Report on the investigation

of the engine room fire on

RMS *St Helena*

25 August 2000

Marine Accident Investigation Branch
First Floor, Carlton House
Carlton Place
Southampton
SO15 2DZ

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(Accident Reporting and Investigation)

Regulations 1999

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.

GLOSSARY

BST	-	British summer time
CP	-	Controllable pitch (propeller)
GMDSS	-	Global Maritime Distress and Safety System
ISM	-	International Safety Management (Code)
kW	-	kilowatt
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
MCR	-	Machinery Control Room
RMS	-	Royal mail ship
rpm	-	Revolutions per minute
SOLAS	-	Safety of Life at Sea (Convention 1974)
UK	-	United Kingdom
UMS	-	Unmanned machinery space
UTC	-	Universal time co-ordinated

SYNOPSIS

At 0108 on 25 August 2000 the UK-registered Class I passenger ship, RMS *St Helena,* left Cardiff for Tenerife on the first leg of a voyage to the South Atlantic.

At about 1325 that afternoon, in an effort to locate a coolant leak, the watchkeeping engineer lifted a rocker box cover on the starboard main engine. This is common practice on the vessel. As he did so, oil sprayed from beneath the cover and impinged on the cladding of the engine's exhaust, where it ignited.

The engineer immediately closed the cover, raised the alarm and hurried to the machinery control room (MCR) from where he stopped the engine. Meanwhile daywork engine room ratings extinguished the fire using a portable extinguisher. There was no significant damage and no one was injured.

Later inspection revealed that a flexible oil pipe inside the rocker box had failed. When the rocker box cover was lifted, oil from the faulty pipe sprayed on to the exhaust.

The vessel's three watchkeeping engineer officers maintain single-handed watches; no ratings are part of the watch. The owners have written permission from the Maritime and Coastguard Agency (MCA) to operate in this fashion. Nonetheless, this does contravene the vessel's Safe Manning Certificate, issued by the MCA, which specifies three assistant watchkeepers in addition to the watchkeeping engineer officers.

Therefore, on 24 November 2000, the MAIB issued the MCA with an interim recommendation to address this inconsistency. It was recommended that the MCA reviews its acceptance of the single-man engineering watch system presently being operated on RMS *St Helena*.

RMS *St Helena*'s owners are recommended to consider making it a requirement that when the vessel is at sea, at least a second person is present in the engine room when any enclosure from which flammable gas, vapour or liquid can escape is opened.

SECTION 1 - FACTUAL INFORMATION

1.1 DETAILS OF VESSEL AND ACCIDENT

NAME	:	RMS *St Helena* **(see Figure 1)**
Port of registry	:	London
Official number	:	718836
Type	:	Class I passenger/cargo
Gross tonnage	:	6,767
Registered power	:	6532kW
Passenger capacity	:	132
Date built	:	1990
Builders	:	A P Appledore (Aberdeen) Ltd York Place Aberdeen
Owners	:	Curnow Shipping Ltd. 48-50 Killigrew Street Falmouth Cornwall TR11 3AP
Main engines	:	Two Mirrlees type 6 K-Major, each coupled to a controllable pitch propeller
Date of accident	:	25 August 2000
Position	:	49°36.3'N 006°10.9'W
Type	:	Engine room fire
Injuries	:	None
Damage	:	None

Note: All times quoted are BST = (UTC + 1hour)

Figure 1

RMS *St Helena*

1.2 NARRATIVE

At 0108 on 25 August 2000, RMS *St Helena* left Cardiff for Tenerife on the first leg of a voyage to the South Atlantic. Twelve hours later she had cleared the Scilly Isles and its traffic separation zones and was heading south.

During the morning the 8-12 watchkeeping engineer had noted a loss of coolant from the main engine valve cooling system, which required him to top up the system. Later that morning the starboard main engine was stopped to renew a leaking joint on a crankcase explosion door. During this stop the chief engineer lifted each rocker box cover on this engine in an effort to locate the cause of the coolant loss. He was unsuccessful.

The starboard main engine was restarted, checked, run up to 600rpm and its shaft generator put on load.

At about 1325 that afternoon, an engine room rating noticed liquid seeping from the top of the starboard main engine. He reported this to the watchkeeping third engineer. Recalling the earlier efforts to locate a leak on the valve cooling system, the third engineer telephoned the chief engineer to report. He was told to attempt to find the source of this leakage.

The third engineer slackened the securing screws on No 4 rocker box cover to ensure there was no overpressure. He then completely undid the screws and lifted the cover slightly, hingeing it about its aft edge. As he did so, a fan of oil sprayed from the rocker box on to the adjacent enclosure for the exhaust manifold, where it ignited.

He dropped the cover and ran through the workshop to the MCR, operated the engine's emergency stop, activated the engineers' emergency call alarm and made a brief verbal report by intercom to the bridge. The time was 1327. The port main engine continued to run.

Meanwhile an engine room rating tackled the fire with a 9-litre foam portable extinguisher. Another rating rigged a hose. Before the third engineer returned from the MCR, the fire had been extinguished. The fire caused no significant damage.

The loss of output from the starboard shaft generator caused some interruption to the vessel's lighting. This prompted the electrician to rush to the engine room, to be joined shortly after by the chief, second and fourth engineers responding to the emergency alarm.

A leaking flexible lubricating oil pipe was found in No 4 rocker box. This was considered to have caused the oil to spray from the rocker box when the cover was lifted. After repairs, the engine was restarted and returned to service at 1405.

1.3 THE VESSEL AND HER SERVICE

RMS *St Helena* is a UK registered Class 1 passenger vessel plying between the UK, Ascension Island, South Africa and the island of St Helena in the South Atlantic. She is of 6767gt, built in 1990 and has two Mirrlees, in-line, six cylinder four stroke, diesel main engines. Each main engine has a shaft generator and drives a controllable pitch propeller (CPP) through a reduction gearbox.

The main engines can be started and stopped from the MCR, or at a local control panel. Each engine can also be stopped locally by operating its governor control lever. The local control panel of the starboard engine is on lower plate level, to starboard and aft of the engine. Its local governor control lever is also at lower plate level, at the aft end of the engine on its inboard, port, side.

The MCR is on the starboard side of the engine room, at the level of the main engines' rocker box covers, and one level above lower plate level. It has one access door at its forward end directly into the engine room. Its aft access door leads into the workshop space where a second door leads into the engine room.

Hinged covers enclose the valve rocker gear of the main engines. One cover per cylinder. The top of the enclosure of the exhaust manifold is level with the top of these rocker covers. The exhaust's enclosure consists of a series of metal covers which are not gas tight **(see Figure 2)**.

The fuel valves are positioned in a small cut-out area of the rocker boxes. Both these and the exhaust valves are liquid cooled. The coolant pipes for the exhaust valves pass into the rocker boxes and then to the valve cages by pipes which include short flexible sections. Some lengths of lubricating oil pipes within the rocker boxes are also flexible **(see Figure 3)**.

1.4 ENGINEERING PERSONNEL

The vessel has four certificated engineer officers: the chief, second, third and fourth engineers. With the exception of the chief engineer, they each take a watch on the 'conventional' four hours on, eight hours off pattern.

Three engine room ratings are also carried. These are described as assistant watchkeepers on the Safe Manning Certificate. However, they keep no watches and are employed on daywork hours only. Typically these hours are between 0800 and 1900 Monday to Friday, and between 0800 and 1700 Saturday and Sunday. There is some variation in these hours on days when the vessel arrives or leaves a port.

Figure 2

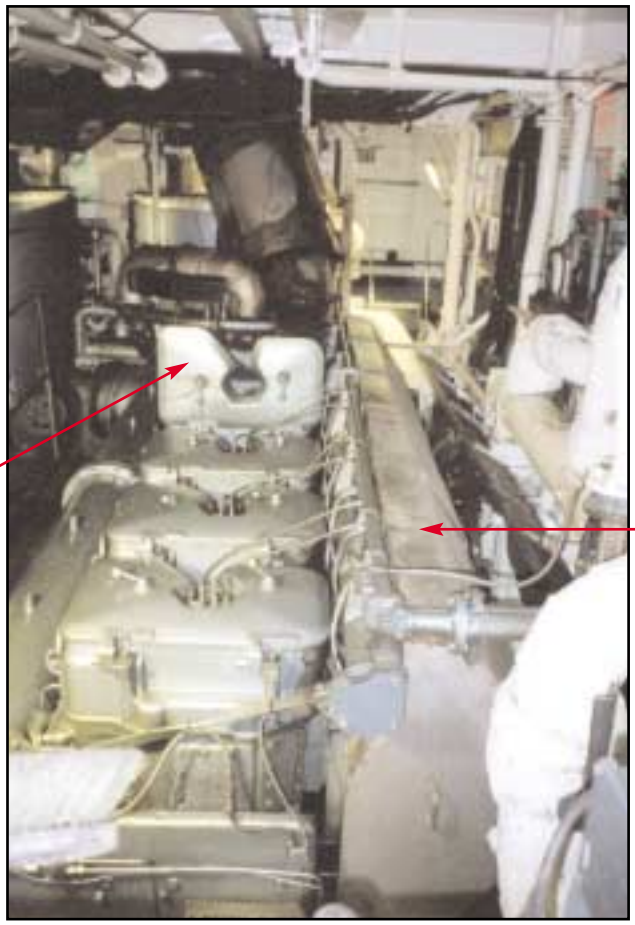

Figure 3

Rocker box with cover raised

1.5 MANNING ARRANGEMENTS

The vessel has a Safe Manning Certificate that sets out a requirement for three assistant watchkeepers to be part of the engine room complement. This was issued in October 1991.

One year later, in September 1992, the MCA gave the owners written permission to operate with single-handed engine room watches, provided certain conditions were met. The Safe Manning Certificate was not amended to suit.

The specified conditions required that the provisions of the standing orders be strictly complied with. Essentially, these set out the requirements for the proper operation of the engineer's safety patrol system, or watch alarm.

1.6 STANDING ORDERS

As required by the *International Safety Management (ISM) Code*, and associated regulations, the vessel has a safety management manual. It contains standing orders pertinent to various aspects of the vessel's operations.

One covers the standing of engine room watches by single watchkeepers. It describes the principles and operation of the engineers' safety patrol system, and the conditions which must be observed during its use.

The engineers' safety patrol system is a form of watch alarm, or 'dead man's alarm'. When in use, it requires resetting using one of several points distributed within the machinery spaces, at intervals not exceeding 20 minutes. Failure to reset results in a primary alarm sounding which, if not accepted within two minutes, activates a secondary alarm in the engineers' accommodation and in the wheelhouse.

SECTION 2 - ANALYSIS

2.1 ENGINE INSPECTIONS

Rocker box covers are often opened on board RMS *St Helena* while the engines are running. Leakage of flexible pipes within the boxes is also common; both coolant and lubricant flexibles fail. All previous rocker box inspections have been made without mishap and no significant spillage of oil is generally expected. No more than a few small droplets are thrown out by the oscillating valve gear. Unfortunately, on this occasion the leaking flexible pipe was a lubricating oil pipe which had failed in such a way as to direct the leaking oil towards the exhaust system, where it ignited.

However, probably because the rocker cover was closed quickly, very little oil leaked. Hence, the quantity of fuel available to feed the fire was correspondingly small.

Inspections of this nature are part of a watchkeeping engineer's role, and have certainly become common practice on *St Helena*. This incident has increased the awareness of the vessel's engineers to the possible associated hazards. This, together with a second person standing by during these inspections should, if not sufficient to prevent a repetition, at least ensure any incident has similarly minor consequences.

2.2 FIRE-FIGHTING

The procedure the third engineer followed for stopping the main engine and reporting to the bridge, complied with the instructions contained in the vessel's safety management manual, and the chief engineer's standing orders. He correctly chose the nearest engine stop control, which is in the MCR.

His movement from his position by the rocker boxes to the control room, on a common level, required him to pass through the workshop. The other stop controls are both at the level of the lower plates in the engine room. Not only is the chosen stop control the closest, it is also adjacent to the engineers' emergency call alarm and the intercom to the wheelhouse; both of which he needed to use.

The engine room ratings who extinguished the fire acted spontaneously, and required no orders from the third engineer. Their fortuitous presence in the engine room, and their swift action, demonstrates the potential value of having a second person standing-by during inspections of the main engines' rocker gear. It could have similar value when opening other systems containing flammable fluids.

The owners are recommended to consider making it a requirement that, when the vessel is at sea, there is at least a second person present in the engine room during the opening of any enclosure from which flammable gas, vapour or liquid could escape.

2.3 MANNING AND CERTIFICATION

The Safe Manning Certificate

The vessel has a Safe Manning Certificate issued by the MCA and dated 22 October 1991. This certificate sets out special conditions concerning persons holding GMDSS qualifications, and other crew able to provide assistance in an emergency. No mention is made of any special conditions concerning the manning of engine room watches.

This certificate sets out a requirement for four engineers and three assistant watchkeepers to be carried. Implicit in this wording is a requirement that these assistant watchkeepers must be part of a two-man engine room watchkeeping system.

However, in a letter issued to the owners and dated 30 September 1992, the MCA confirmed that *'the Department' would consider it acceptable to operate a Single-Man Engineering Watch System on* RMS *St Helena provided the provisions of the Standing Orders are strictly complied with.*

The Standing Orders to which that letter refers, contains the procedures for operating the safety patrol or watch alarm system. They specifically require this system to be in full operation when a single person is maintaining the engine room watch.

St Helena is operated in accordance with this part of the Standing Orders and the provisions of the MCA's letter. However, this appears not to be in accordance with the vessel's Safe Manning Certificate. Whatever the intentions of the MCA on the matter of engine room watchkeeping, the on-board practices should be consistent with the mandatory documentation carried by *St Helena*. The MCA was recommended to review these arrangements in an interim recommendation dated 24 November 2000.

This recommendation stated:

The Maritime and Coastguard Agency is recommended to review its acceptance of the single-man engineering watch system presently being operated on RMS *St Helena, a Class I passenger vessel.*

Engine room manning

This incident was a minor engine room fire, largely because of the limited quantity of fuel available to feed the fire, and the prompt actions of the engine room ratings. However, the consequences could have been more serious. If no ratings had been available to tackle the fire immediately while the third engineer went to the machinery control room to stop the engine, the fire might have spread.

The vessel is equipped to unmanned machinery space (UMS) standards, and there is a watch alarm system set to 20 minute intervals. It was on the understanding that this watch alarm system is fully operational that the MCA agreed, in 1992, that single-handed engine room watches could be operated at sea. The watch alarm system is, therefore, being used as a substitute for a second watchkeeper.

It is unclear why this arrangement was agreed by the MCA, when it conflicts with the vessel's Safe Manning Certificate and, it will be argued, is also contrary to the primary function of the watch alarm system.

Alternatives for manning

For several decades large numbers of seagoing vessels have operated with unmanned machinery spaces outside daywork hours. This practice has become the norm on many types of vessels.

The confidence to operate in this way has grown from the general reliability of machinery monitoring systems and the effectiveness of safety systems, such as those for fire detection.

Regulation 54 of Chapter II-1 Part E of SOLAS makes provision for an administration to give special consideration as to whether or not the machinery spaces of passenger vessels may be periodically unattended.

Although enhancing security, the existing engine room manning arrangements on RMS *St Helena* offer no obviously increased safety levels for the ship, over that offered by unattended operation. However, the watchkeeping engineers are subjected to all the risks of being in the machinery spaces alone and for long periods.

International convention allows the MCA to accept periodically unmanned machinery spaces on passenger vessels. If the MCA is not prepared to accept this arrangement, it should consider the safety of the vessel and the risks to personnel manning the engine room when assessing manning requirements.

The MCA should take account of these risks, its published advice and provisions of SOLAS when undertaking its recommended review of the vessel's engine room manning arrangements.

2.4 ENGINE ROOM WATCH ALARMS

The concept of watch alarms, or dead-man's alarm, was introduced to the industry when machinery spaces began to be unmanned for designated periods, usually overnight. The alarms were intended to be used during those periods when a duty engineer was in an engine room alone performing inspections and collecting data, such as before retiring for the night. These inspections were usually brief and the dead man's alarm would, commonly, be set to ten-minute intervals. Additionally, the bridge watchkeeper would be informed before such an inspection was started. The machinery space access doors could also be alarmed to alert the bridge watchkeeper to anyone entering the machinery spaces unannounced.

Watch alarms were thus used to ensure the safety of the duty engineer while carrying out an inspection extending, perhaps, 20 minutes or so. The period during which the engineer was at risk from being alone in the machinery spaces was thus very limited. Besides, his duties were usually restricted to data recording, inspection and transfer of fuel; operations posing limited risk.

St Helena is using this watch alarm system to a degree that appears to be beyond the original concept. It was originally intended to offer some safeguard to the duty engineer during comparatively brief intervals in an engine room.

The period any one engineer is alone in the machinery spaces of *St Helena* is four hours; his whole watch. His safety relies totally on the watch alarm being functional and being switched on. The risk to personnel associated with this system might be acceptable for brief periods of inspection. However, when used extensively for several consecutive hours a single watchkeeper will be at greater risk, which may no longer be acceptable.

2.5 THE CODE OF PRACTICE

To a degree, *The Code of Safe Working Practices for Merchant Seamen* does recognise the dangers to a single person alone in machinery spaces. In Section 15.9, titled 'Unmanned machinery spaces', it suggests that *Personnel should never enter or remain in an unmanned machinery space alone, unless they have received permission….* It continues….. *They may only be sent to carry out a specific task which they may be expected to complete in a comparatively short time.*

This advice appears to be inconsistent with MCA's agreement for the vessel to operate with single-handed engine room watches.

This Code also offers advice, in Chapter 22.45, on maintenance or repairs to moving machinery. It suggests that the officer in charge should consider whether it is necessary for a second person to be in close attendance while the work is being carried out.

No maintenance or repairs were being planned at the time of this accident. However, the Code offers sensible advice on this subject and highlights the need to consider, and take precautions for, the unexpected. The philosophy of this advice is also contained in the single recommendation directed at the owners of *St Helena* and set out in Section 2.2.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

1. The fire was caused by oil issuing from a leaking flexible hose in No 4 rocker box of the starboard main engine, and igniting after making contact with the exhaust duct. [2.1]

2. Opening main engine rocker box covers while engines are running is common practice on this vessel. [2.1]

3. When he stopped the starboard main engine, the watchkeeping engineer followed the procedures set out in standing orders. [2.2]

4. He correctly elected to stop the engine using the stop button in the machinery control room. [2.2]

5. The fire was extinguished by crewmen on daywork using portable appliances. [2.2]

6. The vessel operates a single-man engine room watchkeeping system. [2.3]

7. The vessel's Safe Manning Certificate specified the carriage of three assistant watchkeepers in addition to the watchkeeping engineers. [2.3]

8. Written agreement by the MCA to operate single man watches is in conflict with the Safe Manning Certificate. [2.3,]

9. The advice on people being alone in engine rooms, contained in the *Code of Safe Working Practices for Merchant Seamen*, appears to be inconsistent with MCA's agreement for *St Helena* to operate with single-handed engine room watches. [2.5]

SECTION 4 - RECOMMENDATIONS

An interim recommendation was made to the MCA on 24 November 2000. This was:

The Maritime and Coastguard Agency is recommended to:

1. Review its acceptance of the single-man engineering watch system presently being operated on RMS *St Helena*, a Class I passenger vessel.

In addition:

The owners of RMS *St Helena* are recommended to:

2. Consider making it a requirement that, when the vessel is at sea, there is at least a second person present in the engine room during the opening of any enclosure from which flammable gas, vapour or liquid can escape.

Note: The MAIB was informed on 2 April 2001 that the owners of RMS *St Helena* have voluntarily returned to a two-person engine room watchkeeping system.

Marine Accident Investigation Branch
May 2001