Report on the investigation of

the grounding of the passenger vessel

Waverley

South of Sanda Island

West Coast of Scotland

20 June 2004

Marine Accident Investigation Branch
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Carlton House
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Southampton
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Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999 – Regulation 4:

The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the cause 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.

NOTE

This report is not written with liability in mind and is not intended to be used in court for the purpose of litigation. It endeavours to identify and analyse the relevant safety issues pertaining to the specific accident, and to make recommendations aimed at preventing similar accidents in the future.

CONTENTS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AIS	-	Automatic Identification System
BA	-	British Admiralty
CSM	-	Customer Service Manager
DOC	-	Document of Compliance
DP	-	Designated Person
DR	-	Dead Reckoning
EBL	-	Electronic Bearing Line
EP	-	Estimated Position
FPSO	-	Floating Production Storage Offshore Loading
GHz	-	GigaHertz
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
IMO	-	International Maritime Organisation
ISM	-	International Safety Management
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
MSN	-	Merchant Shipping Notice
OOW	-	Officer of the Watch
PEC	-	Pilotage Exemption Certificate
PI	-	Parallel Index
PSPS	-	Paddle Steamer Preservation Society
RNLI	-	Royal National Lifeboat Institution
SOLAS	-	Convention on the Safety of Life at Sea
STCW	-	Standards of Training, Certification and Watchkeeping for Seafarers
UTC	-	Universal Time Co-ordinated
VRM	-	Variable Range Marker
WEL	-	Waverley Excursions Ltd

SYNOPSIS

Shortly before 1615 UTC+1 on 20 June 2004, the paddle steamer *Waverley* touched the rocky bottom on the edge of Boiler Reef, to the south-west of Sanda Island. The vessel was damaged on the underside of her hull, but her watertight integrity was not breached and her manoeuvrability was not affected. There were no injuries.

The accident occurred during a sightseeing excursion with 345 passengers and 25 crew on board. The vessel was steaming at 14 knots, and the master had instructed the chief officer, who was on watch, to remain at least 3 cables from the island. Radar was used to monitor the distance from the island. Immediately after the chief officer became aware that the vessel had closed to within this range, the vessel suddenly lurched to starboard and a bump was felt. The master initially assessed that there was a problem with the paddle-wheel propulsion. However, it was quickly determined that this was not the case, and *Waverley* proceeded to Campbeltown, escorted by the Campbeltown lifeboat, which the coastguard had activated as a precaution. The damage to her hull was found during subsequent survey.

The investigation highlighted several contributory factors, including:

- The vessel's passage had not been properly planned;
- The vessel's proximity to the hidden dangers was not appreciated;
- The use of a radar VRM did not give the chief officer sufficient warning of the vessel's encroachment within the prescribed limit of 3 cables from Sanda Island in time for successful corrective action to be taken;
- The vessel's position was not accurately cross-checked by other methods, or by the master;
- Personnel conducting company internal audits of navigation procedures had no deck experience;
- The senior master employed by the vessel manager had no terms of reference;
- A comprehensive risk assessment of the vessel's operation had not been undertaken.

As a result of another subsequent accident, an urgent safety recommendation has been sent to WEL to conduct a comprehensive risk assessment and carry out corrective action before further passengers are carried.

Additional recommendations have been made in this report to WEL, which seek to improve the safe navigation of its vessels.

Figure 1

The paddle steamer *Waverley*

Figure 2

Motor vessel *Balmoral*

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *WAVERLEY* AND ACCIDENT

Vessel details

Registered owner	:	Waverley Steam Navigation Company
Manager(s)	:	Waverley Excursions Ltd
Port of registry	:	Glasgow
Flag	:	UK
Type	:	Passenger Vessel
Built	:	1947, River Clyde, Scotland
Classification society	:	Under MCA survey regime
Construction	:	Steel
Length overall	:	73.04m
Gross tonnage	:	693.13
Engine power and type	:	1567kW, diagonal triple expansion reciprocating steam engine
Service speed	:	14.5 knots
Draft	:	2.1m
Propulsion	:	Steam driven paddle-wheels located amidships on both sides

Accident details

Time and date	:	1515 UTC on 20 June 2004
Location of incident	:	55°16.44N, 005°35.72W
Persons on board	:	370
Injuries/fatalities	:	Nil
Damage	:	Indentations to underside of hull and distortion of internal bulkhead

1.2 BACKGROUND

The paddle steamer *Waverley* **(Figure 1)** is the last remaining seagoing example of her kind. Built in 1947 with reparation money, she operated on the west coast of Scotland until 1973. She was then bought for £1 by the PSPS in 1974, and from 1975 has been used for pleasure excursions, enabling the general public to take day trips along the UK coast. The vessel underwent extensive refits, called the heritage rebuild, in 2000 and 2003 funded by a £7 million grant from the national lottery. During these refits, every effort was made to restore her in the style of the 1940s era. In 2003, *Waverley* was added to the historic ships register as being a vessel of pre-eminent national importance.

The vessel is run by Waverley Excursions Ltd, which also operates the motor vessel *Balmoral* **(Figure 2)**. *Balmoral* is of a similar style and vintage to *Waverley* but is powered by two diesels through fixed pitch propellers. The two vessels run between Easter and October around the UK coast. Operating areas include: the Western Isles of Scotland, the Clyde, North Wales, the Bristol Channel, the South Coast of England, the Thames and East Anglia.

1.3 NARRATIVE

All times are UTC(+1)

1.3.1 Events before the grounding

At 0902 on 20 June 2004, *Waverley* sailed from Greenock with a crew of 25. She then called at Helensburgh, Greenock, Largs, Lochranza and Campbeltown, embarking and disembarking passengers at the different locations. Between 1450 and 1500 she was alongside Campbeltown. While there, the master and mate discussed the next passage, which was scheduled to follow the eastern and southern coasts of the Mull of Kintyre until turning round the western side of Sanda Island. *Waverley* was scheduled to return to Campbeltown at 1720. The master directed the chief officer to remain at least 3 cables off the coast when outbound, and not less than 3 cables to the south of Sanda Island on the return leg. The decision of when and where to turn to return to Campbeltown was to be determined during the passage, with the time available being the critical factor.

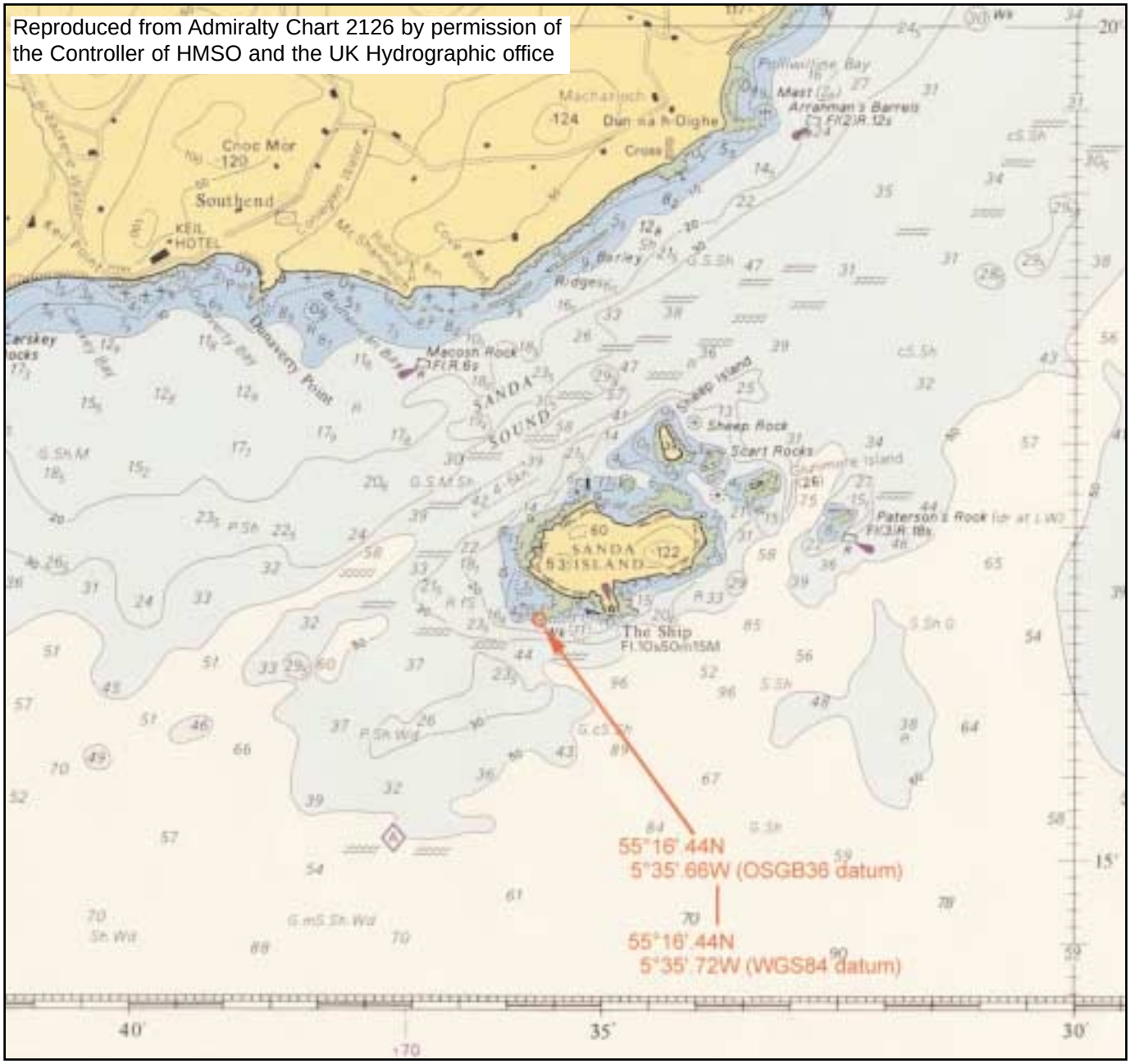
Using the tidal predictions for Greenock, which were noted in the deck log, the master assessed that the vessel would be rounding Sanda Island close to high water, and that the tidal stream would be ebbing in a south-westerly direction. Chart BA 2126 **(Figure 3)** was on the chart table. Several tracks were drawn on the chart but were not for that particular voyage. Navigational dangers were not highlighted.

On departure from Campbeltown, with 370 people on board, the master manoeuvred *Waverley* from the jetty. He handed the con to the chief officer when the vessel was passing Davaar Island. At this time the speed was 14 knots and a helmsman was on the wheel. As the vessel headed along the

coast, the chief officer monitored the vessel's position and distance off the coast by using the radar and by visual references. No fixes were plotted on the chart and no parallel indices were plotted on the radar displays.

The master left the bridge at about 1515. He returned at 1550 and went to the chartroom area at the rear of the bridge to complete some paperwork. While there, he agreed with the chief officer that when the vessel was south of the Keil Hotel **(Figure 3)**, course would be altered to port to pass to the south of Sanda Island.

Figure 3



At 1600, the vessel turned to port until Sanda Island was on the port bow. The chief officer was primarily using the lower of the two radar displays fitted, and does not recall whether this was set to the 0.75 or 0.5 mile range scale. The upper radar was set to the 1.5 mile range scale. When the island was at a range of 5 cables, the master reiterated to the chief officer to go no closer than 3 cables. At this point, the chief officer cross-referenced the position shown by GPS with chart 2126, but did not plot a fix. A VRM on the lower radar was also reduced from 5 cables to 3 cables. A south-easterly course was being steered.

Soon after, the chief officer noticed that Sanda Island was just inside the 3 cable range indicated by the VRM. The chief officer did not measure the exact distance to the nearest point of land on Sanda Island, but estimated that it was about 2.8 cables. To open the range, a course alteration to starboard was ordered. Moments later, a sudden shuddering and bump was felt, and the vessel lurched to starboard.

1.3.2 Events after the grounding

The chief officer immediately put the engine telegraph to half ahead. At the same time, the master moved from the chart room area, and continued the movement of the telegraph to stop. The vessel stopped in the water within about one vessel's length.

The master's initial assessment was that the port paddle-wheel's number one rod had failed. He looked out of the bridge windows and assessed that the vessel was between 3 and 3.5 cables off the island, and that wind and tidal stream would carry the vessel further away. The master then instructed the helmsman to go below to take soundings, and the chief officer to put a fix on the chart.

The master left the bridge and went below to discuss the situation with the vessel's engineers. En route, he met one of the passengers he knew to be a Clyde pilot, and asked him to go to the bridge to assist the chief officer if required. The master was aware that the pilot was not able to take charge of the vessel's navigation, but thought his experience would be of benefit. When the pilot arrived on the bridge, he estimated the vessel was about 2 cables off Sanda Island, but did not check this range by radar. The fix obtained by GPS at 1615, which was noted in the deck log by the chief officer immediately following the vessel being stopped, showed the vessel to be at 55°16.44N, 005°35.72W **(Figure 3)**.

After determining that neither of the paddle-wheels were defective, the master returned to the bridge. He considered that the vessel must have run over something but did not know what. After the helmsman reported that there was no sign of flooding below, the master made an announcement via the public address system that the vessel had a technical problem, which had been resolved and that the vessel would be returning to Campbeltown.

The vessel initially proceeded at slow speed while checks were made to ensure the paddle-wheels were working correctly. The steering gear was also tested. No problems were experienced, and speed was gradually increased to about 14 knots. Shortly after, the master contacted the harbourmaster in Campbeltown and arranged for a local diver to survey the hull on arrival. He also informed the coastguard and the vessel manager's director of operations by mobile telephone that the vessel had run over something, but that there was no cause for alarm, and that an underwater inspection was arranged in Campbeltown. The master had used a mobile telephone to contact the coastguard because he did not want to attract media interest. As a precaution, the coastguard activated the Campbeltown lifeboat, which quickly sailed to *Waverley* and escorted the paddle steamer to her berth.

When the vessel arrived in Campbeltown, the diver, who was a recreational diver, was instructed to concentrate his inspection on the port paddle-wheel and the port side of the hull. No commercial divers were available. The underwater inspection lasted between 10 and 15 minutes, and the only damage seen was several small notches cut into the leading edges of three of the paddle floats. The diver was unable to survey under the keel because of the limited under-keel clearance, and poor underwater visibility.

The master considered the damage to the paddle floats to be consistent with having run over something, and with the agreement of a duty MCA surveyor, sailed at about 1810 for Lochranza with 239 passengers on board. The vessel finally arrived in Greenock after disembarking the remaining passengers at Largs and Helensburgh, at 2225.

1.4 DAMAGE

On 21 June, a detailed inspection of the vessel's internal spaces revealed distortion of the hull plating and internal structure. As a result, she was dry docked in Birkenhead on 27 June to allow a comprehensive external and internal inspection of the hull.

The most significant area of damage was on the flat bottom, on the port side of the hull, in line with the forward end of the port paddle box **(Figure 4)**, where a large indentation in the hull had caused some buckling of an internal bulkhead. From this point there were several longitudinal scratches and scrapes along the lowest points of the hull all the way to the aft keel area **(Figure 5)**. Similar scratches were also found on the starboard side of the flat underside of the hull, but these started further aft than on the port side **(Figure 6)**. Two slight grooves, along with paint scrapes, also extended along the aft third of the narrow keel, which is the lowest point of the hull **(Figure 7)**. A small amount of a black deposit was also found on the keel at various points. The horizontal plates attached to the lower edge of the rudder and just forward of the rudder had some paint scraped off **(Figure 8)**. The forward section of the hull up to the port paddle box was clear of any significant damage, although there were two thin

black streaks found on the starboard bow near the keel. WEL arranged for samples of this paint, along with samples of the black deposit to be analysed by a chemist. This analysis determined that the black deposit was a rubber compound, and that the paint did not contain any traces of sand or gravel.

The paddles were also inspected whilst in dock. The port side paddle had sustained some minor damage to its floats, consisting of small notches of varying size in the same position on each float **(Figure 9)**. It was thought that this might have been caused by chain used to rotate the paddles during the winter lay up. The only other damage noted was to the timber belting around the starboard paddle box. This was thought to have been sustained during its many previous berthings.

Figure 4

Indentation damage to *Waverley*'s hull - port side midships, looking aft

Figure 5

Scratching and scrape damage, port side, looking aft

Figure 6

Scrape damage starboard side, looking forward

Figure 7

Small indentation damage to keel at aft end

Figure 8

Damage to underside of *Waverley*'s rudder

Figure 9

Damage to port side paddle floats

1.5 ENVIRONMENTAL CONDITIONS

The wind recorded in the deck log for 1600 on 20 June was north-north-west force 4. The predicted tidal stream was westerly at 2.25 knots. The predicted high water at Greenock was 1515, and the predicted height of tide at 1615 was 2.7m. It was 38% spring tides. The nearest secondary port to Sanda Island was Southend, Kintyre. The predicted height of tide at 1615 at Southend was 1.58m. Records for the area provided by Clyde Estuary Control indicate that there was no significant difference between predicted and actual tidal heights at 1615.

1.6 THE VESSEL

1.6.1 Certification and MCA liaison

Waverley's certification allows her to operate with a varying number of passengers depending on her area of operation. As a Class III passenger vessel she can carry up to 740 passengers. As a Class IV vessel she can have up to 800 people onboard. Finally, as a Class V vessel she may carry up to 925 passengers. See **Annex A** for standard definitions of the limits of operation for each class. The passenger certificate also imposes additional local limitations on the vessel when operating in specific areas. When *Waverley* transits between operating areas, she does so as a Class VIII vessel, and does not carry passengers.

The MCA customer service manager for both *Balmoral* and *Waverley* is based at the MCA's Cardiff office. However, it was only within the last 2 years that *Waverley* was transferred from the Glasgow office to Cardiff. Apart from the Cardiff and Glasgow offices, a number of other MCA offices were involved with her certification process, including Great Yarmouth, Beverley and Liverpool.

1.6.2 Bridge equipment

Much of the bridge equipment was fitted during the vessel's refit in 2003, and was chosen by the operations director and the senior master at the time. Two 9 GHz Koden radar displays, fed by a JRC JLR10 GPS compass for heading, and a JRC GPS 112/NAV5 for position and speed, were sited one above the other on the port side of the bridge, forward. The lower radar was north up, and the upper radar was vessel's head up. Problems had been experienced with the lower radar regarding picture quality, but none were reported on 20 June. The chief officer was primarily using the lower display, which had two EBLs and two VRMs tools available. The only method of plotting parallel index lines on the radar displays was by the combined use of the EBL and VRM. The plotting of parallel index lines in this way on these radar displays was not routinely undertaken. Instead, reliance was placed on the VRMs to monitor distance off land.

Two GPS receivers were carried, the first sited at the front of the bridge, and a second sited in the chart room area at the back of the bridge. A Koden CVS 118 fish finder was sited at the front, centre of the bridge. This was used to show the depth of water below the keel, but was reported by the vessel's officers to be

very sensitive, and to have occasionally given spurious readings in this respect. At the time the chief officer was noting a GPS position at 1615, digital readout on the fish finder displayed a series of XXXX. The fish finder was fitted with a depth alarm, but this was not used.

The vessel was steered by a helmsman on a traditional wheel. An automatic pilot had been fitted, but had not been commissioned due to an incompatibility between the electrical control equipment and the steam limiting valve on the steering engine. A magnetic compass was sited in front of the helm. This was last adjusted in April 2004, and its maximum deviation was 2°E.

A photograph showing the layout of the bridge is at **Figure 10**. The main chart table was sited at the back of the bridge, with one of the GPS receivers above it. A smaller foldaway chart table was sited at the front of the bridge on the starboard side, but was not in use at the time of the accident.

The vessel was also fitted with a JRC JHS 180 AIS, but no shore station recordings of the transmitted positional data on the day of the accident were available.

1.6.3 Hull and watertight integrity

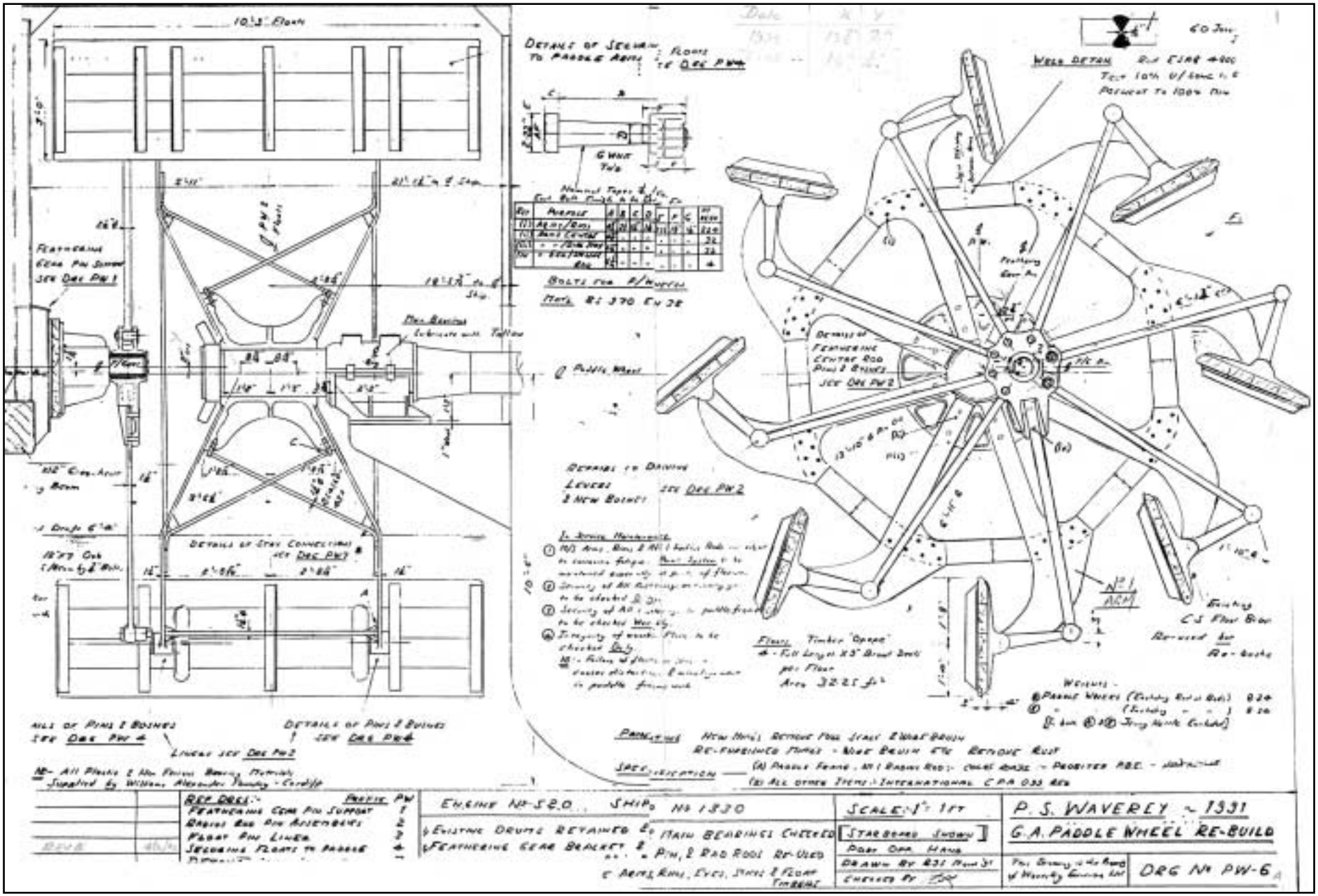
Waverley was originally constructed using riveted steel, but welding techniques had since been used during subsequent repair and refit. She has a double bottom, except in way of her engine and boiler rooms and the two small aftermost compartments. The vessel is divided by seven transverse bulkheads, which are watertight only up to the main deck. She is designed to survive flooding to any single watertight compartment, or the fore peak and first compartment combined. Flooding beyond this, however, might result in the vessel being lost.

1.6.4 Propulsion machinery

A diagonal triple expansion reciprocated steam engine drives a single shaft that connects to the two paddles. As a result, the paddles can not be run independently. The steam is produced by two boilers, both of which were replaced during the heritage rebuild. The paddles are made up of eight wooden floats, which are feathered as the paddle-wheel rotates. This ensures maximum thrust is put into the water. The mechanism for feathering the floats **(Figure 11)** is via a star centre that drives rods connected to the individual floats. The number one rod is rigidly fixed to the star centre and drives the other connecting rods as the paddle turns. Number one rod is therefore critical to the feathering mechanism and consequently to the operation of the paddle-wheel, as without it, the floats enter the water at the wrong angle. In 1999 and 2002 the number one rod failed causing loss of all propulsion. The rod had since been redesigned and replaced.

Figure 10

Waverley's bridge layout



Paddlewheel arrangement showing float feathering gear

Figure 11

1.7 DECK OFFICERS

1.7.1 The master

The master was one of three masters employed by WEL to operate both of its vessels. He was first employed by the company as *Waverley*'s chief officer between 1988 and 1990. In 1991 he was awarded his master's certificate and worked as relief master until 1993, when he became a full-time employee. At the end of 1994, the master left WEL to work in the short-sea trade and study for a degree, but returned to WEL in 2001. He had re-joined *Waverley* on 13 June, following a week of leave.

The master held pilotage exemption certificates for the Clyde, Thames, Bristol Channel, Swansea, and south-east Wales. He was on the bridge at all times when operating within a pilotage area, and manoeuvred the vessel on all occasions when arriving at or departing from a berth. The master considered that the navigation of the vessel during the sightseeing excursions was similar to pilotage conditions, where great reliance is placed on visual reference, and pre-planned tracks are not used. He was not aware that the chief officer had navigated in the vicinity of Sanda Island during previous trips. The master had not been in command during the number one rod failures in 1999 and 2002. His recorded hours of work and rest from 13–20 June are at **Annex B**.

1.7.2 The chief officer

The chief officer had served for 10.5 years in oil and product tankers for a major oil company until 1999. The chief officer had then worked on board cruise liners, FPSOs and a water taxi until employed by Waverley Excursions Ltd on April 21, 2004. After joining *Waverley*, the vessel operated mainly in the Firth of Clyde, the Western Isles and the Bristol Channel. This was the chief officer's third trip in the vicinity of Sanda Island.

The chief officer spent most of the time on the bridge when underway. Other duties included: the correction of the navigational charts and publications carried, voyage planning, safety officer responsibilities and supervision of deck maintenance. The chief officer did not feel tired at the time of the accident. A copy of the chief officer's hours of work and rest records from 20 May until 23 June is at **Annex C**.

1.8 VESSEL MANAGEMENT

1.8.1 Vessel operations

Waverley and *Balmoral* are owned by the PSPS through the Waverley Steam Navigation Trust, which is a charity registered in Scotland. The vessels' commercial operation and management are undertaken by WEL in Glasgow.

WEL's board of directors comprises four executive members and a number of non-executive members. The four executive members are the operations director, the safety director, the commercial director and the senior master. The safety director is a retired naval architect and provides his services on a voluntary basis. The other executive directors are paid.

About 50 seagoing crew are employed to work on both vessels when in service between April and October. Of these, only the three masters, along with two chief engineers are retained over the winter. During this period, the masters plan the schedules for the following season, and the engineers plan and monitor the vessels' upkeep, including an annual period in dry dock. The planning of the schedules involves the selection of routes, timings, and points of passenger embarkation and disembarkation, many of which have significant tidal restrictions.

The senior master had worked for Waverley Excursions Ltd as a chief officer since 1991, and had been a master since 1997. He had been a member of the board of directors since October 2003, but did not have any terms of reference for this role.

1.8.2 Safety management

Both *Waverley* and *Balmoral* were certified in accordance with the ISM Code. WEL was first issued with a DOC in 1999, which was then re-validated in July 2004 by the MCA office in Glasgow. WEL took the decision to certify both vessels under this code, even though this was only required for *Balmoral* because of an annual voyage she undertakes to the Isle of Man, which is classed as an international voyage. Had *Waverley* not been certified under the ISM Code, compliance with the Domestic Safety Management Code would have been required.

WEL's safety director is the DP for *Waverley* and *Balmoral* in accordance with the requirements of the ISM code. He was on holiday abroad at the time of the accident and was not made aware of what had happened until his return about 2 days later. Nobody was nominated to deputise for him in this role during his absence. Communication between the vessels and the shore-based staff is regular, and the board members are well known to the vessel crews.

1.8.3 ISM Audits

An audit plan has been drawn up to allow a structured approach to checking compliance with safety management procedures. The audits are conducted by the safety director, the operations manager, and other executive board members when it is convenient to do so. With respect to navigation, the plan only requires deck watchkeeping routines to be observed. The audit of passage planning and execution is not specified.

1.9 COMPANY PROCEDURES

The company's procedures manual was written in 1998 by the safety director, assisted by a previous senior master who has since left the company. Several revisions have been made since they were first issued. Included in the procedures are:

Passage planning:

> *Passage plans shall be prepared for all Company vessels making a voyage between operational districts or operating excursions over long distances or in exposed waters. When on passage the vessel's position has to be constantly monitored by utilisation of all appropriate navigational aids.*

Radar and electronic aids to navigation:

> *Masters and deck officers should ensure that all equipment is functioning correctly and be fully aware of the limitations of the electronic aids to navigation fitted on their vessels. They should also be conversant with radar parallel indexing techniques.*

Potential accident and emergency situations:

> *The master shall take total control of the vessel*.

1.10 REGULATORY REQUIREMENTS

1.10.1 Safety management

The Merchant Shipping (International Safety Management (ISM) Code) Regulations 1998 came into force on 1 July 1998. The ISM Code sets an international standard for the safe management and operation of vessels, and requires companies to document and implement clear procedures, standards and instructions for safety management ashore and afloat. The role of a DP is a very important part of this process. The regulations require a DP to be very experienced in the operation of vessels, both at sea and in port, and to ensure the safe operation of the vessels he is responsible for. He is also to provide a direct link between the vessel's staff and the senior management of the operating company.

1.10.2 Voyage planning

SOLAS V Regulation 34 requires the masters of all vessels which proceed to sea to ensure that the intended voyage has been planned using the appropriate nautical charts and publications, and to ensure that the guidelines issued by the IMO in Annex 25 to Resolution A.893(21) are followed. Additional guidance is also provided in SOLAS V Annex 24, which should be used in conjunction with the IMO guidelines. The principles of voyage planning include:

- Intended tracks and course alteration points, along with areas of danger, should be marked on the navigational charts, taking into account the margins of allowable error and minimum under-keel clearance.
- The possibility of main engine or steering failure at a critical moment must be considered.
- Everyone who is concerned with the navigation of the vessel should be comprehensively briefed.
- The vessel's position is closely and continuously monitored, and is cross-checked using different methods; reliance on a single method of position fixing should be avoided.
- The decisions of individuals are cross-checked so that errors can be detected.
- The estimated times of arrival at critical points for tide heights and flow should be taken into account, as should the reliability, limitations and condition of the navigation equipment.

1.10.3 Navigation equipment requirements

SOLAS V Regulation 19 prescribes the carriage requirements for shipborne navigational systems and equipment. Under this regulation, vessels constructed before July 2002 are allowed to be fitted with the equipment which fulfils the requirements of Regulations 11, 12 and 20 of SOLAS V/74. A summary of these requirements is at **Annex D**. Regulation 19 also required that vessels built before July 2002 should carry a GNSS, and that an AIS should be fitted within a time frame determined by vessel type, tonnage, and whether engaged on international or domestic voyages.

1.10.4 Hours of work/rest

MSN 1767 (M) details the application of The Merchant Shipping (Hours of Work) Regulations 2002 and STCW 95. The regulations stipulate that there must be a minimum of 10 hours rest in any 24 hour period, and 77 hours in any 7 day period. The 10 hours of rest can be split into 2 periods, but one period must be at least 6 hours in duration. Records of hours must be kept and made available for inspection by the MCA. Exceptions to the limits of hours of rest may be allowed provided they are the result of an agreement between employers and seafarers. Exceptions are also allowed for emergencies.

1.10.5 Hours of work agreement with MCA

Under an hours of work agreement negotiated with, and agreed by the MCA, the crews of *Waverley* and *Balmoral* were permitted to work longer hours than is prescribed in MSN 1767 (M). However, at least 8 hours of rest were to be taken each day, but the weekly total hours of rest specified in the MSN was not to be reduced. The operations director periodically checked the crew's hours of work records; if the hours worked exceeded the maximum permitted, he would investigate why. In his experience, this usually happened because individuals had failed to take into account the breaks that they had taken during a working day.

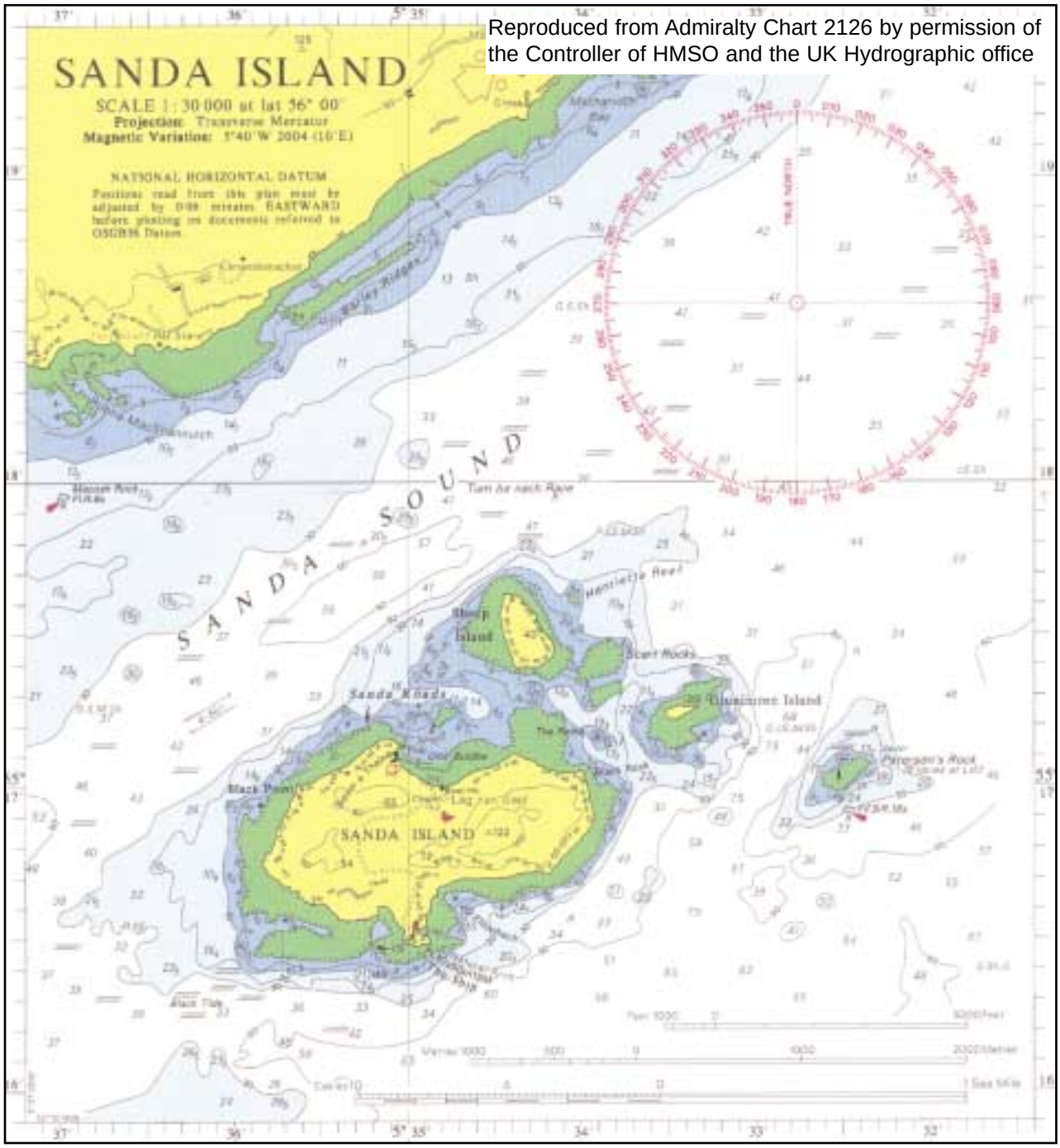
1.11 NAVIGATIONAL INFORMATION

The chart in use at the time of the accident was Chart 2126 **(Figure 3)** the scale of which was 1:75 000. The area of drying ground jutting out to the south-west of Sanda Island is referred to locally as Boiler Reef. The Sailing Directions for the area make a brief reference to *'a drying reef that extends 3 cables SW from the W end of Sanda Island*' and '*The Ship, is a promontory near the middle of the south side of Sanda Island'*.

There have been several major shipwrecks on the south side of Sanda Island. *Byron Darnton* was a 7176 gross ton Liberty vessel, which ran aground in stormy weather in March 1946. She lies just off 'The Ship' lighthouse on the southern tip of Sanda. *Gracehill*, a 172 net ton cargo vessel ran aground on the western end of Boiler Reef in March 1957. The most recent large casualty was *Hereford Express*, which drifted on to Boiler Reef after her tow parted in October 1970. Since then, the RNLI has assisted a number of smaller craft which have run aground in this vicinity.

The Hydrographic Office is producing a 1:30 000 scale plan of Sanda Island as an insert on Chart 2126 in response to numerous groundings which have occurred in the area. A draft version of this chart is at **Figure 12**.

Figure 12



Reproduced from Admiralty Chart 2126 by permission of the Controller of HMSO and the UK Hydrographic office

Extract from draft revised chart 2126

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 FATIGUE

It is evident from **Annex C** that the chief officer was not able to have the minimum 77 hours rest per week as required by the hours of work agreement between WEL and the MCA for four of the five weeks shown. However, the chief officer did not feel tired at the time of the accident. Additionally, the fatigue model used by MAIB has shown that alertness and performance are not necessarily degraded when the hours worked are between 0700 and 2300. This was the period in which nearly all of the chief officer's hours of work were contained. Therefore it is considered unlikely that the chief officer's performance was degraded by fatigue.

2.3 NATURE OF THE ACCIDENT

Figure 3 shows that *Waverley*'s position, as noted in the deck log at 1615, was on the danger line[1] marking Boiler Reef, and 2 cables from the nearest point of land. This was consistent with the distance off Sanda Island estimated by the Clyde pilot. Given this position, together with a draught in excess of 2.1m due to squat, a height of tide of 1.58m, and her south-easterly course, it is almost certain that the damage to *Waverley*'s hull was caused by her touching the rocky bottom of Boiler Reef. This is supported by the most significant damage sustained. The black marks found on the hull could have been caused by either the hull coming into contact with debris from wrecks or discarded fishing gear on the edge of Boiler Reef, or by contact with other external objects since her last docking in April 2004.

Given the speed of the vessel just prior to the grounding[2], the rocky nature of the seabed and the limited scope of the hull's watertight sub division, it is extremely fortunate that the consequences of this accident were not far worse, especially when one considers the number of passengers on board *Waverley* at the time, and the remote location of Sanda Island.

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[1] A dotted line drawn on Admiralty charts to draw attention to a danger which would not stand out clearly enough if represented solely by its symbol (eg an isolated rock) or delimits an area containing numerous dangers, through which it is unsafe to operate.

[2] Making involuntary contact with the ground, except for touching briefly so that no damage is caused
(Merchant Shipping (Accident Reporting and Investigation) Regulations 1999).

2.4 PASSAGE PLANNING

Passage planning is a requirement of SOLAS V chapter 34. WEL instructed its masters through its company safety manual to ensure passage plans were prepared when transiting between operational areas, and when on long excursions or in exposed waters. It did not, however, require passage plans to be prepared for routine sightseeing excursions, or specify minimum under-keel clearances for its vessels.

One aim *of Waverley's* excursions is to make her trips as enjoyable as possible by transiting close to the coast. This inevitably means that its vessels operate closer to navigational dangers during their excursions, than when on passage between operating areas or in exposed waters. As a consequence, the need for these sightseeing excursions to be planned in detail is probably even more important than it is for voyages in open water.

Navigating close to a shoreline cannot always be easily achieved by following pre-planned navigational tracks, particularly along meandering coastlines, or coastlines with many inlets. This is because the number of course alterations and the short length of the tracks required to fully utilise the safe water available might prove impractical. It is unlikely that this would be the case for all of the excursions conducted by *Waverley*, and on this occasion there is little reason why the vessel could not have followed a pre-planned track without detriment to the enjoyment of her passengers.

However, in the absence of a pre-planned track, it was essential that other elements of passage planning were undertaken in order to keep the vessel clear of navigational dangers. As a minimum, these should have included the accurate calculation of the height of tide for the area based on the nearest secondary port, and the highlighting of navigational dangers on chart 2126. Had this been done, it would have highlighted that the height of tide in the area was over one metre less than was published for Greenock, and that the hidden dangers to the south-west of Sanda Island extended about 2.6 cables. By approaching to within 3 cables of Sanda Island, which was the extent of the reef described in the Sailing Directions, the resulting safety margin was only about 70m. This was totally insufficient considering the speed of the vessel, the methods used to monitor position, and the scale of the chart available.

2.5 OPERATING CLOSE TO NAVIGATIONAL DANGERS

2.5.1 The use of radar

When passing to the west and south of Sanda Island, the principal equipment used to determine the vessel's position was radar. The use of a VRM to keep *Waverley* 3 cables off the nearest point of Sanda Island was quick and simple, but unlike a radar parallel index line, it did not allow the chief officer to accurately predict the vessel's future track in relation to the coast. As a consequence, although the chief officer reacted when *Waverley* closed to within 3 cables of the nearest point of land, corrective action was taken too late to avoid the grounding.

WEL company procedures required all OOWs to be conversant with the use of parallel index techniques. It was possible to utilise parallel index on both the radars fitted to *Waverley*. Despite this, parallel index techniques were not routinely used by the bridge team. This was probably due to the fact that, as the running of parallel index lines is used to provide real time information on a vessel's lateral position relative to her planned track, in the absence of a planned track their application would have been arbitrary and of little value. Had *Waverley* been following a pre-planned track at the time of the accident, the use of a parallel index line would have enabled the chief officer to quickly detect *Waverley* closing the dangers, and allowed early proactive action to be taken.

However, even had the vessel been following a planned track, and parallel index lines been used to monitor position, the use of VRM and EBL tools to achieve this is not ideal. This is because it is easy to move the controls for these functions unintentionally, making it necessary to frequently check the range and bearing set. A radar display capable of displaying fixed electronic parallel index lines independent from its variable measuring facilities is more reliable in this respect.

2.5.2 Cross-checking of positions

The regulation contained in SOLAS V (para 1.10.2) and the guidance issued by the IMO regarding passage planning clearly states that a vessel's position should be cross-checked using different methods. Although the chief officer used a GPS position in conjunction with chart 2126 after the course alteration to pass to the south of Sanda Island, the position was not plotted. This 'fix' therefore provided only an approximation of *Waverley's* position, and made little contribution to the safety of the vessel. By keeping the chart on the table at the back of the bridge, the chief officer could not easily refer to the chart or plot GPS positions, and monitor the vessel's position by radar at the same time. Correlation of the radar picture, charted information, GPS position, and visual reference would have been much easier had chart 2126 been placed on the foldaway table at the front of the bridge.

As the chief officer had been given the freedom to close to about 70m off the hidden dangers to the south-west of Sanda Island, it would have been a sensible precaution for the master to also monitor the vessel's position. He was on the bridge, and did not know if the chief officer was familiar with the area. With two officers monitoring the situation, there would have been a greater probability of the encroachment of the 3 cable range being detected in time to take corrective action.

2.5.3 The echo sounder

As the fish finder fitted was prone to spurious readings, this would have undoubtedly discouraged its use by the crew. Due to the steep gradient of the seabed in the waters adjacent to Boiler Reef, it is impossible to determine whether close monitoring of the fish finder or use of the depth alarm would have

provided the crew with adequate warning of the proximity to the reef in time for action to be taken to prevent the vessel from going aground. However, as *Waverley* operates in close proximity to navigational dangers on many of her excursions, and many of her points of embarkation and disembarkation are tidally constrained, the lack of an echo sounder in which the crew have confidence, is considered detrimental to the safe navigation of the vessel.

2.6 DECISION MAKING

2.6.1 Leaving the bridge

WEL company procedures instruct its masters to take control of a vessel in the event of an emergency. Normally, the bridge is the best place from which to do this; it is the hub of internal and external communication, and where the vessel can be manoeuvred, and navigational safety monitored. The master's decision to leave the bridge to go to the engine room was therefore questionable. Even though he had stopped the vessel in the water, had visually checked the vessel's drift, had ordered a fix to be plotted, and instructed the helmsman to sound the tanks before doing so, there was little to be gained from the master investigating the perceived mechanical problem personally.

Considering that the vessel was stopped in the water, close to hidden dangers, it might have been more advantageous for the master to trust the engineering department to report any problems to him, particularly in view of the vessel's unusual propulsion system. This would have allowed the master to maintain an overview and to consider the options available while the technical investigations were underway. He would also have been available to supervise the chief officer in anchoring the vessel, if required, rather than rely on the assistance of an off duty Clyde pilot.

2.6.2 Communication with the coastguard

After establishing that the hull was sound, the propulsion was working and the steering operational, *Waverley* continued on her passage to Campbeltown. The master called the coastguard as a precaution using a mobile telephone in preference to using the VHF radio. Because of this, the coastguard were not able to fix the vessel's position using VHF direction finding equipment, and other vessels in the area were not made aware of *Waverley'*s predicament. Both of these would have been of benefit had the situation suddenly worsened.

The coastguard's deployment of the lifeboat to escort *Waverley* back into Campbeltown is considered to have been a sensible precaution to have taken, particularly in view of the number of passengers on board and the distance from a safe haven.

2.6.3 Initial survey

After the vessel had returned to Campbeltown, the only damage found during the underwater survey was the minor damage to three paddles on the port wheel. This damage accorded with the master's view that the vessel had run over something. The master was aware that the diver had been unable to look at the underside of the hull, but as there was no evidence of water ingress into the hull, or degradation of her manoeuvrability, the master considered the vessel to be safe to continue her voyage. Based on the information available, this appears to have been a reasonable assessment, although had a close inspection of the charted position at the time of the accident been conducted, the probability that the vessel had touched the bottom would have been obvious.

2.7 COMPANY SAFETY MANAGEMENT

WEL does not have a traditional commercial structure like many other vessel managers, but its adoption of the ISM Code for *Waverley* as well as *Balmoral* is an indication that it is committed to operate its vessels safely. WEL's directors are well known to most staff onboard its vessels, and good channels of communication with regard to safety issues appear to be in place. Although the DP was not available immediately following the accident, the master had the authority to take the actions he considered necessary, and received the full support of the operations director during subsequent surveys. The company has since nominated a director to deputise for the DP in his absence.

The expertise available in the company, regarding the technical and engineering aspects of *Waverley* and *Balmoral*, is excellent. This is largely due to the company directors, particularly the safety and operations directors who are a naval architect and marine engineer respectively, also being enthusiasts, who have been instrumental in the vessels' restoration, maintenance, and operation.

However, the nautical input at director level is limited to that of the senior master, who does not have a specific remit in this role, and spends a great deal of his time in command of either of the vessels during the operating season. The lack of a requirement to conduct passage planning on all passages, and the limitation of internal audits to the observation of watchkeeping routines by non-nautical directors, are failings within the company's operating and audit procedures. Given the experience of the senior master, it is likely that such deficiencies could be addressed if he were to adopt a more active and targeted approach. This would require him to be equipped with terms of reference and appropriate authority, along with opportunities to visit the vessels other than when in command. Alternatively, the use of external auditors with appropriate nautical experience could be considered.

2.8 RISK ASSESSMENT OF THE VESSEL'S OPERATION

Waverley's operation is unusual in a number of ways:

- she is an old vessel with paddle-wheel propulsion;
- she routinely operates very close to navigational hazards;
- she operates in many different areas of UK coastal waters; and
- she can carry a significant number of passengers (915 maximum).

Precautions taken by the MCA to help ensure her safe operation include: vessel and company certification in accordance with regulatory requirements; the restriction of passenger numbers in different situations; and the imposition of navigational and weather limits. In addition, WEL ensured its masters were familiar with the waters in which they operate, and provided equipment in excess of the requirements of **Annex D**, such as the GPS compass and fish finder, and the provision of foldaway table at the front of the bridge. The company's actions demonstrate that it has considered some of the navigational needs of the vessel in relation to her operation.

However, the lack of passage planning, the absence of a specified under-keel clearance, the absence of a specified safe distance from navigational hazards, and the limitations of the navigation equipment available, indicate that the risks of continually operating in close proximity to navigational dangers and maintaining tidally constrained schedules, have not been fully assessed. The safe operation of both *Waverley* and *Balmoral* would undoubtedly benefit from a formal risk assessment, which would guide the company in a revision of its procedures, and might prompt the implementation of further control measures in excess of regulatory requirements.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

The following safety issues have been highlighted by the investigation. They are not listed in any priority order.

1. Given the vessel's position on the south-western edge of Boiler Reef, together with a draught in excess of 2.1m due to squat, a height of tide of 1.58m, and her south-easterly course, it is almost certain that the damage to *Waverley*'s hull was caused by her touching the rocky bottom. [2.3]

2. Given the speed of the vessel just prior to the grounding, the rocky nature of the seabed and the limited scope of the hull's watertight sub division, it is extremely fortunate that the consequences of this accident were not far worse, especially when one considers the number of passengers on board *Waverley* at the time, and the remote location of Sanda Island. [2.3]

3. As *Waverley* operates closer to navigational dangers during excursions, than when on passage between operating areas or in exposed waters, the need for these sightseeing excursions to be planned in detail is probably even more important than it is for voyages in open water. [2.4]

4. There is little reason why *Waverley* could not have followed a pre-planned track during this excursion without detriment to the enjoyment of her passengers. [2.4]

5. By approaching to within 3 cables off Sanda Island, the resulting safety margin was only about 70m. This was insufficient considering the speed of the vessel, the methods used to monitor position, and the scale of the chart available. [2.4]

6. The use of a VRM to keep 3 cables off the nearest point of Sanda Island was quick and simple, but it did not allow the chief officer to accurately predict the vessel's future track in relation to the coast, and corrective action was taken too late. [2.5.1]

7. Had *Waverley* been following a pre-planned track at the time of the accident, the use of a parallel index line would have enabled the chief officer to quickly detect *Waverley* closing the dangers, and allowed proactive action to be taken. [2.5.1]

8. The use of VRM and EBL tools for parallel indexing is not ideal because it is easy to move the controls for these functions unintentionally. A radar display capable of displaying fixed electronic parallel index lines is more reliable in this respect. [2.5.1]

9. Correlation of the radar picture, charted information, GPS position, and visual reference would have been much easier had chart 2126 been placed on the foldaway table at the front of the bridge. [2.5.2]

10. Had the master also monitored the vessel's position, there would have been a greater probability of the encroachment of the 3 cable range would have been detected in time to take corrective action. [2.5.2]

11. As *Waverley* operates in close proximity to navigational dangers on many of her excursions, and many of her points of embarkation and disembarkation are tidally constrained, the lack of an echo sounder in which the crew have confidence, is considered detrimental to the safe navigation of the vessel. [2.5.3]

12. The master's decision to leave the bridge was questionable as there was little to be gained from him investigating the perceived mechanical problem personally. [2.6.1]

13. By not using VHF radio to inform the coastguard, the coastguard were not able to fix the vessel's position using VHF direction finding equipment, and other vessels in the area were not made aware of *Waverley'*s predicament. Both of these would have been of benefit had the situation suddenly worsened. [2.6.2]

14. Based on the information available, the master's assessment regarding the condition of the vessel appears to have been reasonable. However, had a close inspection of the charted position at the time of the accident been conducted, the probability that the vessel had touched the bottom would have been obvious. [2.6.3]

15. The nautical expertise at director level within WEL is limited to that of the senior master, who does not have a specific remit in this role, and spends a great deal of his time in command of either of the vessels during the operating season. [2.7]

16. The lack of passage planning, the absence of a specified under-keel clearance, and the limitations of the navigation equipment available, indicate that the risks of continually operating in close proximity to navigational dangers and maintaining tidally constrained schedules, have not been fully assessed. [2.8]

SECTION 4 - ACTION TAKEN

4.1 Following the accident, WEL has taken the following actions:

- Commissioned an external audit of the navigational procedures on board *Waverley*. The recommendations made in the audit report are at **Annex E**;
- Issued a Safety Memorandum reminding its masters and chief officers of the need to use appropriate navigational tools when conducting an excursion **Annex F**;
- Nominated a deputy DP;
- Replaced the lower bridge radar display with a JRC/JMA radar, and;
- Replaced the fish finder with a conventional depth sounder.

4.2 As a result of a subsequent accident, the Chief Inspector of Marine Accidents wrote to WEL's senior management. In his letter, the Chief Inspector recommended that WEL:

> "*Conduct a comprehensive risk assessment of the company's navigational policies and procedures. This risk assessment should include, but not be limited to, the company's instructions to Masters, the suitability of the navigational equipment outfit on both vessels, an assessment of the capabilities of all navigational watchkeepers, including masters, and the effectiveness of current bridge team practices. The ability of ship's staff to deal with likely emergency scenarios should also be properly evaluated, especially with respect to the care and safety of passengers. Corrective action should be completed before further passengers are carried."*

(Rec 2004/243 Chief Inspector's letter 8 November 2004).

4.3 Following discussions with WEL, the MCA has stated its intention to conduct the annual SMC audits of *Waverley* and *Balmoral* during the summer season.

SECTION 5 - RECOMMENDATIONS

Waverley Excursions Limited is recommended to:

2005/101 Require that all voyages undertaken by its vessels are planned and conducted in accordance with requirements of SOLAS V and IMO guidance.

2005/102 Ensure that all navigational procedures are validated by a person with relevant training and experience, and that these procedures are then audited to the required standard.

2005/103 Ensure that all navigational equipment is fit for purpose.

2005/104 Define the terms of reference of the senior master with regard to his advice on, and involvement in, navigational policy, audit and performance.

Marine Accident Investigation Branch
January 2005

ANNEX A

Definitions of the classes of passenger vessels and water categories

Class	Description
III	Ships engaged only on voyages in the course of which they are at no time more than 70 miles by sea from their point of departure and not more than 18 miles from the coast of the United Kingdom, and which are at sea only in favourable weather and during restricted periods;
IV	Ships engaged only on voyages in Category A, B, C or D waters;
V	Ships engaged only on voyages in Category A, B or C waters;
VI	Ships engaged only on voyages with not more than 250 passengers on board, to sea, or in Category A, B, C or D waters, in all cases in favourable weather and during restricted periods, in the course of which the ships are at no time more than 15 miles, exclusive of Category A, B, C or D waters, from their point of departure nor more than 3 miles from land;
VI(A)	Ships carrying not more than 50 passengers for a distance on not more than 6 miles on voyages to or from isolated communities on the islands or coast of the United Kingdom and which do not proceed for a distance of more than 3 miles from land; subject to any conditions which the Secretary of State may impose.

- A Class III or VI vessel may only proceed on a voyage to sea in favourable weather and in daylight during the restricted Summer period (Between 1 April to 31 October inclusive).

MERCHANT SHIPPING NOTICE

Extract from MSN 1776 (M)

Categorisation of Waters

Notice to Owners, Operators and Masters

This Notice supersedes Merchant Shipping Notice MSN 1758(M).

Summary

This statutory Merchant Shipping Notice sets out the categorisations of waters in the United Kingdom.

Key Points

- the notice replaces and augments MSN 1758(M).
- the changes and additions are shown in **bold** and *italics* respectively.
- the categorisations determine the waters not regarded as "sea" for the purposes of Merchant Shipping legislation (excepting marine pollution).

1. The Annex to this Merchant Shipping Notice sets out the categorisations that apply to waters in the United Kingdom. These categorisations are given statutory force by way of Regulation 2 of the Merchant Shipping (Categorisation of Waters) Regulations 1992.

2. Amendments to Merchant Shipping Notice MSN 1758 and its Annex are shown in **bold** and additions are shown in *italics*.

3. The four categories of waters are as follows:

   Category A: Narrow Rivers and canals where the depth of water is generally less than 1.5 metres.

   Category B: Wider rivers and canals where the depth of water is generally 1.5 metres **or more** and where the significant wave height could not be expected to exceed 0.6 metres at any time.

   Category C: Tidal rivers and estuaries and large, deep lakes and lochs where the significant wave height could not be expected to exceed 1.2 metres at any time.

   Category D: Tidal rivers and estuaries where the significant wave height could not be expected to exceed 2.0 metres at any time.

4. These categorisations apply specifically to the operation of Class IV, V and VI Passenger Ships and also determine which waters are not regarded as "sea" for the purposes of regulations made, or treated as made, under Section 85 of the Merchant Shipping Act 1995.

5. Under the Merchant Shipping (Prevention of Oil Pollution) Regulations 1996 it should be noted that "sea" includes any estuaries or arms of the sea.

6. These categorisations should not be confused with classifications for Passenger Ships as designated in the Merchant Shipping (Passenger Ships on Domestic Voyages) Regulations 2000 which implement the EC Directive on Safety Rules and Standards for Domestic Passenger Ships.

7. The categorisations shown in the Annex apply at all times of the year unless otherwise indicated. "Summer" means the months of April to October, inclusive, and "winter" means the months of November to March, inclusive.

8. This Notice will come into force on 1 April **2003.**

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March 2003

MS 46/4/4

Safer Lives, Safer Ships, Cleaner Seas

Department for Transport

The MCA is an executive agency of the Department of Transport

ANNEX B

Master’s hours of work 3 June - 25 June 2004

WAVERLEY EXCURSIONS (GUERNSEY) LTD : MONTHLY TIMESHEET AND RECORD OF HOURS OF REST OF SEAFARER.

Name of Ship: B Waverley **IMO Number:** _____ **Flag of Ship:** UK

Name of Seafarer: _____ **Department:** DECK **Rank:** MASTER

Name of Master: _____ **Period Ending:** _____ **Watchkeeper:** Yes/No (please delete)

3/4/04

	Week 1.						Week 2.						Week 3.						Week 4.						Week 5.					
	Hours Worked			Hours of Rest			Hours Worked			Hours of Rest			Hours Worked			Hours of Rest			Hours Worked			Hours of Rest			Hours Worked			Hours of Rest		
	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs
Thu	1000	1800	8	1200 0000	0800 1000	16			Leave				0800	1930	11½	0000 1930	0800 2400	12½	0800 1300	1500 2400	12	0000 1500	0800 1200	12							
Fri	0830	1830	10	0000 2230	0830 2400	10							0730	2300	14	0000 2300	0730 2400	10	0000 1000	0800 1700	11	0800 1700	1000 2400	13						
Sat													0800	2300	15	0000 2300	0800 2400	9												
Sun			Leave				0800 1900	1900 2400	12	0000 0800	0800 2300	12	0000 0800	2030 2300	15½	0030 2330	0800 2400	8½												
Mon							0000 0730	0800 2400	17	0000	0800	7	0730 1800	1800 0400	11	0000 1700	0800 1300	13												
Tue							0800 1800	1000 2400	10	0000 1000	0800 1800	14			16		1330 2400	8												
Wed							0800	1800	14	0000 1800	0800 2400	10	0800	2000	12	0000 0800	0800 2400	12												
Total		22				26		53				43		94½				81½												

For office use only.										
Total Hours										
Sum'y		[redacted]		[redacted]		[redacted]		[redacted]		[redacted]

The Merchant Shipping (Hours of Work) Regulations, 2002 and 'Workforce Agreement' apply to this ship.
This form is subject to examination and endorsement under procedures established by the UK Maritime & Coastguard Agency.
I agree that this record is an accurate reflection of the hours of work and rest of the above seafarer.

Signature of Seafarer: _____ **Signature of Dept. Head:** _____ **Signature of Master:** _____

ANNEX C

Chief Officer’s hours of work 20 May - 23 June 2004

WAVERLEY EXCURSIONS (GUERNSEY) LTD : MONTHLY TIMESHEET AND RECORD OF HOURS OF REST OF SEAFARER.

Name of Ship: WAVERLEY **IMO Number:** _____ **Flag of Ship:** BERMUDA

Name of Seafarer: _____ **Department:** DECK **Rank:** C/O

Name of Master: _____ **Period Ending:** _____ **Watchkeeper:** Yes/No (please delete)

29/05/24	Week 1.						Week 2.						Week 3.						Week 4.						Week 5.					
	Hours Worked			Hours of Rest			Hours Worked			Hours of Rest			Hours Worked			Hours of Rest			Hours Worked			Hours of Rest			Hours Worked			Hours of Rest		
	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs	From	To	Hrs
Thu	0800	2330	15½			8½	0800 1330	1800 1730	11½			12½	0630	2110	15			9	0800	2330	15½			8½	0900	2300	14			
Fri	0700	2230	15½			8½	0730	2000	12½			11½	0600	2100	15			9	0800	2400	16			8	0800	2300	15			
Sat	0900	2400	17			7	0830 1700	1400 2200	10½			13½	0730	2345	15¾		8¼	15¾	0000	0730 2400	13			11	0900	2400	16			
Sun	0830	1530 2400	15			9	0730	2100	13½			10½	0630	1630 2330	12			12	0900	2000	11			13	0800	2300	15			
Mon	0000 0650	0000 2230	16½			7½	0700	2200	15			9	0630	2130	15			9	0000 0730	0600 1700	11½			6½	0700	2000	13			
Tue	0715	2300	16¾			9¼	0830	2300	13½			10½	0600	1700	13			11	0700 1430	0900 1900	13½			10½	0730 0800	0300 2300	16½			
Wed	0730	2200	14½			9¼	0800	2115	13¼			10¼	0700	2300	15½			8½	0800	1900	11			13	0900 2000	1300 2400	11			
Total		105¾				62¼		85¾				78¼		101¼				66¾		97½						100½				

For office use only.										
Total Hours										
Sum'y										

The Merchant Shipping (Hours of Work) Regulations, 2002 and 'Workforce Agreement' apply to this ship.
This form is subject to examination and endorsement under procedures established by the UK Maritime & Coastguard Agency.
I agree that this record is an accurate reflection of the hours of work and rest of the above seafarer.

Signature of Seafarer: _____ **Signature of Dept. Head:** _____ **Signature of Master:** _____

ANNEX D

Summary of the equipment required by Regulation 12 of SOLAS V/74

Annex 12 - Navigaiton Equipment - Existing Ships

MCA NOTES ON EQUIPMENT FOR EXISTING SHIPS - p.3

Text of REGULATIONS 11, 12 AND 20 OF SOLAS V/74 - p.4

V/74 REG PARA NO.	EQUIPMENT FOR SHIPS BUILT BEFORE 1 JULY 2002 Existing ships may continue to meet requirements of SOLAS V/74 Except - GNSS to be fitted at first survey after 1 July 2002 and AIS to be fitted according to timetable in Reg.19.2.4 Equipment to meet IMO Performance Standards. See: ANNEX 8 – Notes on PERFORMANCE STANDARDS and TYPE APPROVAL and ANNEX 9 - Table of IMO PERFORMANCE STANDARDS and TESTING STANDARDS	All Ships	All passenger ships	Less than 150 GT	150 GT and over	300 GT and over	500 GT and over	1600 GT and over	3000 GT and over	10000 GT and over	100000 GT and over
Reg 11	Daylight signalling lamp				I	I	I	I	I	I	I
Reg 12 (b)	Standard magnetic compass				X	X	X	X	X	X	X
12 (c)	Steering compass and means of taking bearings			X							
12 (d)	Gyro compass						X	X	X	X	X
12 (d)	Gyro repeater(s)							X	X	X	X
12 (f)	Phone to emergency steering	X	X	X	X	X	X	X	X	X	X
12 (f)	Compass reading to emergency steering						X1	X1	X1	X1	X1
12 (g)	Radar – 9 GHz		I			I	X	X	X	X	X
12 (h)	Second radar									X	X
12 (i)	Radar plotting facilities		I			I	I	X	X2	X2	X2
12 (j)	ARPA									X	X
12 (k)	Echo sounder						I	I	I	I	I
12 (l)	Speed and distance measuring device						I	I	I	X3	X3
12 (m)	Rudder, propeller, pitch indicators						X	X	X	X	X
12 (n)	Rate of turn indicator										X
12 (p)	RDF (may be exempted if position finding system fitted)							X4	X4	X4	X4
Reg 20	Adequate up to date charts and nautical publications	X	X	X	X	X	X	X	X	X	X
	GNSS or terrestrial	X5	X5	X5	X5	X5	X5	X5	X5	X5	X5

Regulation Appendix

Annexes
A1. Categories of Waters & Classes of Ships
A2. Table of Requirements for Ships
A3. Nautical Charts & Publications
A4. WMO Maritime Services
A5. Routeing Systems
A6. Safe Manning
A7. Equipment Manuals
A8. Performance Standards & Type Approval
A9. Performance Standards for Navigational Equipment
A10. Voyage Data Recorders
A11. Navigation Equipment - New Ships
A12. Navigation Equipment - Existing Ships
A13. Magnetic Compass
A14. Electronic Charts
A15. Radar Reflectors
A16. Radar Equipment
A17. Automatic Identification Systems
A18. Steering Gear, Heading & Track Control Systems
A19. High Speed Craft Code
A20. Inspection & Survey of Navigational Equipment
A21. Pilot Transfer Arrangements
A22. Recording of Navigational Events
A23. Passenger Ship Operational Limitations
A24. Voyage Planning
A25. Guidelines for Voyage Planning

	position finding system (SOLAS V/19.1.2.2)									
	AIS (before 1 July 2008 (SOLAS V/19.2.4.2)	I6			I6	I6	I6	I6	I6	I6
	AIS from 1 July 2008 (SOLAS V/19.2.4.3)	X		I	X	X	X	X	X	X
	VDR (SOLAS V/20.1.2 & 1.3))	I6								

X : on all voyages
I : on international voyages
1 : ships constructed on/after 1 Feb '92
2 : at least as effective as a reflection plotter
3 : speed and distance through water
4 : until first survey after 1 July 2002
5 : By first survey after 1 July 2002
6 : phased implementation (SOLAS V/19.2.4 & 20)

EQUIPMENT CARRIAGE REQUIREMENTS – EXISTING VESSELS

Regulation V/19 allows existing ships (constructed before 1 July 2002) to comply with the carriage requirements of SOLAS V/74 as follows:

19.1.2) Ships constructed before 1 July 2002 shall:

> ***19.1.2.1)*** *subject to the provisions of paragraphs 1.2.2 and 1.2.3, unless they comply fully with this regulation, continue to be fitted with equipment which fulfils the requirements prescribed in regulations V/11, V/12 and V/20 of the International Convention for the Safety of Life at Sea, 1974 in force prior to 1 July 2002;*
>
> ***19.1.2.2)*** *be fitted with the equipment or systems required in paragraph 2.1.6 not later than the first survey after 1 July 2002 at which time the radio direction-finding apparatus referred to in V/12 (p) of the International Convention for the Safety of Life at Sea, 1974 in force prior to 1 July 2002 shall no longer be required; and*
>
> ***19.1.2.3)*** *be fitted with the system required in paragraph 2.4 not later than the dates specified in paragraphs 2.4.2 and 2.4.3.*

NOTES:

Existing ships can continue to comply with the requirements of SOLAS V/74 for Signalling Lamps (Reg.11) Navigational Equipment (Reg.12) and carriage of nautical publications (Reg.20) if they do not comply FULLY with the new requirements of SOLAS V Reg.19. See the full text of these three Regulations below.

They are, though required to fit:

1.) a GNSS receiver or a terrestrial radionavigation receiver no later than the first survey after 1 July 2002. When this equipment is fitted there need to be fitted with RDF apparatus, and

2.) an AIS Receiver, by the dates specified in Reg. 19.2.4

3.) a VDR, on the classes of vessel and by the dates specified in Reg. 20

TEXT OF SOLAS V/74 – REGULATIONS 11, 12 and 20

REGULATION 11
*Signalling Lamps**

> All ships of over 150 gross tonnage, when engaged on international voyages, shall have on board an efficient daylight signalling lamp

which shall not be solely dependent upon the ship's main source of electrical power.

REGULATION 12
Shipborne navigational equipment#

a.) For the purpose of this regulation constructed in respect of a ship means a stage of construction where:

i.) the keel is laid; or

ii.) construction identifiable with a specific ship begins; or

iii.) assembly of that ship has commenced comprising at least 50 tonnes or 1% of the estimated mass of all structural material whichever is less.

b.)

i.) Ships of 150 gross tonnage and upwards shall be fitted with:

1.) a standard magnetic compass, except as provided in subparagraph (iv);

2.) a steering magnetic compass, unless heading information provided by the standard compass required under (1) is made available and is clearly readable by the helmsman at the main steering position;

3.) adequate means of communication between the standard compass position and the normal navigation control position to the satisfaction of the Administration; and

4.) means for taking bearings as nearly as practicable over an arc of the horizon of 360°.

ii.) Each magnetic compass referred to in subparagraph (i) shall be properly adjusted and its table or curve of residual deviations shall be available at all times.

iii.) A spare magnetic compass, interchangeable with the standard compass, shall be carried, unless the steering compass mentioned in subparagraph (i)(2) or a gyro-compass is fitted.

iv.) The Administration, if it considers it unreasonable or unnecessary to require a standard magnetic compass, may exempt individual ships or classes of ships from these requirements if the nature of the voyage, the ship's proximity to land or the type of ship does not warrant a standard compass, provided that a suitable steering compass is in all cases carried.

c.) Ships of less than 150 gross tonnage shall, as far as the Administration considers it reasonable and practicable, be fitted with a steering compass and have means for taking bearings.

d.) Ships of 500 gross tonnage and upwards constructed on or after 1 September 1984 shall be fitted with a gyro-compass complying with the following requirements:

i.) the master gyro-compass or a gyro repeater shall be clearly readable by the helmsman at the main steering position;

ii.) on ships of 1,600 gross tonnage and upwards a gyro repeater or gyro repeaters shall be provided and shall be suitably placed for taking bearings as nearly as practicable over an arc of the horizon of 360°.

e.) Ships of 1,600 gross tonnage and upwards, constructed before 1 September 1984, when engaged on international voyages, shall be fitted with a gyro-compass complying with the requirements of paragraph (d).

f.) Ships with emergency steering positions shall at least be provided with a telephone or other means of communication for relaying heading information to such positions. In addition, ships of 500 gross tonnage and upwards constructed on or after 1 February 1992 shall be provided with arrangements for supplying visual compass readings to the emergency steering position.

g.) Ships of 500 gross tonnage and upwards constructed on or after 1 September 1984 and ships of 1,600 gross tonnage and upwards constructed before 1 September 1984 shall be fitted with a radar installation. From 1 February 1995, the radar installation shall be capable of operating in the 9 GHz frequency band. In addition, after 1 February 1995, passenger ships irrespective of size and cargo ships of 300 gross tonnage and upwards when engaged on international voyages shall be fitted with a radar installation capable of operating in the 9 GHz frequency band. Passenger ships of less than 500 gross tonnage and cargo ships of 300 gross tonnage and upwards but less than 500 gross tonnage may be exempted from compliance with the requirements of paragraph (r) at the discretion of the Administration, provided that the equipment is fully compatible with the radar transponder for search and rescue.

h.) Ships of 10,000 gross tonnage and upwards shall be fitted with two radar installations, each capable of being operated independently* of the other. From 1 February 1995, at least one of the radar installations shall be capable of operating in the 9 GHz frequency band.

i.) Facilities for plotting radar readings shall be provided on the navigation bridge of ships required by paragraph (g) or (h) to be fitted with a radar installation. In ships of 1,600 gross tonnage and upwards constructed on or after 1 September 1984 the plotting facilities shall be at least as effective as a reflection plotter.

j.)

i.) An automatic radar plotting aid shall be fitted on;

1.) ships of 10,000 gross tonnage and upwards, constructed on or after 1 September 1984;

2.) tankers constructed before 1 September 1984 as follows:

aa.) if of 40,000 gross tonnage and upwards by 1 January 1985;

bb.) if of 10,000 gross tonnage and upwards but less than 40,000 gross tonnage, by 1 January 1986;

3.) ships constructed before 1 September 1984, that are

not tankers, as follows:

aa.) if of 40,000 gross tonnage and upwards by 1 September 1986;

bb.) if of 20,000 gross tonnage and upwards, but less than 40,000 gross tonnage, by 1 September 1987;

cc.) if of 15,000 gross tonnage and upwards, but less than 20,000 gross tonnage, by 1 September 1988.

ii.) Automatic radar plotting aids fitted prior to 1 September 1984 which do not fully conform to the performance standards adopted by the Organization# may, at the discretion of the Administration, be retained until 1 January 1991.

iii.) The Administration may exempt ships from the requirements of this paragraph, in cases where it considers it unreasonable or unnecessary for such equipment to be carried, or when the ships will be taken permanently out of service within two years of the appropriate implementation date.

k.) When engaged on international voyages ships of 1,600 gross tonnage and upwards constructed before 25 May 1980 and ships of 500 gross tonnage and upwards constructed on or after 25 May 1980 shall be fitted with an echo-sounding device.

l.) When engaged on international voyages ships of 500 gross tonnage and upwards constructed on or after 1 September 1984 shall be fitted with a device to indicate speed and distance. Ships required by paragraph (j) to be fitted with an automatic radar plotting aid shall be fitted with a device to indicate speed and distance through the water.

m.) Ships of 1,600 gross tonnage and upwards constructed before 1 September 1984 and all ships of 500 gross tonnage and upwards constructed on or after 1 September 1984 shall be fitted with indicators showing the rudder angle, the rate of revolution of each propeller and in addition, if fitted with variable pitch propellers or lateral thrust propellers, the pitch and operational mode of such propellers. All these indicators shall be readable from the conning position.

n.) Ships of 100,000 gross tonnage and upwards constructed on or after 1 September 1984 shall be fitted with a rate-of-turn indicator.

o.) Except as provided in regulations I/7(b)(ii), I/8 and I/9, while all reasonable steps shall be taken to maintain the apparatus referred to in paragraphs (d) to (n) in efficient working order, malfunctions of the equipment shall not be considered as making a ship unseaworthy or as a reason for delaying the ship in ports where repair facilities are not readily available. *

p.) When engaged on international voyages, ships of 1,600 gross tonnage and upwards shall be fitted with a radio direction-finding apparatus. The Administration may exempt a ship from this requirement if it considers it unreasonable or unnecessary for such apparatus to be carried or if the ship is provided with other radionavigation equipment suitable for use throughout its intended voyages.

q.) Until 1 February 1999, ships of 1,600 gross tonnage and upwards constructed on or after 25 May 1980 and before 1 February 1995, when engaged on international voyages, shall be fitted with radio equipment for homing on the

radiotelephone distress frequency.

r.) All equipment fitted in compliance with this regulation shall be of a type approved by the Administration. Equipment installed on board ships on or after 1 September 1984 shall conform to appropriate performance standards not inferior to those adopted by the Organization. *Equipment fitted prior to the adoption of related performance standards may be exempted from full compliance with those standards at the discretion of the Administration, having due regard to the recommended criteria which the Organization might adopt in connection with the standards concerned.

s.) A rigidly connected composite unit of a pushing vessel and associated vessel, when designed as a dedicated and integrated tug and barge combination, shall be regarded as a single ship for the purpose of this regulation.

t.) If the application of the requirements of this regulation necessitates structural alterations to a ship constructed before 1 September 1984, the Administration may allow extension of the time limit for fitting the required equipment not later than 1 September 1989, taking into account the first scheduled dry-docking of such a ship required by the present regulations.

u.) Except as provided elsewhere in this regulation, the Administration may grant to individual ships exemptions of a partial or conditional nature, when any such ship is engaged on a voyage where the maximum distance of the ship from the shore, the length and nature of the voyage, the absence of general navigation hazards, and other conditions affecting safety are such as to render the full application of this regulation unreasonable or unnecessary. When deciding whether or not to grant exemptions to an individual ship, the Administration shall have regard to the effect that an exemption may have upon the safety of all other ships.

** Refer to the following recommendations adopted by the Organization by the resolutions indicated:*

- *Recommendation on general requirements for shipborne radio equipment forming part of the GMDSS and for electronic navigational aids (resolution A.694(17));*
- *Recommendation on performance standards for magnetic compasses (resolution A.382(X));*
- *Recommendation on performance standards for gyro-compasses (resolution A.424(XI));*
- *Recommendation on performance standards for radar equipment (resolutions A.477(XII) as amended by resolution MSC.64(67), annex 4, A.222(VII) and A.278(VIII));*
- *Performance standards for automatic radar plotting aids (resolution A.823(19));*
- *Recommendation on performance standards for echo-sounding equipment (resolution A.224(VII) as amended by resolution MSC.74(69), annex 2);*
- *Recommendation on performance standards for devices to indicate speed and distance (resolution A.824(19) as amended (resolution MSC.96(72));*
- *Performance standards for rate-of-turn indicators (resolution A.526(13));*
- *Recommendation on unification of performance standards for navigational equipment (resolution A.575(14));*
- *Performance standards for radio direction-finding systems (resolution A.665(16));*
- *Recommendation on performance standards for shipborne receivers for use with differential OMEGA (resolution A.479(XII));*
- *General requirements for electromagnetic compatibility for all electrical and electronic ship's equipment (resolution A.813(19)).*
- *Recommendation on performance standards for shipborne Loran-C and Chayka receivers (resolution A.818(19)). , Recommendation on performance standards for shipborne global positioning system receiver equipment (resolution A.819(19));*
- *Recommendation on performance standards for shipborne GLONASS receiver equipment (resolution MSC.53(66)); , Recommendation on performance standards for shipborne DGPS and DGLONASS maritime radio beacon receiver equipment (resolution MSC.64(67), annex 2);*
- *Recommendation on performance standards for combined GPS/GLONASS receiver equipment (resolution MSC.74(69), annex 1);*
- *Recommendation on performance standards for daylight signalling lamps (resolution MSC.95(72)).*
- *Recommendation on methods of measuring noise levels at listening posts (resolution A.343(IX)).*

Regarding unification of ARPA signals, see MSC/Circ.563 and IEC Publication 872.

** Refer to resolution MSC.95(72), Performance Standards for daylight signalling lamps.*

 # See resolution A.156(ES.IV), Recommendation on the carriage of electronic position-fixing equipment, and resolution A.815(19), World-wide radionavigation system.

+ Refer to section 4 of the Recommendation on performance standards for radar equipment adopted by the Organization by resolution A.477(XII) and resolution MSC.64 (67), Recommendations on new and amended performance standards (annex 4).

‡ Refer to the Performance standards for automatic radar plotting aids adopted by the Organization by resolution A.823(19).

+Refer to the Recommendation on the use and testing of shipborne navigational equipment adopted by the Organization by resolution A.157(ES.IV).

Regulation 20
Nautical publications

All ships shall carry adequate and up-to-date charts,*sailing directions, lists of lights, notices to mariners, tide tables and all other nautical publications necessary for the intended voyage.

** Refer to the Recommendation on performance standards for electronic chart display and information systems (ECDIS) (resolution A.817(19), as amended) and resolution MSC.86(70).*

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ANNEX E

Recommendations from external navigation audit

Recommendations.

Whilst the system of passage planning between ports of call has been initialised, it is recommended that it be further expanded and refined. In particular it would be beneficial if the details of all hazards and probable or potential factors considered to be relevant were included in the "Remarks" column, as an "aide memoir" to the navigator. It would also be beneficial if fixed hazards could be highlighted or marked with coloured pencil on the actual paper charts themselves to further draw the attention of the navigator to these dangers. As the three Masters regularly interchange between the two vessels in the fleet, this would help to avoid any confusion which may occur when they re-assume command after a period of shore leave or time away from each vessel.

It would also help the Chief Officers to assist the Masters when they return to either vessel in acquainting them of any developments or changes which have occurred since they were last on board. It would further be of assistance to any relieving staff new to the service who are, from time to time, brought in to provide reliefs.

The setting up of this system will involve some extra work initially, but once in place would only require a weekly review.

As far as the equipment on board is concerned – it was not within the brief of the author of this report to comment or criticise. It is however noticed that the echo sounder fitted to the "Waverley" is of the type described as a "fish finder", and while it gives a very pretty picture, it appears to be very erratic and of little or no use when in very shallow water. This is endemic of this type of equipment which is basically provided for the leisure market. The author would be failing in his duty as a professional mariner and consultant if he did not draw the attention of the operators to this fact.

Report Dated 12th July, 2004.

Signed.....

Master Mariner

Marine Consultant.

ANNEX F

Company Safety Memorandum

WAVERLEY EXCURSIONS LIMITED

SAFETY MEMORANDUM – 03/04

From: Safety Director **1st July 2004**

To: Ships' Masters and Chief Officers

SAFE NAVIGATION

The attention of masters and watch-keeping deck officers is drawn to the Company Safety Management System Manual Section 7. (in particular, the relevant parts of Core Procedure WEL 02/97 – Marine Operations) and Section 5. – "Master's Authority & Responsibilities"

As operators of coastal excursion ships, it is part of our business to offer our passengers views of coastal scenery and other attractions that can only be seen from a ship. However, in providing this passenger facility, due regard must be given at all times to the safe navigation of the vessel.

In preparing a coastal excursion route, the largest scale chart that is available is to be consulted and consideration given to under keel clearance, hull squat and clearing distance from the coast and any off-lying danger: both above and under water. All appropriate methods of fixing the position of the vessel are to be used and radar should not be the sole method adopted. The operational limitations of any navigational aid used must be taken into account at all times when fixing a position.