundry.

Each smoke sensor was powered by a 9 volts battery, and indication of a low battery level was provided by a single audible beep every 5 minutes. A number of batteries were found to be flat during several inspections and surveys conducted in recent years. No alternative source of power was provided. When activated, the sensors emitted a local audible alarm and, apart from the heat sensor below the laundry, they also triggered audible and visual alarms (LEDs) on a control panel sited on the bridge (**Figure 10**). No manual call points were fitted but this had been accepted by the MCA.

Figure 10



Alarm control panel

The control panel LEDs, which also provided indication for bilge levels, bilge pump operation and gas leaks, were arranged schematically for ease of identification. Switches on the control panel enabled the LEDs to be tested and for audible alarms to be muted. The status of the mute switch on the main alarm panel at the time of the fire is not known. The yacht did not have a dedicated general alarm, but the smoke sensors could be activated simultaneously by a push button on the control panel, which sent an independent 9V supply to each sensor. A high level alarm system for the vessel's black and grey water tanks was also sited on the bridge, the audible alarms of which were muted.

1.4.2 Testing and system knowledge

Other than lamp tests on the bridge control panel, no routine testing or maintenance of the fire detection and alarm system was undertaken. The captain was not fully conversant with the operation of the system and was under the impression that an alarm bell would sound all over the vessel if any smoke or heat sensor should be triggered. He was also unaware of the push button on the fire panel which triggered all the sensors.

1.5 FIRE-FIGHTING EQUIPMENT

Two fire pumps were carried. The primary pump was a fixed 220 V AC 1.5 HP motor driven pump in the engine room which could be started either locally from inside the engine room or remotely from the galley. Although the fixed pump was frequently used to wash off the anchor chain, the captain was not aware of its remote starting position. The second pump, which was portable, was diesel driven and was stored in the aft lazarette. Access to the lazarette was via a flush deck hatch on the aft deck, which was obstructed by chairs and tables. The pump, which was also difficult to remove from the lazarette because of the amount of other equipment which was also stowed there, was last tested in February 2007.

A fixed CO₂ fire-fighting system was fitted in the engine room, which also contained several CO₂ extinguishers and a dry powder extinguisher. A number of dry powder extinguishers were also distributed in the accommodation, including two in the laundry room. Fire hoses were located in the engine room, amidships and on the fore deck. One set of breathing apparatus was carried.

1.6 LIFERAFTS AND TENDER

1.6.1 Liferafts

The yacht's liferafts comprised a 1 x 16 person RFD liferaft sited on the port side of the upper bridge deck approximately 5 metres forward of the stern, and 2 x 10 person Zodiac liferafts on the starboard side of the Jacuzzi deck above the bridge. All three liferafts were last serviced in February 2006 and had been due for annual service in February 2007.

1.6.2 Tender

The yacht's tender was 4.8m in length and had a capacity of 9 persons, although its weight capacity was 1065 kg. It was equipped with a 60 HP outboard engine and was fully fuelled.

1.7 CREW

1.7.1 Employment and work patterns

The captain joined the vessel in August 2006, following a telephone interview by the manager of the vessel. Apart from the captain and the senior deckhand, none of the crew were given contracts of employment. No crew agreements⁴ had been in place on board the vessel since at least 1998.

The vessel relocated to the Caribbean in November 2006 and returned to the Mediterranean in June 2007. An engineer had been part of the crew during this period, but he left the vessel on 13 July 2007 and was not replaced.

During the passage from the Caribbean, severe weather conditions were experienced and the crew were exhausted when the vessel arrived in Cagliari, Sardinia on 12 July 2007. This was more than a week later than anticipated. The yacht sailed the following day on a 10 day private charter. The vessel's next charter started on 26 July 2007 when she sailed from Bonifacio. Since the departure of the engineer, the captain undertook all engineering responsibilities and the majority of the navigational watchkeeping duties. Consequently, he had few periods of rest and managed only about 5 hours sleep in each 24 hour period. The rest of the crew also worked very long hours when the vessel was on charter. No records of the crew's hours of work and rest were maintained.

1.7.2 Experience and training

The captain had 22 years experience on yachts, of which the last 5 years were as captain. He held an RYA Yacht Master Offshore certificate, which had been endorsed for commercial use by the RYA (on behalf of the MCA), and he had completed elementary first-aid and sea survival courses as well as a radio licence course. The captain had not completed an STCW 95 approved fire-fighting course.

The senior deckhand had worked as an AB on merchant vessels and accordingly had completed the training courses required by STCW 95, including an advanced fire-fighting course. None of the remaining crew had completed any fire-fighting or sea survival training. No safety induction procedures were conducted when passengers came on board or new crew joined. Safety and fire drills were rarely, if ever carried out.

⁴ The Merchant Shipping Act 1995 requires that every United Kingdom ship shall have an agreement in writing between each person employed and the person employing him. For United Kingdom ships these are known as crew agreements and they are required to be in writing and in a form approved by the Maritime and Coastguard Agency. Crew agreements are additional to and separate from any company contract or similar document.

1.8 VESSEL MANAGEMENT

When the beneficial owner of *Lady Candida* bought the vessel in May 2005, he approached Safehaven International Limited (SHI)⁵ in Guernsey to register an offshore company in the Channel Islands through which the yacht was to be operated. Accordingly, Delphinus Marine Limited was set up as the registered owner of *Lady Candida*, which issued letters of appointment to the captain in command at the time and to the person nominated as the vessel's manager. The letters only outlined the authority delegated to the individuals. No contract of employment was established between Delphinus Marine Ltd and the nominated manager, who offered his services in the capacity of 'friend' of the beneficial owner and received no payment. SHI provided payroll and financial management services. It was not engaged to provide yacht management services. To charter the yacht, Delphinus Marine established a rolling contract with Camper & Nicholsons, Monaco.

From the end of 2006, the vessel's nominated manager became difficult to contact. Therefore, to continue to operate the vessel, the recently appointed captain dealt directly with SHI for crew related matters and with the beneficial owner's legal representative with regard to financial expenditures. He was often informed that there were insufficient funds in the company accounts to pay for vessel maintenance.

1.9 CERTIFICATION AND SURVEY

Lady Candida was issued with a *Certificate of Compliance for a Large Charter Yacht* (LY1)⁶ by the MCA in April 2005, which was valid to November 2009. This was subject to:

the ship, its machinery and equipment being efficiently maintained, annual surveys and manning complying with the Code of Practice, and to the following conditions; commercial voyages were restricted to no more than 60 miles from a safe haven in favourable weather only.

The certificate of compliance stated sufficient lifesaving appliances were provided for 16 persons.

The last annual survey to be conducted was in May 2006 in San Remo, Italy, when 11 deficiencies were noted. In particular, additional approved portable extinguishers were required to be provided in the engine room and galley, a fire hose nozzle was found to be seized and several lifejacket lights needed replacement. The survey report form indicated that most of the deficiencies were required to be corrected before the vessel was next used for commercial charter. Following the survey, the MCA was not made aware that the deficiencies identified had been addressed. Consequently, they remained extant on MCA's internal database. *Lady Candida* had been due an annual survey in May 2007 but this had been delayed until August due to the vessel being in the Caribbean.

⁵ SHI is based in Guernsey and offers services in areas such as the incorporation and administration of companies, registration of vessels, marine finance facilities and insurance, super yacht financial management and VAT consultancy. It administers several hundred companies, many of which are registered owners of yachts. The majority of the yachts under the administrative umbrella of SHI are predominantly for the beneficial owner's use only.

⁶ The "Code of Practice for the Safety of Large Commercial Sailing and Motor Vessels" was introduced in 1998. It is commonly known as LY1 and applies to vessels in commercial use for sport or pleasure, which are 24 metres (load line length) and over.

Ensign, the large yacht unit of the MCA, is a dedicated business unit set up to support the Large Yacht Code. It was officially launched in October 2001 and is based in South Shields, UK. The unit conducts surveys in accordance with LY1 or the Large Commercial Yacht Code (LY2) on all UK registered large commercial yachts, and on Red Ensign⁷ or any other flag of yacht if requested by the Flag State. However, it is a consultative body and has no enforcement powers.

Manning issues are retained by the Seafarers Standards Branch at MCA Headquarters in Southampton. Seven UK based surveyors are employed and there are about 370 UK registered yachts over 24m. The demand for surveys tends to be seasonal, being at a maximum in the spring prior to the start of the main charter season. Most UK registered yachts operate and are surveyed abroad. Each survey takes about one working day.

1.10 LARGE YACHT CODE

1.10.1 Background and application

LY1 was developed jointly by the United Kingdom and a number of Red Ensign administrations (Bermuda, Cayman Islands, Isle of Man and Gibraltar), along with a wide group of industry experts and representatives, with the intention of providing a guide to industry. It is not an IMO instrument, but is increasingly seen by many administrations as the standard for the construction and safe operation of yachts over 24 metres load line length. Compliance with the Code is generally considered within the commercial yacht industry to be advantageous to owners. It is a positive feature when chartering and also potentially increases a vessel's value.

“The Large Commercial Yacht Code” (LY2) came into force in 2004. This was a revision of LY1 and took into account advances in technology and changes of operational practice within the yachting industry. Following the introduction of LY2, the LY1 code continued to be applied to vessels originally built to, or surveyed against, its requirements. However, a requirement of LY2 that a safety management system be introduced on all commercial yachts became mandatory for all vessels from 1 January 2007, irrespective of the code they were surveyed against. The requirements of the safety management system, which is commonly known as ‘mini ISM’⁸ are at **Annex A**. The captain of *Lady Candida* was reminded of this requirement by Ensign via e-mail on 12 June 2007.

1.10.2 Fire detection and protection

The LY1 code requires a fire detection and alarm system with a control panel within the wheelhouse and with audible alarms located where they are most likely to be heard. For a vessel less than 50m in length and less than 500 GRT, the LY1 code does not require a separate general alarm. The LY2 code requires that fire detection and alarm systems comply with SOLAS II-2/7 and the FSS code. These require that the fire detection and alarm system is not used for any other purpose, and that at least two independent power sources are provided.

⁷ The Red Ensign Group consists of the United Kingdom, UK Crown Dependencies (Isle of Man, Guernsey and Jersey) and UK Overseas Territories (Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Falkland Islands, Gibraltar, Montserrat, St Helena and the Turks & Caicos Islands). Any vessel registered in these locations is entitled to fly the Red Ensign flag, is known as a “British ship” and is eligible to receive British consular services as well as protection from the Royal Navy.

⁸ Compliance with the International Safety Management Code is a mandatory requirement for all vessels over 500 GRT undertaking international voyages

For yachts below 500 GRT, the LY1 code does not specify fire insulation requirements for compartments except in the case of machinery space and machinery ventilation trunking where this passes through the accommodation space. Laundry and drying spaces are classed as low risk areas in both LY1 and LY2.

1.10.3 Lifejackets

Lady Candida was required to carry lifejackets for each adult on board plus at least an additional 10%. In addition, children's lifejackets were required to be provided for each child on board.

1.10.4 Manning, crew training and qualifications

A vessel over 24m load line length, under 200 GRT and operating within 60 miles of a safe haven is required by LY1 to carry a minimum of one deck officer holding a Yacht Master Offshore certificate and one engineer with an Approved Engine Course (AEC). A 'Basic Fire Fighting Course Certificate' and a 'First Aid At Sea Certificate' are requirements for all deck and engineering officers. Deck officers are additionally required to hold a Basic Sea Survival Course Certificate, which all other crew members are also recommended to hold.

1.11 ADDITIONAL REGULATION

MSN 1767 'Hours of Work, Safe Manning and Watchkeeping Revised Provisions from 7 September 2002' requires that every crew member must have at least 10 hours of rest in every 24 hour period and 77 hours in every 7 day period. It also requires a record of hours of rest to be maintained for each seafarer.

The Merchant Shipping (Repatriation) Regulations 1979 describe the obligations of an employer to a shipwrecked crew and state that employers of seamen shall:

a) as soon as practicable after the seaman is left behind or brought ashore after the shipwreck make such provision as is necessary for his return to a place ascertained under regulation 6;

b) "... make such provision for the seaman's food and lodging and such other relief and maintenance as may be necessary ..."

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 ORIGIN OF THE FIRE

The control relays and switching equipment for the windlass had a history of overheating, and there is a possibility that the fire originated in the storage space under the laundry room. However, as clothes were found burning inside a tumble dryer and smoke was seen coming from its deck vent at an early stage, it is almost certain the origin of the fire was within the tumble dryer. The absence of a regular cleaning routine would have allowed lint from clothes to accumulate and partially block the air outlet from the dryer. The dryer would have run for longer periods of time causing substantial heat to develop. This is supported by the experience of the previous crew. As lint is a highly combustible material, it is probable that the heat generated would have been sufficient to cause ignition.

Statistical evidence (**Annex B**) indicates that a large number of tumble dryer fires are caused by vent blockage leading to overheating and fire. As tumble dryers on board large charter yachts are likely to be in frequent use, particularly when guests are embarked, the risk of lint accumulation is high. Therefore, it is essential that accumulated lint is cleaned from the machines and air vent pipes at regular intervals if overheating, and possibly fire, is to be avoided.

2.3 PROPAGATION OF THE FIRE

The fire in the tumble dryer would have intensified following the increased airflow once the laundry escape hatch and dryer door were opened, particularly as the wind over the deck at the time was over 20 knots. Although the junior deckhand extinguished the burning clothes from inside the dryer, it is evident from the continued growth of the fire that it had already spread beyond the tumble dryer before this action was completed. It is most likely that the fire had spread to the flexible plastic vent pipe, which would have not been visible and would have acted as a conduit to the plywood ceiling. Smoke was seen in the VIP cabin at an early stage and it is probable that the fire soon burned through the wooden partition installed under its forward bunk. Given the amount of thick black smoke seen in the forward section of the internal alleyway when the captain opened the door separating the guest and crew accommodation, it is probable that the door between the laundry room and accommodation was left open. This would have contributed to the airflow within the laundry following the opening of the escape hatch. It would also have allowed the fire to spread internally, unchecked.

Apart from some plastics, the fire in the laundry and its adjacent compartments was carbonaceous in nature. As such, it possibly could have been extinguished had the supply of air to the laundry been kept to a minimum and water applied at an early stage. However, although speed was reduced soon after the fire was reported, no course alteration was made to reduce the wind over the foredeck. The escape hatch was also kept open throughout. Furthermore, although the captain ordered fire hoses to be prepared, no water was ever applied to the fire because the fixed pump could not be started and no attempt was made to use the portable fire pump.

The fixed fire pump would not start due to the fact that its power supply breaker had tripped. It is not known why the supply breaker had tripped but the captain's assessment, that the breaker and the origin of the fire were possibly connected and that the re-setting of the breaker might cause the fire to spread further, was illogical. In these circumstances, had the support of a qualified engineer been available as required by LY1, a more accurate diagnosis would have been possible. Consequently, the possibility of starting the fixed fire pump and applying water to the fire would have increased considerably.

The stowage arrangements of the portable fire pump, the lack of fire drills, and the fact that the pump was last tested in February 2007, indicate that the pump was seldom used. Therefore, even had the use of the portable pump been attempted, not only would the ship's crew have been unfamiliar with its operation, but also there is a strong likelihood that it would not have started without difficulty.

2.4 EFFECTIVENESS OF THE FIRE DETECTION SYSTEM

Given the large amounts of thick black smoke seen in the laundry and alleyway by the junior deckhand and captain respectively before any smoke alarms appear to have been heard, it is evident that the fire detection system failed to provide adequate warning. Although it is possible that the audible alarms on the bridge were muted, the failure of some alarms to sound locally, particularly the alarm in the forward crew alleyway, indicates that the sensors were not functioning correctly. In view of the lack of maintenance and testing, along with the captain's poor knowledge of the system, it is highly likely that some sensors did not work because their batteries were flat, as identified during previous inspections and surveys, or had been removed.

The fire detection system fitted on board *Lady Candida* met the requirements of LY1. However, it was a much lower specification than systems compliant with LY2, which meet the requirements of SOLAS II-2/7 and the FSS Code. These include a requirement to have an independent alternative power supply to batteries, and for a general alarm to be activated if a sensor alarm is not acknowledged on the system control panel within 2 minutes. Where such failsafe systems are not fitted, as in the case of *Lady Candida*, the effective operation of the fire detection equipment can only be relied upon provided robust maintenance procedures are put in place to ensure the system is working at all times, and that operational practices are followed to ensure the system is properly monitored.

2.5 ABANDONMENT AND FOUNDERING

The captain's decision to evacuate the guests was taken quickly and, as the tender was fully fuelled and readily available, the conditions were calm, the yacht was only 3 miles from the coast, and the guests could embark relatively easily, the use of this option was reasonable.

During the abandonment by the remaining crew, two of the three liferafts carried were not accessible due to the spread of the fire. The crew's ability to access the remaining liferaft demonstrates the advantages of not siting all liferafts in a single location, which is common practice.

It is apparent that consideration was not given to the effects of the wind on the relative movements of *Lady Candida* and the liferaft after it had been launched. Such an evaluation is likely to have identified the need to move the liferaft to the stern before embarking in order to allow it to drift clear once its painter was cut. It was fortunate that no injuries resulted from the entrapment of the liferaft alongside the burning vessel.

As water was seen coming from the yacht's lower port holes about 2 hours before she sank, a considerable amount of water must have accumulated in the vessel during the tugs' attempts to extinguish the fire. It is evident that the weight of the water, together with free surface effect, was sufficient to cause the ship to lose stability and founder.

2.6 DECISION MAKING

The captain's decisions to evacuate the guests from the vessel, to initiate a "Mayday", to isolate the fuel system, and to abandon the vessel, were positive and helped to prevent injury to the guests and crew, and possibly harm to the environment. However, his failure to manoeuvre the vessel to reduce the wind over the foredeck, his assessment of the problem with the fixed fire pump, and his decision not to attempt to use the portable fire pump, considerably reduced the possibility of the fire being extinguished. In addition, the captain's failure to recognise the danger to the liferaft before embarking increased the risk of injury to his crew.

Given the vessel's recent trans-Atlantic voyage in rough sea conditions, the captain's increased workload following the departure of the engineer, the pressure of preparing the vessel for charter after returning from the Caribbean, along with the demands of operating a yacht on commercial charter, which resulted in the captain achieving less than 5 hours sleep in each 24 hour period, it is highly likely that the performance of the captain was affected by fatigue. In addition, his decisions and actions were taken in an extremely stressful situation, and as only the senior deck rating had been trained in fire-fighting and none of the remaining crew had participated in onboard fire and safety drills, the support available to the captain was limited.

2.7 VESSEL OWNERSHIP AND MANAGEMENT

The structure of ownership and administration for *Lady Candida* as described in paragraph 1.8 is not uncommon among the smaller yachts within the large yacht industry. The management and operation of *Lady Candida* was left almost entirely to her captain. Although many captains have proven themselves capable of managing all aspects of a vessel's operation, this is highly dependent on an individual's personality, experience and competency. A significant number of departures from the requirements of LY1 were identified during this investigation. These included:

- There was no safety management system
- No engineer was carried
- The captain had not completed mandatory fire-fighting training
- Regular fire and safety drills were not carried out on board
- No records of work and rest were maintained
- Seventeen persons were carried on board when only sixteen were permitted due to limitations in life saving equipment

- There were no crew or passenger induction procedures
- There were no routine maintenance tasks to check smoke detector batteries or clean lint from the dryers
- The portable emergency fire pump was stored in a location with difficult access, and it had not been tested for 5 months
- Liferaft servicing date was overdue by 5 months
- No children's lifejackets were carried
- Neither the captain nor the senior deckhand was aware that the fire pump could be started from the galley
- There was no crew agreement in place
- Only two crew had written employment contracts
- No assistance to crew was provided on the day they were shipwrecked.

The extent and nature of these departures demonstrate *Lady Candida's* non-compliance with LY1 in key areas relating to her safe operation.

Although the captain had a pivotal role to play for his vessel's compliance with applicable regulation, her owners also had a major responsibility in this respect, either directly, or via a third party. As a minimum, the owners were responsible for ensuring that the captain had completed all training courses required by LY1, which he had not, and had the necessary experience and support to safely manage the vessel.

Yacht management companies cover all aspects of the day to day management of a vessel, including: technical management, registration, recruitment, administration and insurance, purchasing, ISPS, and ISM. However, the acquisition of such services is frequently seen by owners as unnecessary and expensive. This is unfortunate as the interpretation and application of applicable regulations is not always straightforward and, had the operation of *Lady Candida* been subject to periodic oversight by a person with an understanding of the requirements of LY1 and other national regulation, this would have at least provided an independent verification of the vessel's compliance. Importantly, the absence of a safety management system would probably have been highlighted. Adherence to the requirements of the safety management system (**Annex A**) would have then helped to identify and rectify many of the above departures, several of which were contributory to the fire and subsequent sinking.

It is understood that there is currently a shortage of appropriately qualified captains and crew within the large yacht industry. As the industry continues to grow, and there are approximately 400 large yachts currently under construction, the availability of trained personnel is unlikely to improve in the short term. In these circumstances, the importance of safety management in the large yacht industry, in ensuring the safe operation of its vessels, is likely to increase.

2.8 SIMILAR ACCIDENTS

In 1998, the US NTSB investigated a fire on board the cruise vessel *Ecstasy*. The resulting investigation report states:

it was determined that lint, which accumulated in the vessel's exhaust ducting and plenums from the laundry, was fuel source that enabled the fire to spread in the ducting.

When the NTSB inspectors inspected the laundry ventilation ducts of similar vessels they found lint accumulation several inches thick in the ducts. The NTSB made the following recommendations to the cruise industry:

Immediately inspect, within your fleet of ships, the laundry ventilation systems, including ducts, plenums, and exhaust terminuses, for any combustible material, such as lint, and clean the systems, as necessary, to reduce the risk of fire. (Urgent) (M-98-125)

Institute a program to verify on a continuing basis that the laundry ventilation systems, including ducts and plenums, remain clean and clear of any combustible material that poses a fire hazard on your vessels. (M-98-126)

The accident on board *Lady Candida* was the first example that has been reported to the MAIB of a fire which had originated in the laundry of a large charter yacht. However, since 1991, seven fires in the laundry spaces of other UK registered vessels have been reported to the MAIB.

In August 2005, the 1964 built, 365 GRT luxury yacht *Land's End* grounded and was holed on the St Joseph Reef off the west coast of Corsica while on passage in calm weather, eventually sinking some days later. A significant contributory factor to the accident was the inadequacy of the safety management system with respect to basic bridge procedures. Also, the management arrangements for the vessel did not provide any external audit mechanism of the ship's operation.

2.9 THE ROLE OF SURVEY

By its nature, an annual survey conducted by Ensign, or any other administration, is a periodic audit of a vessel's compliance with applicable codes and national regulations. It is a snapshot and, as such, is limited in its scope and cannot cover all aspects of applicable regulation. This is illustrated by the fact that none of the vessel's surveys since 1998 identified the absence of crew agreements. It is also recognised that assessing conformity with technical requirements of regulation, particularly in older vessels, is not always straightforward and is frequently subject to deliberation and negotiation with a vessel's captain, manager, or owner.

The last annual survey conducted by Ensign on *Lady Candida* was in May 2006 during which a small number of deficiencies were recorded or commented upon relating to fire-fighting and lifesaving equipment. Although the deficiencies did not contribute to the crew's inability to extinguish the fire, or impact on the subsequent abandonment of the vessel, it is considered that the lack of confirmation that corrective action had been taken reduced the effectiveness of the survey procedure.

There are practical difficulties associated with ensuring deficiencies are rectified before a yacht next sails on a commercial voyage, particularly when a survey has been conducted in a distant location and is probably one of a number conducted over a short period. However, notwithstanding an owner's responsibility for a vessel's compliance with applicable codes and national regulation, the operation of a 'closed loop' system by Ensign, with respect to the rectification of deficiencies identified during survey, would encourage prompt follow up action where required. This would add to the rigour of the survey process and improve vessel safety.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

3.1.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. Where safety equipment such as fire detection systems are fitted in compliance with LY1, which is of a lesser technical standard than LY2, the effective operation of this equipment can only be relied upon provided robust maintenance procedures are put in place to ensure the system is working at all times, and that operational practices are followed to ensure the system is properly monitored [2.4]

3.1.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION ALSO LEADING TO RECOMMENDATIONS

1. Although the deficiencies identified during the vessel's last annual survey did not contribute to the crew's inability to extinguish the fire or impact on the subsequent abandonment of the vessel, the lack of confirmation that corrective action had been taken reduced the effectiveness of the survey procedure. [2.9]

3.1.3 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE NOT RESULTED IN RECOMMENDATIONS BUT HAVE BEEN ADDRESSED

1. It is almost certain that the origin of the fire was the tumble dryer in the laundry, and the cause was the accumulated lint blocking the air outlet, causing the dryer to work longer than normal and causing excess heat, and igniting the lint. [2.2]
2. It is essential that accumulated lint is cleaned from the machines and air vent pipes at regular intervals if overheating, and possibly fire are to be avoided. [2.2]
3. The fire could possibly have been extinguished had the supply of air to the laundry been kept to a minimum and water applied at an early stage. [2.3]
4. Had the support of a qualified engineer been available as required by LY1, a more accurate diagnosis of the problem with the fixed fire pump would have been possible, and therefore the chances of starting the fixed fire pump and applying water to the fire would have increased considerably. [2.3]
5. The most likely cause that the fire detection system did not work is that the smoke alarm batteries were flat or had been removed. [2.4]
6. An evaluation of the conditions before the crew embarked in the liferaft would have identified the need to move the liferaft to the stern before embarking. [2.5]
7. It is highly likely that the performance of the captain was affected by fatigue. [2.6]
8. As no fire and safety drills had been conducted on board, the support provided to the captain by the untrained crew would have been limited. [2.6]
9. A significant number of departures from the requirements of LY1 were identified. [2.7]
10. The management and operation of *Lady Candida* was left almost entirely to her captain; her owners had a major responsibility for ensuring that the captain had the necessary experience and support to safely manage the vessel. [2.7]
11. There was no oversight by a yacht management company with an understanding of the requirements of LY1 and other national regulation, which would have provided support to the captain and an independent verification of the vessel's compliance. [2.7]

SECTION 4 - ACTION TAKEN

4.1 MAIB

The UK's Marine Accident Investigation Branch has, in parallel with the publication of this report, produced a two-page account of the accident and the principal lessons to be learned from it. This summary account is being circulated as widely as possible within the international large yacht industry. Safety issues, such as the necessity to ensure compliance with the requirements of applicable codes and other national regulation, the hazard of lint fires in tumble dryers, and the importance of safety management systems, have been highlighted in the "flyer".

4.2 SAFEHAVEN INTERNATIONAL LIMITED

Safehaven International Limited has appointed a yacht compliance officer who is a qualified yacht master instructor with extensive experience in managing both private and chartered yachts. It is intended he will visit clients' vessels and review with the captain all elements of the yacht's manning, operation, equipment and technical specifications, including:

- a review of the qualifications of the captain, engineer and crew
- a review of the applicable ISM or Mini ISM requirements and their implementation
- a review of systems, drills and yacht management
- a review and implementation of recommendations made in all statutory and other surveys undertaken
- a general review of specific responsibilities to ensure full compliance with applicable regulations.

The yacht compliance officer will act as a general liaison officer with the captain and crew of the company's clients' yachts on all aspects of their employment. His role is to provide a shore-based back-up for all yachts owned through structures under Safehaven's administration and management worldwide.

SECTION 5 - RECOMMENDATIONS

The MCA is recommended to:

- 2008/110 Issue guidelines to its surveyors conducting annual surveys on board vessels complying with LY1, to check that appropriate procedures are in place to ensure the limitations of the fitted fire detection system, and other systems fundamental to vessel safety which do not meet the higher technical specifications required by LY2, are understood and that the systems are properly maintained and tested.
- 2008/111 Develop follow-up procedures to ensure deficiencies identified during the annual survey of large yachts are addressed promptly and do not remain outstanding until the next annual survey.

**Marine Accident Investigation Branch
February 2008**

Safety recommendations shall in no case create a presumption of blame or liability