

Report on the investigation of the grounding and loss of the  
Cypriot-registered general cargo ship

***Jambo***

off Summer Islands

West Coast of Scotland

29 June 2003

Marine Accident Investigation Branch  
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**Extract from**  
**The Merchant Shipping**  
**(Accident Reporting and Investigation)**  
**Regulations 1999**

The fundamental purpose of investigating an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 1999 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.

**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.

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## **GLOSSARY OF ABBREVIATIONS AND ACRONYMS**

AB	-	Able bodied seaman
BEC	-	Bridge Equipment Checklist
ETA	-	Estimated Time of Arrival
ETV	-	Emergency Towing Vessel
GPS	-	Global Positioning System
IMO	-	International Maritime Organization
MCA	-	Maritime and Coastguard Agency
OS	-	Ordinary seaman
PSSA	-	Particularly sensitive sea area
RNLI	-	Royal National Lifeboat Institution
SMS	-	Safety management system
SOSREP	-	Secretary of State's Representative for Marine Salvage and Intervention
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
UKHO	-	United Kingdom Hydrographic Office
UTC	-	Universal Co-ordinated Time
VHF	-	Very High Frequency

## SYNOPSIS



All times are ship's time (UTC+2)

At 0515 on 29 June 2003, the Cypriot-registered general cargo vessel *Jambo* ran aground off the Summer Islands, at the entrance to Loch Broom on the west coast of Scotland. The German-owned, single-hold vessel, built in 1990, was carrying 3300 tonnes of zinc concentrate from Dublin to Odda in Norway. She subsequently sank. The grounding prompted fears of serious environmental damage.

*Jambo* carried seven crew, with the master and the chief officer holding the 6 to 12 and the 12 to 6 watches respectively. In addition to watchkeeping, the chief officer was responsible for overseeing cargo operations in port.

The AB assigned to the watch was absent from the bridge for at least an hour before the vessel grounded. No watch alarm was fitted on *Jambo's* bridge, nor was there a requirement for such a device to be fitted.

The chief officer fell asleep while alone on the bridge, missing his intended change of course off Rubha Reidh. At 0515, he was awoken, standing at the engine controls, by the impact of the vessel grounding.

The sea was calm, there was no swell and the visibility was good. It was daylight, although the sun was yet to rise. The vessel was stationary aground.

The master alerted Stornoway coastguard by VHF radio to report the situation. The coastguard tasked Lochinver RNLi lifeboat, the coastguard ETV *Anglian Prince* and the Achiltibuie coast rescue team to the scene. The Lochinver lifeboat arrived on scene at 0721, and all crew members were evacuated safely. *Jambo* sank with her bow out of the water, lying on her port side at 0955.

Six-on six-off watches are tiring in any event, and the problem was compounded by the regular port visits, during which time the chief officer was still required to work, regardless of how this disrupted his watch pattern. He fell asleep as a result of very high levels of fatigue caused by the cumulative effect of this irregular working pattern.

Watchkeeper incapacitation is a serious issue, which leads to over six groundings a year in UK waters, on average. The MAIB is carrying out a safety study into this problem, and the findings of this report will be included in that study.

Recommendations have been made for the MCA to take forward at the IMO, the compulsory fitting of bridge watchkeeper alarms and the findings from three safety studies/research projects covering fatigue, safe manning and bridge watchkeeping. The MCA is also recommended to ensure that the research into vessel traffic in the Minches is conducted as soon as possible.



Mv *Jambo* alongside

## **SECTION 1 - FACTUAL INFORMATION**

### **1.1 PARTICULARS OF JAMBO AND ACCIDENT**

#### **Vessel details**

Registered owner	:	Accent Shipping Co Ltd
Manager	:	Reederei Hesse GmbH & Co KG
Port of registry	:	Limassol
Flag	:	Cyprus
Type	:	General dry cargo
Built	:	1990 Pattje Waterhuizen
Classification society	:	Lloyd's
Construction	:	Steel, strengthened for heavy cargoes, bottom strengthened for loading and unloading aground, ice class 1D
Length overall	:	88.15m
Gross tonnage	:	1990
Service speed	:	11 knots
Other relevant info	:	Bow thruster, 65kW

#### **Accident details**

Time and date	:	0315 UTC (0515 ship's time) 29 June 2003
Location of accident	:	58° 01'.14N 005° 27'.15W
Persons on board	:	Seven
Injuries/fatalities	:	0
Damage	:	Total loss



## 1.2 BACKGROUND INFORMATION

*Jambo* was one of eight vessels managed by Reederei Hesse. A single-hold, general cargo vessel built in 1990, she had been managed by Reederei Hesse since 1998. *Jambo* normally operated between Sweden, the Baltic ports and the North Sea ports, the UK and Ireland.

Passages were usually between 1 and 3 days with 1 or 2 days spent in port. *Jambo* carried seven crew, with the master and the chief officer being the only bridge watchkeepers. In addition to watchkeeping, the chief officer was responsible for overseeing cargo operations in port.

The master and chief officer worked 6 hour watches at sea. These were normally split, such that the master did the 6 to 12 watch, that is 0600 to 1200 and 1800 to 2400, and the chief officer took the 12 to 6 watch, that is 1200 to 1800 and 0000 to 0600.

## 1.3 NARRATIVE

All times are ship's time (UTC +2), all courses are true.

*Jambo* sailed from Stjermoy, Norway on 18 June 2003 at 1710 for Glasgow, with a cargo of china clay. Having been alongside for 1½ days discharging this cargo, she sailed in ballast for Dublin at 2030 on 25 June.

During the crossing to Dublin, the cargo hold was cleaned out in preparation for the next cargo. *Jambo* anchored off Dublin in the morning of 26 June, to wait for the berth to become available.

Having weighed anchor at 2300, *Jambo* berthed at 0055 the following day (27 June). The chief officer had got up before the anchor was heaved, went off duty at about 0100, and returned to duty at 0700 for loading operations.

The cargo loaded was 3300 tonnes of zinc concentrate. This is a concentrate of the zinc sulphide mineral, sphalerite, chemical composition ZnS. Loading was completed at about 1830. The chief officer went to bed at 2000 and, at about 2100, *Jambo* sailed for Odda, Norway.

The master and chief officer resumed normal sea watches, the master doing the 6 to 12 watch. The master's normal practice was to require ABs to be on the bridge between 2200 and 0600, during periods of restricted visibility, or when close to land. One AB would come on watch at 2200 and he would be relieved at 0200. These ABs acted as lookout when required, but also carried out other duties, as required by the watchkeeper. They also inspected the accommodation and engine room during hourly 'rounds'.

Before entering the Minches on 28 June, the master reported to Stornoway coastguard at 2205, as recommended by the IMO and detailed in the Admiralty List of Radio Signals, giving vessel and passage information.

The chief officer followed his normal pattern that day, sleeping well during the morning. However, after his evening meal he was unable to sleep before going on watch at midnight. When he relieved the master, the master assessed him, as he would any relief, and was content that the chief officer was fit to take the watch.

The vessel was on a course of 012° and the next course alteration to 058° was due at about 0030 on 29 June 2003. This was off Waternish point (**see Figure 1**). The next course alteration shown on the chart was to 032° at a position 1.5 miles north-east of the Eileen Trodday light. This track took the vessel up clear of Cape Wrath.

The master had left the bridge and was watching television in his cabin. As he had anticipated, the reception was lost at 0025 because of the first change of course, and he went to bed.

While watchkeeping, the chief officer worked on the bridge computer for a few minutes at a time, completing and printing voyage reports, stability calculations associated with the cargo, and the company's safety management system paperwork. He felt this was an onerous task, as he thought much of the paperwork associated with the safety management system was pointless and hence a waste of his time. He found the printer to be slow and the monitor's screen difficult to read in daylight.

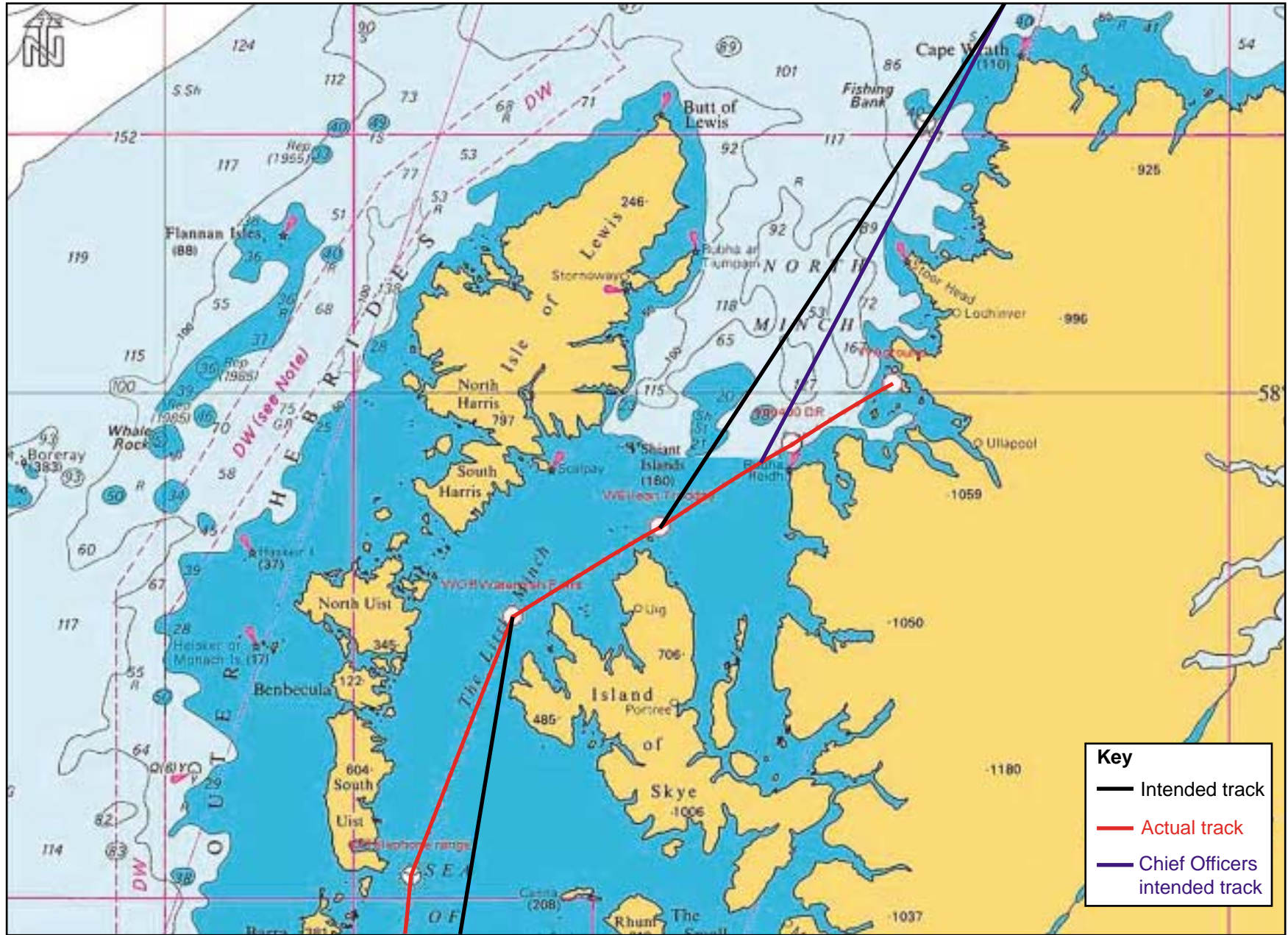
At about 0145, the AB on watch went below to call his relief and complete his rounds. His relief came up to the bridge at about 0200, and the chief officer discussed some ongoing maintenance work with him in the ship's office, commenting that this might be something that could be progressed later.

At about 0220, the vessel passed the course alteration shown on the chart (**see Figure 1**) 1.5 miles north-east of the Eileen Trodday light. However, the chief officer intended to alter course for Cape Wrath off Rubha Reidh.

The AB then on watch was a heavy smoker and, since the chief officer did not permit smoking on the bridge, he was allowed to smoke in the mess room during his rounds. These were first completed at about 0300.

At about 0355, the AB again asked the chief officer if he could go on his rounds. The chief officer, who was feeling tired by that time, agreed, and asked the AB to bring him a cup of Turkish coffee when he returned.

While waiting for this coffee, he walked around the bridge to keep himself alert.



Mv Jambo - navigational tracks

Figure 1

The AB completed his rounds and drank a cup of coffee and smoked a cigarette in the mess room, before going to the ship's office to continue the maintenance work he had discussed with the chief officer at the beginning of the watch.

The chief officer fell asleep between 0405 and 0415, missing his intended change of course off Rubha Reidh. At 0515 he was awoken, standing at the engine controls, by the impact of the vessel grounding off the Summer Islands, at the entrance to Loch Broom (**see Figure 2**).

The master was also awoken by the impact, and heard three or four loud bangs as the vessel came to rest. He went to the bridge immediately, arriving within 15 seconds. The chief officer was in the process of slowing and stopping the engine. The AB on watch returned to the bridge soon after the master had arrived there.

The sea was calm, there was no swell and the visibility was good. It was light, although the sun was yet to rise. The vessel was stationary aground at position 58° 01'.14 N 005° 27'.15W.

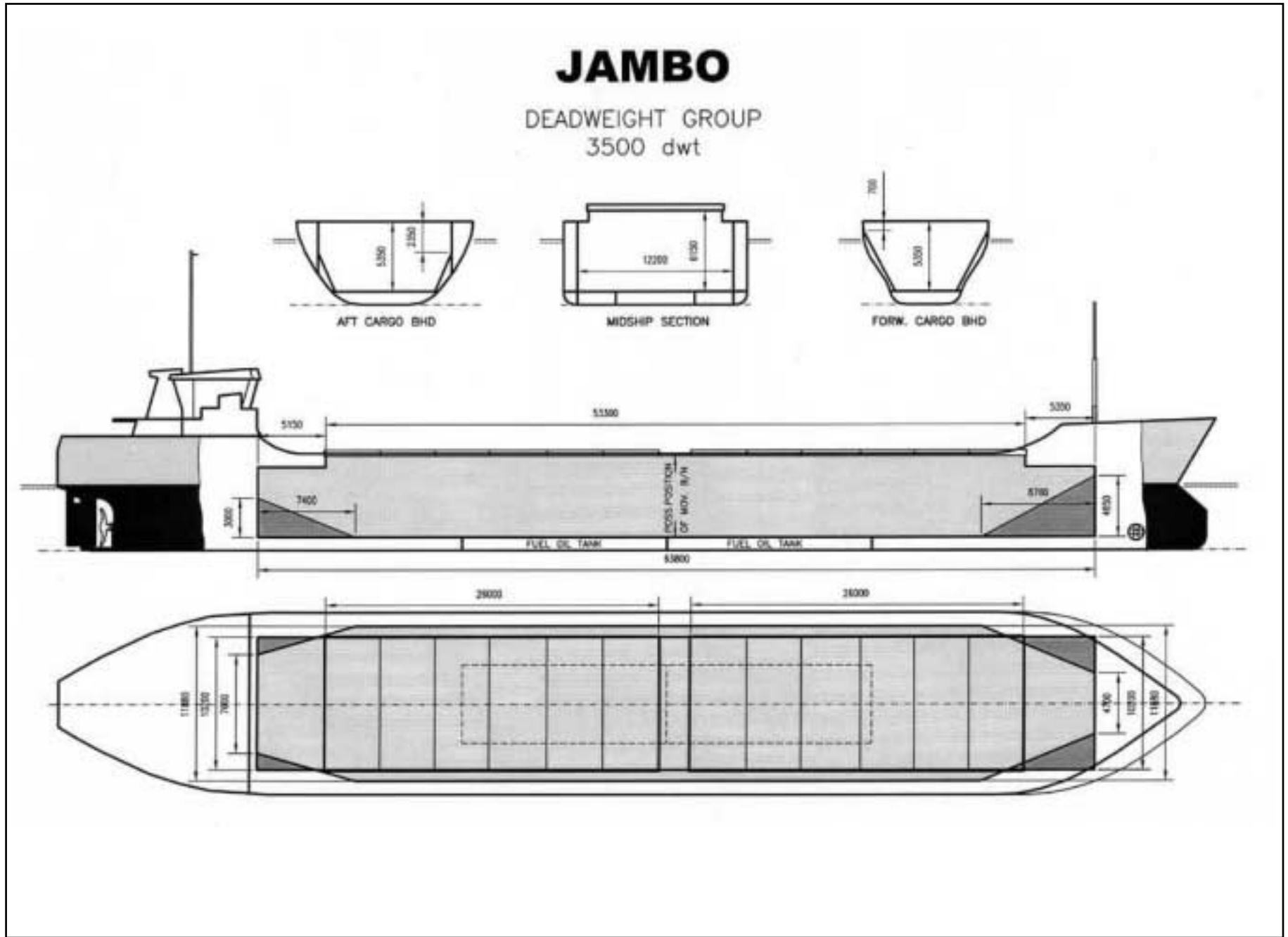
The master sounded the general alarm and instructed the chief officer, assisted by the crew, to take soundings of the ballast tanks which were empty for the passage. A few minutes later, he asked the crew to check the hold for water.

Figure 2



Mv *Jambo* aground at the entrance to Loch Broom about 0730, 29 June 2003





General layout of vessel

The chief officer reported that the forepeak tank, bow thruster compartment, and No 1 double bottom port ballast tank were all flooded, and that there were about 2 metres of water in the forward end of the hold (**Figure 3**). He then took soundings around the vessel to find out to what extent she was aground.

The master telephoned Reederei Hesse's designated person ashore but was unable to reach him, so called the back-up, who was the vessel's superintendent, and reported the situation.

At 0600, the master called Stornoway coastguard by VHF radio to report the situation. The coastguard tasked the Lochinver RNLI lifeboat, the coastguard ETV *Anglian Prince*, and the Achiltibuie coast rescue team to the scene.

The Lochinver lifeboat arrived on scene at 0721 and evacuated four of the seven crew. Members of the lifeboat crew then assisted the master in assessing the situation. *Jambo* had a 5° list to port and the decks were awash on both sides (**Figure 2**).

*Jambo* continued to take on water and sink by the stern. At 0859, the remaining three crew were taken off by the Lochinver lifeboat. *Anglian Prince* arrived on scene at 0909 and, at 0955, her master reported that *Jambo* had sunk with her bow out of the water and lying on the port side (**Figures 4, 5 and 6**).

The lifeboat returned to Lochinver with the crew, arriving at 1112. *Anglian Prince* remained on scene to monitor any pollution from the wreck until a salvage team had been assigned.

Figure 4



Mv *Jambo* sinking, about 0930, 29 June 2003

Figure 5



Mv *Jambo* sinking, about 0945, 29 June 2003

Figure 6



Mv *Jambo* - lying on port side with bow showing, about 1130, 29 June 2003

## 1.4 EVENTS FOLLOWING THE GROUNDING

### 1.4.1 Salvage

SOSREP took control of the salvage operation on the same day as the accident. SMIT Salvage BV and Klyne Tugs were appointed salvors on 1 July 2003.

By 7 July, most of the oil on board had been successfully recovered from the vessel. On 15 July, a temporary exclusion zone was set up around her in response to unauthorised diving on the wreck.

During September, *Jambo* slipped into deeper water and capsized. This made access to the cargo for recovery more difficult.

At the time of writing, according to the salvors, about 1500 tonnes of the cargo have been recovered.

## 1.5 CHIEF OFFICER'S WORK PATTERN

It was the chief officer's normal routine to get up for his midnight watch at about 2345, and arrive on the bridge at 2355. At 0600, he came off watch and went straight to bed, getting up at 1130 to have a cup of coffee before relieving the master at 1200.

At 1800, he came off watch and had his daily meal. This was chosen by him from the lunch and dinner menus on board, and left out for him by the cook. At about 2030, he returned to his cabin to get 2 or 3 hours sleep before going back on watch.

In port, both the master and the chief officer were required to work. The master dealt with paperwork and officials associated with entering and leaving port, and the chief officer was responsible for discharging and loading the cargo. This, invariably, led to disruption of the 6-on 6-off pattern worked at sea.

Records of the hours worked by the master and the chief officer were kept at all times, both to enable overtime to be calculated and also to ensure that neither was working excessive hours. Although these timesheets for June 2003 were lost with *Jambo*, the previous month's were available (**see Appendix**).



## 1.6 FATIGUE

### 1.6.1 The chief officer's view

The chief officer felt tired during his watch on the morning of 29 June because he was unable to sleep before going on watch. He found the 6-on 6-off watch pattern tiring, especially when it was altered regularly by extra working duties when in port.

There were no apparent reasons for his being unable to sleep; his cabin was sufficiently quiet and his bunk comfortable; and there was nothing specific on his mind that may have kept him awake.

### 1.6.2 Company instructions

The company's safety management system (SMS) contained the following instructions on fatigue:

#### Fatigue

*The officer in charge of the first watch when leaving port should be adequately rested prior to going on watch to ensure that a safe and efficient watch is maintained. This is necessary from a health, as well as a safety consideration.*

*The Master is expected to interpret this requirement in a reasonable manner and with the safety of the crew and ship firmly in mind. Masters must make suitable watch arrangements to ensure an adequate amount of rest while maintaining a reasonable momentum of work.*

### 1.6.3 Regulations governing fatigue

The international regulations designed to prevent fatigue in watchkeeping officers are laid down in STCW 95 Section A-VIII/1 *Fitness for duty*, which states:

- 1 *All persons who are assigned duty as officer in charge of a watch or as a rating forming part of a watch shall be provided a minimum of ten hours of rest in any 24-hour period.*
- 2 *The hours of rest may be divided into no more than two periods, one of which shall be at least six hours in length.*
- 3 *The requirements for rest periods laid down in paragraphs 1 and 2 need not be maintained in the case of an emergency or drill or in other overriding operational conditions.*

- 4 *Notwithstanding the provisions of paragraphs 1 and 2, the minimum period of ten hours may be reduced to not less than six consecutive hours provided that any such reduction shall not extend beyond two days and not less than 70 hours rest are provided each seven-day period.*
- 5 *Administrations shall require that watch schedules be posted where they are easily accessible.*

#### 1.6.4 Further research

The QinetiQ Centre for Human Sciences was contracted by the MAIB to study the chief officer's routines and hours of work in the days and months preceding the accident, and to comment on his likely level of fatigue at the time. They were also told that his sleeping conditions were satisfactory and that there was nothing in particular on his mind.

Sections of QinetiQ's report are included below:

##### *The 'six-on six-off' system*

*The division of work into six-hour watches means that individuals work the same two six-hour periods throughout the voyage. The Mate was responsible for covering the two periods from 0000-0600 and from 1200 to 1800. This is the more difficult of the two work patterns, as it covers the six-hour period during the night when individuals are naturally most tired. This is due principally to the influence of the circadian rhythm or 'body clock' which normally reaches its lowest point between 0400 and 0600. At this time, alertness and performance tend to be at their lowest and it is most difficult to resist the pressure for sleep.*

*When the low point of the circadian rhythm corresponds the later stages of a long period of continuous work, then the problems are likely to be more severe. It is therefore an advantage of the six-on six-off system that the night watch is only six hours in duration. A disadvantage is that there is then only a six-hour period at the end of the watch in which to have a recovery sleep. If there is any residual tiredness, there is the possibility of taking a nap at some time between 1800 and 2400, although this is not a natural time for sleep. The Mate's inability to sleep during this period prior to the accident is not surprising.*

*However, the question arises for how long such a pattern can reasonably be operated. In general, it is preferable to minimise the number of consecutive night duties in order to limit the sleep deficit associated with successive daytime sleeps.*

*From the information available [supplied by MAIB], it appears that the Mate had been working for approximately twelve hours a day over at least the ten days prior to the accident, and possibly for a considerably longer period. The periods at sea are interspersed by shorter periods in port, where most of the duty is*

carried out by day. However, there appears to have been only six hours available for overnight rest in Dublin immediately prior to the final voyage. The last opportunity for a full night's sleep was while the vessel was berthed in Glasgow, four nights before the accident took place.

*There is a continual alternation between the pattern at sea, involving night work, and the short periods in port where work is mainly during the day. This is not an ideal work pattern as there is little time for the body to adapt to the new routine. In these circumstances, it is important that some recovery from the night work can be provided when in port, so that the crew member can be reasonably well rested before setting sail.*

*The six-on six-off work pattern may be tolerable for relatively extended periods, but the disruption of rest caused by periods of work in port inevitably causes high levels of fatigue and the six-on six-off pattern does not facilitate recovery.*

In its conclusion, the QinetiQ report stated:

*This is a demanding work pattern, in which a high work rate is combined with frequent night work. In this situation, there is an increased risk of excessive sleepiness overnight.*

QinetiQ also used a computer program, developed to predict levels of fatigue in aircrew, to assess the likely level of fatigue being suffered by the chief officer over the months of April and May. This was adapted to suit the marine environment, and the following conclusion was reached:

*... the model used indicates very high levels of fatigue in several duty periods, particularly between 0200 and 0600. Such high levels of fatigue are likely to be associated with significant impairment of alertness and difficulty in remaining awake, particularly when engaged in monotonous tasks. This suggests that the combination of circumstances that led to the chief officer falling asleep was not unique. It appears that his work pattern entailed a recurrent risk of fatigue likely to compromise his ability to perform watchkeeping duties reliably.*

## **1.7 THE CREW**

### **1.7.1 General**

On 8 August 2002, the Department of Merchant Shipping of the Republic of Cyprus issued *Jambo* with a minimum safe manning document.

In compliance with this document, *Jambo* had seven crew, consisting of the master, chief officer, chief engineer, two ABs, OS and cook. The master was Croatian and the rest of the crew were Polish. All had been supplied by the Cypriot-based manning agency Seagiant Shipmanagement Ltd, used for all crews employed by Reederei Hesse.

### 1.7.2 The master

The master knew the vessel well. He had been on board for 5 months and 1 day, of this, his third trip on *Jambo*. He had been sailing as a master for 27 years.

### 1.7.3 The chief officer

The chief officer had been on board for 3 months and was well respected by the master. He had been sailing as a chief officer for 5 years with this manning agency.

## 1.8 ENVIRONMENTAL CONDITIONS

Conditions on 29 June 2003 were calm, and visibility was excellent. Although sunrise was at 0459 ship's time (0259 UTC), full darkness was never reached and the horizon was visible throughout the night.

High water at Ullapool was at 0844 ship's time (0644 UTC). It was the day before spring tides and the predicted tidal stream in the area of the grounding was less than 1 knot.

## 1.9 ROUTE PLANNING

*Jambo* often used the Minches when sailing north from Ireland. The selection of the route was not laid down by the company but was left to the master. Both the master and the chief officer had navigated through the Minches on many previous occasions.

### 1.9.1 Navigational constraints

IMO Resolution A.768(18), adopted on 4 November 1993, paragraph 3.1.3 states:

*Except due to stress of weather or any other case of force majeure, all laden tankers over 10000 gross tonnage should not pass through the Minches.*

All vessels passing through the Minches are recommended by the Resolution to report to Stornoway Coastguard on channel 16, at least 1 hour before the ETA of entering the route, and again on final departure. This guidance is also detailed in the UKHO's Sailing Directions for the West Coast of Scotland.

*Jambo* did report as required, to the Stornoway Coastguard, at 2005 UTC on 28 June 2003.

The IMO was considering a number of proposed "particularly sensitive sea areas" (PSSAs), including the Minches. However, should the Minches become a PSSA, it is intended only that the reporting procedure currently in place be made mandatory.

## 1.9.2 Company instructions

The company's standing orders, with regard to navigation, read as follows:

*The voyage should be planned, considering information from the charts, tide tables and weather forecasts. The charts must be kept corrected and well prepared with marked course, course changes, dangerous grounds, relevant VHF-Channels, reporting points etc.*

The MAIB has no reason to believe that this instruction was not carried out.

The company's safety management system also includes the following instructions for *Navigating in Narrow and Busy Traffic Areas*:

- *Safe and careful navigation is important for the safety of crew, ship and cargo.*
- *It is a substantial aspect that all vessels maintain capability of good manoeuvrability.*
- *That means the vessel has to be able to reduce speed, stop and go astern at any time.*
- *All necessary engines have to be on stand by.*
- *Increased position plotting is necessary.*
- *Sailing directions shall be read in advance.*
- *Tidal predictions to be obtained and considered at all times.*

It would appear that since the engine was not on stand-by, and the number of positions being plotted on the chart was limited, these instructions were not complied with. Also, although increased position plotting may have alerted the chief officer to the fact that he had missed a waypoint, he would have to have been awake to have done this.

Regarding passage planning and fatigue, the company SMS includes the following instructions:

*Passage planning should be carried out in accordance with the Bridge Equipment Checklist (BEC). The plan should be made out on the Passage Plan checklist which should be signed by the Navigating Officer and Master prior to sailing.*

Again, these instructions were followed, although the associated paperwork was lost with the vessel. This paperwork would have been retained on board for reference and for audits.

## 1.10 CONDUCT OF THE PASSAGE

### 1.10.1 Navigation

The chief officer's normal practice was to monitor the vessel's position using the radar and one of the three available GPS readouts on the bridge. He altered course at the waypoints entered into the GPS plotter, and marked these positions on the chart.

Waypoints were put into *Jambo's* GPS plotter, and waypoint alarms were enabled. However, these had a low sound level and there was no off-track alarm facility on the device.

### 1.10.2 Precautions

Other than the posting of ABs on the bridge from 2200 to 0600, the master took no precautions before sailing through the Minches.

The precautions required by the company SMS are discussed in Section 1.9.2.

## 1.11 LOOKOUT ROUTINES

The company's SMS specifies that an additional lookout must be called to the bridge during restricted visibility, and whenever the officer of the watch deems it necessary.

The master's normal practice was to require ABs to be on the bridge between 2200 and 0600, during periods of restricted visibility and when close to land. These ABs acted as lookouts when required, but also carried out other duties as required by the watchkeeper. These normally included hourly rounds and inspecting the accommodation and engine room.

STCW 95 states in Section A-VIII/2 paragraphs 14 and 15:

*14. The look-out must be able to give full attention to the keeping of a proper lookout and no other duties shall be undertaken or assigned which could interfere with that task.*

*15. The duties of the look-out and helmsperson are separate and the helmsperson shall not be considered to be the look-out while steering, except in small ships where an unobstructed all-round view is provided at the steering position and there is no impairment of night vision or other impediment to the keeping of a proper lookout. The officer in charge of the navigational watch may be the sole look-out in daylight provided that on each such occasion:*

- .1 the situation has been carefully assessed and it has been established without doubt that it is safe to do so*

.2 *full account has been taken of all relevant factors including, but not limited to:*

- *state of the weather,*
- *visibility,*
- *traffic density,*
- *proximity of dangers to navigation, and*
- *the attention necessary when navigating in or near traffic separation schemes; and*

.3 *assistance is immediately available to be summoned to the bridge when any change in the situation so requires.*

At the time of the accident, it was not full darkness. Sunrise was at 0259 UTC, but full darkness was never reached, and the horizon was visible throughout the night.

## **1.12 BRIDGE EQUIPMENT**

### **1.12.1 General**

There were no reports of any malfunction in the navigational equipment available on the bridge.

The chief officer described the condition of the computer monitor used to complete his paperwork as being poor, in that it was difficult to read in daylight. However, this had not been brought to the attention of the management company.

### **1.12.2 Watch alarm**

Bridge navigational watch alarms are systems fitted to the bridge of vessels to ensure that in the event of the watchkeeper being incapacitated for any reason, the remaining deck officers on board are alerted.

They usually consist of alarms in either the master's cabin and/or the deck officers' accommodation. The bridge watchkeeper is required to reset a timer on the system at regular intervals not exceeding a set time, often about 10 minutes. The method used to reset this timer varies from system to system, but the simplest systems have a number of buttons located on the bridge, and pressing any one of these at any time resets the timer.

Should the timer not be reset, the system will usually warn the watchkeeper on the bridge and then sound the alarm, alerting the master and/or the remaining deck officers that the watchkeeper is not able to reset the timer.

*Jambo* was not equipped with any form of watch alarm, nor was any such device required by regulation.



Of the eight vessels operated by Reederei Hesse, only *Jambo* and her sister vessel were not fitted with a watch alarm.

## **1.13 SAFETY MANAGEMENT**

### 1.13.1 The ISM Code

On 29 November 1999, in Rotterdam, Lloyd's Register issued *Jambo* with her Safety Management Certificate.

### 1.13.2 The company safety management system

The ISM compliant safety management system used by Reederei Hesse was written in-house for the vessels run by the company. The MAIB considered the system to be good, simple and user-friendly.

While all safety management systems incur a degree of paperwork, that associated with the SMS on *Jambo* was not excessive.

## **1.14 CURRENT STUDIES/RESEARCH PROJECTS**

### 1.14.1 Safety studies/research projects

There are currently three safety studies/research projects, which include aspects on seafarers' fatigue in the short-sea and coastal shipping industry. They are as follows:

1. The Seafarers' International Research Centre is carrying out a three-phase research project in *Fatigue Offshore*. This is being conducted jointly with Cardiff University's Centre for Occupational and Health Psychology and is supported by the MCA and other organisations.
2. The MCA is starting a research project into European flag states' criteria for minimum safe manning levels.
3. The MAIB is conducting a safety study into bridge watchkeeping issues.

### 1.14.2 Additional research

A research project is being carried out on behalf of the MCA into vessel traffic in environmentally sensitive and high traffic areas. This is an ongoing study, incorporating the accident rates for the areas being studied.

The results of this study will be used for a number of purposes including the consideration of possible traffic protection measures such as mandatory reporting, traffic separation schemes and other routing measures.

The area of the Minches has been programmed in to be studied in 2004.



## 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 CAUSE OF ACCIDENT

*Jambo* went aground because the waypoint was missed by the chief officer who was alone on the bridge and asleep.

The chief officer, who knew he was tired, did not ensure that the available lookout remained on the bridge. He allowed the lookout to go below to complete his rounds. However, the chief officer did this expecting the lookout to return with a cup of strong coffee within a few minutes.

The fact that the chief officer was fatigued is discussed in Section 1.6. However, fatigue not only causes sleepiness and lack of alertness, but is also known to affect people's judgment. In his condition, it is quite possible that his judgment was seriously impaired and his decisions (a) in allowing the lookout to go below, and (b) in not altering course, as marked on the chart, off the Eileen Trodday light, might have been affected by this impairment.

### 2.3 OTHER INCIDENTS

As a result of the MAIB's concern about this and other similar accidents it has investigated, a preliminary search of the MAIB's database for incidents from 1993 to 2003 involving bridge watchkeepers' incapacitation or absence, was carried out. Early results totalled some 60 groundings in UK waters.

This is clearly a serious issue, leading to about six groundings per year in UK waters on average. To ensure a comprehensive study of these concerns, the MAIB is carrying out a safety study into bridge watchkeeper issues, and the findings of this, and earlier reports, will be included in that study.

Similar accidents investigated by the MAIB include: *Golf Star* (1995), *Normannbay* (1996), *Cita* (1997), *Pentland* (1998), *Coastal Bay* (2000), *Lomur* and *Lysfoss* (2001), and *Mulheim* (2003).

### 2.4 MANNING LEVELS

The manning level on board *Jambo* complied with the minimum safe manning document issued to the vessel on 8 August 2002 by the Department of Merchant Shipping of the Republic of Cyprus.

This document was applied for by Reederei Hesse's representative in the normal way, and it was issued. The previous safe manning document for the vessel also stipulated a minimum crew of seven, and the vessel was originally built with accommodation to suit this number.

In the professional judgment of the MAIB, for an experienced chief officer to become so fatigued as to fall asleep for an hour or more while on watch, the level of manning on board must have been insufficient for the operation it was conducting. However, when issuing minimum safe manning certificates, the working pattern of the vessel is not necessarily considered. The workload of the crew is considered to be sufficiently regulated by STCW 95 Section A-VIII/1 Fitness for Duty.

Reederei Hesse tries to have a cadet on each of its vessels. However, there are problems in providing sufficient accommodation, and, although they do ease the general workload, cadets are of limited value in reducing the watchkeepers' workload.

#### 2.4.1 Commercial considerations

The majority of vessels in this sector of industry operate a two watch system. To operate a three watch system would put the ship owner at a commercial disadvantage. Therefore, operators are reluctant to increase manning above the minimum "safe" manning required by international regulations. However, the minimum safe manning is the minimum manning level required to take the vessel to sea. It does not take into account the vessel's usage. It is the responsibility of the operator to ensure that the manning level on board is sufficient for the safe operation of the vessel in its intended usage.

#### 2.4.2 Risk assessment

There was no requirement to undertake any form of risk assessment on minimum safe manning as part of the application for this document. Again, the fatigue issue is considered by flag states to be adequately covered by STCW 95 Section A-VIII/1.

However, risk assessments by the operator, on the safety of the operation, should be carried out to ensure that the manning is sufficient for the safe operation of the vessel in its intended usage.

As the MCA is conducting a research project into minimum manning levels, and it is applicable to this accident, it is recommended that the findings be taken forward to IMO, along with the findings from the projects described in Section 1.14.

## 2.5 LOOKOUT

The implications of the standards regarding watchkeeping stated in STCW 95 Section A-VIII/2, especially paragraphs 14 and 15 quoted in Section 1.11, have been the subject of discussion among seafarers since they were first issued. The MAIB has also discussed the need for clarification of these standards in a number of its reports, and has, in the past, recommended to the MCA to further at IMO that the requirements of paragraph 15 are made clear.

The AB assigned to the watch, was absent from the bridge for at least an hour before *Jambo* grounded. Instead of acting as lookout, he was working on a maintenance task in the ship's office.

As the chief officer was tired, the vessel was close to land and in uncertain light, common sense and best practice would suggest that allowing the lookout to stay below for long periods was, at best, ill-advised.

## 2.6 WATCH ALARM

There was no watch alarm fitted on the bridge of *Jambo*, nor was there a requirement for such a device to be fitted.

What STCW 95 Section A-VIII/2 paragraph 15 is quite clear about, is that:

*The officer in charge of the navigational watch may be the sole look-out in daylight provided that on each such occasion:*

- .1 the situation has been carefully assessed and it has been established without doubt that it is safe to do so*

The only way to establish without doubt that it is safe for the OOW to be the sole lookout, is to ensure that should he become incapacitated in any way, this fact is brought to the attention of the remaining deck officers without delay.

It is not sufficient to have the lookout 'on the end of a radio', when MAIB experience shows that one of the prime dangers is that of the OOW being unable to call the lookout because he is incapacitated by fatigue or some other reason. Therefore, if lookouts are not maintained on the bridge at all times, it is essential that such vessels are fitted with watch alarms.

In resolution MSC.128(75) adopted on 20 May 2002, the IMO sets out *performance standards for a bridge navigational watch alarm system*. This resolution recognises that *many operational bridge-related marine accidents could be averted if an effective and operational bridge navigational watch alarm system were fitted to vessels*. However, there were no regulations requiring the fitting of such a device at the time of the accident.

Had a watch alarm been fitted, and been in operation on *Jambo*, her master would have been alerted to the fact that the chief officer had fallen asleep. This would have allowed him to take over the watch and probably have prevented the vessel grounding.

The MAIB recognises the value of watch alarms, and has made a recommendation to the MCA, to take up at IMO the mandatory fitting of watch alarms to all vessels.

Although recommending the fitting and use of watch alarms, the MAIB is aware that these devices are an attempt to address the symptoms, rather than the causes of, fatigue in watchkeepers. This issue is addressed below.

## 2.7 FATIGUE

### 2.7.1 Working pattern

The MAIB analysed the available data regarding the hours worked by the chief officer on *Jambo* using the timesheets for March, April and May, and the chief officer's description of his work and rest in the days leading up to the accident. The results of this analysis are shown in the **Appendix**. The MAIB concluded that the hours he worked in the days preceding the accident generally conformed with the regulations. There were, however, periods when he had less than 6 consecutive hours rest in a 24 hour period, these could be considered to have been as a result of overriding operational conditions and, as such, be covered by the exemption clause of the regulations.

The company's SMS requires the master to ensure that the officer in charge of **the first watch when leaving port** is adequately rested prior to going on watch. However, it makes no provisions to ensure that watchkeepers in general are protected from the cumulative effects of disrupted watch patterns.

Although the regulations go some way in ensuring that watchkeepers are not overly fatigued during duty periods, they do not address the issue of disrupted routines either. Six-on six-off watches are tiring in any event. To have this pattern broken by regular port visits, when the chief officer was required to work, regardless of how this disrupted his watch pattern, led to increased levels of fatigue.

Cumulatively, over the time the chief officer had been working on *Jambo*, this led to him suffering very high levels of fatigue. As QinetiQ comments in its report:

*In general, it is preferable to minimise the number of consecutive night duties in order to limit the sleep deficit associated with successive daytime sleeps.*

And:

*There is a continual alternation between the pattern at sea, involving night work, and the short periods in port where work is mainly during the day. This is not an ideal work pattern as there is little time for the body to adapt to the new routine. In these circumstances, it is important that some recovery from the night work can be provided when in port, so that the crew member can be reasonably well rested before setting sail.*

While leaving Dublin before the accident, very little recovery from the disrupted sleep was possible. In fact, the chief officer had only 6 hours available for rest after a 13 hour day, before going on watch.

Crucially, he was unable to sleep on the evening before the accident. In the MAIB's opinion, this was not as a result of his feeling adequately rested, but a combination of his having just eaten his one and only meal of the day (itself a product of his watches clashing with the meal times on board) and this not being a natural time for sleep, as stated in the QinetiQ report.

QinetiQ also observed:

*Company instructions recognise the master's responsibility to ensure that the officer in charge of the first watch, when leaving port, is adequately rested and emphasise the safety implications of this requirement. The instructions also draw attention to the need to consider the maintenance of a "reasonable momentum of work". Balancing the potential consequences of fatigue, against the commercial consequences of a delayed departure, demands fine judgment. It is likely that masters will, probably more often than not, be more influenced by commercial than by safety considerations simply because the commercial impact is immediately apparent and the risks, by their nature, are only probable. The master's judgment would also be influenced by whether or not he considered that regulations had been complied with. It is not, therefore, surprising that the master made no provision to compensate for the disrupted rest experienced by the chief officer in Dublin and allowed him to return to the six-on six-off schedule that night.*

The chief officer found the six-hour watch pattern difficult, particularly in light of the frequent disruptions when in port. On his previous vessel, which had not been operated by Reederei Hesse, he had been one of three watchkeepers working a four-on eight-off watch rota. This was an arrangement he found much easier and which allowed him more time to recover from out-of-watch work, such as when in port.

As mentioned earlier in this report, the fatigue suffered by the chief officer, not only made him sleepy, but also affected his judgment, and this may have contributed to his failure to ensure that the lookout was put to best use.

In conclusion, the chief officer fell asleep as a result of fatigue brought about by his irregular working and sleeping hours over the preceding months since he joined *Jambo*. Since his hours of rest were generally found to be within the requirement of the regulations, these appear to have provided insufficient protection from fatigue.

### 2.7.2 The Seafarers' International Research Centre

The Seafarers' International Research Centre is conducting a three-phase research project into *Fatigue Offshore*. This is being carried out jointly with Cardiff University's Centre for Occupational and Health Psychology and is supported by the MCA and other organisations.

Phase 2 of this research was completed as this report was being written. Its conclusions included:

*Fatigue is best predicted by exposure to a combination of potential hazards. This has important implications for audits, suggesting that it is inappropriate to focus on individual factors such as working hours.*

This supports the MAIB's findings that the hours of rest regulations are insufficient, and suggests that they may over simplify the means of avoiding fatigue.

Phase 2 also recognised that:

*There are also other variables, such as voyage cycle time, that potentially may lead to fatigue but which we have not been able to study in the present project.*

As a result of this, phase 3 will include a more detailed study of the development of fatigue, by looking at the effects of different port/sea cycles.

In addition to this, phase 3 has a number of stated aims, which include:

*To extend the research to other sectors: Short-haul bulkers, feeder and mainline containerships, reefers, long-haul tankers and cruise ships will be studied.*

*In addition, a survey will be conducted to assess fatigue, health and injury in the fishing industry.*

*The impact of fatigue on multi-tasking will also be investigated with the view to determining which working practices may lead to greater risk (eg problems of the "one man bridge" where the watchkeeper may also be doing paperwork or other tasks).*

At the time of writing this report, neither phase 3 of this research project, nor the MAIB and MCA safety studies/research projects, were completed. The MCA is therefore recommended to take the findings of the above three safety studies/research projects, once completed, and forward to the IMO.

## **2.8 ENVIRONMENTAL ISSUES**

This accident could have occurred in any coastal waters. It was not the result of any particular hazard to navigation.

It is not the remit of the MAIB to evaluate the sensitivity of the environment in which an accident occurs, or damage to that environment caused by an accident. However, the ongoing work being carried out on behalf of the MCA, into vessel traffic in environmentally sensitive and high traffic areas of the UK coast, will include the area of the Minches. This research will take into account the number and type of accidents in these areas.

In light of this, and other similar accidents in the area of the Minches, a recommendation has been made to the MCA to ensure that this element of the research is conducted as soon as possible, and that the results are analysed and any safety measures identified are put in place.

## SECTION 3 - CONCLUSIONS

### 3.1 SAFETY ISSUES

The following are the safety issues identified in the MAIB investigation. They are not listed in any order of priority but are in the order in which they appear in the analysis:

1. *Jambo* went aground because the waypoint was missed. [2.2]
2. The waypoint was missed by the chief officer who was alone on the bridge and asleep. [2.2]
3. Bridge watchkeeper incapacitation or absence has led to over six groundings a year in UK waters on average between 1993 and 2003. [2.3]
4. When issuing minimum safe manning certificates, the working pattern of the vessel is not necessarily considered by flag states, because the workload of the crew is considered to be sufficiently regulated by STCW 95 Section A-VIII/1 Fitness for duty. [2.4]
5. The AB assigned to the watch was absent from the bridge for at least an hour before the vessel grounded. [2.5]
6. No bridge watch alarm was fitted on the bridge of *Jambo*. [2.6]
7. There were no regulations requiring the fitting of a bridge watch alarm at the time of the accident. However, if an operational alarm had been fitted, it would have probably prevented this accident. [2.6]
8. Although the chief officer's work pattern generally conformed with the hours of work regulations, he fell asleep as a result of fatigue. [2.7]
9. The regulations governing hours of rest and the relevant company instructions did not adequately protect the chief officer from the effects of fatigue, as they failed to cope with the disruption entailed in loading operations in port. [2.7]
10. There are currently three safety studies/research projects which include aspects on seafarers' fatigue in the short-sea shipping sector. [2.7]
11. There is currently a research project into accident statistics and vessel traffic in environmentally sensitive and high traffic areas, including the Minches, being carried out on behalf of the MCA. [2.8]



## **SECTION 4 - ACTION TAKEN**

### **4.1 WATCH ALARM**

On 2 July 2003, Reederei Hesse ordered a *bridge watch alarm with recording system*. This was to be fitted on board *Plato*, the only other vessel in its fleet not already equipped with a bridge watch alarm.

The specification for this device includes the requirement that the times when it is switched off and on are logged internally. This will allow Reederei Hesse to monitor its use, and ensure that it is not left switched off while the vessel is at sea.

### **4.2 MANNING**

In February 2003, Reederei Hesse wrote to Gdynia Maritime School Ltd, confirming its intention to enter into an agreement to ensure that young Polish men and women from maritime schools receive the necessary instruction, during their initial vocational training, to become competent navigational and engineering OOWs.

## **SECTION 5 - RECOMMENDATIONS**

**The Maritime and Coastguard Agency (MCA)** is recommended to:

1. Take forward, to the IMO, the compulsory fitting of watchkeeper alarms to all vessels when there is an intention to operate with a sole person on watch.
2. Take the findings from the following three safety studies/research projects to IMO, with a view to instigating an international way forward to address the problem of bridge watchkeeper fatigue:
  - Seafarers' International Research Centre project into fatigue offshore.
  - MCA's research project into Safe Manning Requirements in near coastal waters in Europe.
  - MAIB's Bridge Watchkeeping Safety Study, (due to be published in 2004).
3. Ensure that the research into vessel traffic in the Minches is conducted as soon as possible, that the results are analysed, and any safety measures identified are put in place.

**Marine Accident Investigation Branch  
December 2003**

**RECORD OF CHIEF OFFICER'S WORKING HOURS**

**Compiled from time sheets for March, April and May 2003, and  
chief officer's description of his work and rest  
in the days leading up the accident**

M.V. Jambo

Working hours

Chief Officer

Time	From	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	WORK	REST in 24 hours	Previous 7 days rest
	to	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00				
Mar	1									1	1	1		1	1	1	1	1	1							9	15	
	2	1	1	1	1	1	1							1	1	1										9	15	
	3									1	1	1	1								1	1	1	1		12	12	
	4									1	1	1	1								1	1	1	1		12	12	
	5				1	0.5				1	1	1	1		1	1	1	1	1							10.5	13.5	
	6	1	1	1	1	1	1							1	1	1	1	1	1							12	12	
	7	1	1	1	1	1	1							1	1	1	1	1	1		1					12	12	91.5
	8	1	1	1	1	1	1							1	1	1	1	1	1							12	12	88.5
	9	1										1									1		1	1	1	7	17	90.5
	10	1	1	1	1	1	1	1	1						1	1	1	1	1							12	12	90.5
	11	1	1	1	1	1	1							1	1	1	1	1	1							12	12	90.5
	12						1		1	1	1	1	1		1	1	1	1	1							11	13	90
	13	1	1	1						1	1	1	1		1	1	1	1	1		1					12	12	90
	14							1	0.5	1	1	1	1		1	1	1	1	0.5		1	1				12	12	90
	15							1	0.5	1	1	1	1		1	1	1									8.5	15.5	93.5
	16	1	1	1	1	1	1							1	1	1	1	1	1							12	12	88.5
	17	1	1	1	1	1	1							1	1	1	1	1	1							12	12	88.5
	18	1	1					1	1	1	1	1	1		1	1	1	1								12	12	88.5
	19							1	0.5	1	1	1	1		1	1	1	1			1	1	0.5			12	12	87.5
	20									1	1	1	1		1	1	1	1	1							9	15	90.5
	21	1	1	1	1	1	1							1	1	1	1	1	1							12	12	90.5
	22	1	1	1	1	1	1							1	1	1	1	1	1							12	12	87
	23																									0	24	99
	24									1	1	1	1		1	1	1	1	1				0.5	1		10.5	13.5	100.5
	25									1	1	1	1		1	1	1	1	1							9	15	103.5
	26	1	1	1	1	1	1			1	1				1	1	1	1	1							13	11	102.5
	27	1	1	1	1	1	1							1	1	1	1	1	1							12	12	99.5
	28									1	1	1	1		1	1	1	1			1	1				10	14	101.5
	29	1	1	1	1	1	1							1	1	1	1	1	1							12	12	101.5
	30	1	1	1	1	1	1							1	1	1	1	1	1							12	12	89.5
	31	1	1	1	1	1	1							1	1	1	1	1	1							12	12	88

M.V. Jambo

Working hours

Chief Officer

Time	From to	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	WORK	REST in 24 hours	Previous 7 days rest
		1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00				
Apr	1														1	1	1	1	1	1	1	1	1	1	1	12	12	85
	2								0.5	1	1	1	1	1	1	1	1	1	1	1						10.5	13.5	87.5
	3	1	1	1	1	1	1								1	1	1	1	1	1						12	12	87.5
	4				1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	0.5			17.5	6.5	80
	5			1	1	1	1	1	1						1	1	1	1	1	1						11	13	81
	6	1	1	1	1	1	1	1							1	1	1	1	1	1						12	12	81
	7			1	1	1	1	1	1	1					1	1	1	1	1	1	0.5	0.5				14	10	79
	8	1	1	1	1	1	1								1	0.5	1	1	1	1						11.5	12.5	79.5
	9									1	1	1	1			1	1	1	1	1						9	15	81
	10									1	1	1	1			1	1	1			1					8	16	85
	11	1	1	1	1	1	1								1	1	1	1	1	1		0.5	0.5			13	11	89.5
	12									1	1	1	1			1	1	1	1	1	0.5		0.5	1		11	13	89.5
	13	1	1	1	1	1	0.5								1	1	1	1	1	1						11.5	12.5	90
	14	1	1	1	1	1	1								1	1	1	1	1	1						12	12	92
	15	1	1	1	1	1	1	1	0.5	1	1				0.5	1	1	1	1	1						15	9	88.5
	16	1	1	1	1	1	1	1	1							1	1	1	1	1	1		1	1	1	15	9	82.5
	17	1	1	1	1	1	1								1	1	1	1	1	1						12	12	78.5
	18	1	1	1	1	1	1								1	1	1	1	1	1						12	12	79.5
	19	1	1	1	1	1	1								1	1	1	1	1	1						12	12	78.5
	20	1	1	1	1	1	1								1	1	1	1	1	1	0.5	0.5	0.5	0.5		14	10	76
	21										1	1														2	22	86
	22									1	1	1	1			1	1	1	0.5		1	1	0.5			11	13	90
	23									1	1	1	1			1	1	1	1							8	16	97
	24	1	1	1	1	1	1								1	1	1	1	1	1						12	12	97
	25	1	1	1	1	1	1								1	1	1	1	1	1	1	1	1	1	1	18	6	91
	26	1	1	1	1	1	1								1	1	1	1	1	1	1	1	1	1	1	18	6	85
	27															1	1									2	22	97
	28								0.5	1	1	1	1			1	1	1	1							8.5	15.5	90.5
	29	1	1	1	1	1	1								1	1	1	1	1	1						12	12	89.5
	30	1	1	1	1	1	1			1	0.5				1	1	1	1	1	1		1				14.5	9.5	83

M.V. Jambo

Working hours

Chief Officer

From Time	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	WORK	REST in 24 hours	Previous 7 days rest
	to 1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00			
May 1	1	1	1	1	1	1				1	1	1								1	1	1	1	1	9	15	80
2									1	1	1	1		0.5	1	1	1	1		1	1	1	1	1	14.5	9.5	83.5
3	1	1	1	1	1	0.5								1	1	1	1	1		1	1	1			13.5	10.5	72
4	1	1	1	1	1	1							1	1	1	1	1	1							12	12	68.5
5	1	1	1	1	1	1							1	1	1	1	1	1							12	12	68.5
6	1	1	1	1	1	1							1	1	1	1	1	1							12	12	71
7	1	1	1	1	1	1							1	1	1	1	1	1					1	0.5	13.5	10.5	81.5
8									1	1	1	1		1	1	1	0.5					1			9.5	14.5	81
9	1	1	1	1	1	1							1	1	1	1	1	1							12	12	83.5
10	1	1	1	1	1	1							1	1	1	1	1	1							12	12	85
11	1	1	1	1	1	1							1	1	1	1	1	1							12	12	85
12			1	1	1	1					0.5		1	1	1	1	1	1		1	0.5				12	12	85
13	1	1	1	1	1	1							1	1	1	1	1	1							12	12	85
14	1	1	1	1	1	1							1	1	1	1	1	1		0.5	0.5		1		14	10	84.5
15		1					1	1	1	1	1	1	1	1	1	1				0.5	1		1	1	13	11	81
16	1	1	1	1	1	1	1	1					1	1	1	1	1	1							14	10	79
17	1	1	1	1	1	1		1	1																8	16	83
18										1	1	1													3	21	92
19									1	1	1	1		1	1	1	1								8	16	96
20								1	1	1	1	1		1	1	1									8	16	100
21	1	1	1	1	1	1							1	1	1	1	1	1					1	1	14	10	100
22	1	1	1	1	1	1	1	1							0.5	0.5	0.5		0.5						10	14	103
23	1	1	1	1	1	1							1	1	1	1	1	1							12	12	105
24	1	1	1	1	1	1							1	1	1	1	1	1							12	12	101
25	1	1	1	1	1	1							1	1	1	1	1	1							12	12	92
26	1	1	1	1	1	1							1	1	1	1	1	1							12	12	88
27	1	1	1	1	1	1							1	1	1	1	1	1							12	12	84
28		0.5								0.5	1	1		1	1	1	1	1							9	15	89
29	1	1	1	1	1	1							1	1	1	1	1	1							12	12	87
30	1	1	1	1	1	1	1	1	1									1	1						11	13	88
31	1	1	1	1	1	1							1	1	1	1	1	1							12	12	88

M.V. Jambo

Working hours

Chief Officer

From Time	To Time	24	25	26	27	28	29	WORK	REST in 24 hours	Previous 7 days rest
0:00	1:00	1	1	1	1	1	1	19	5	
1:00	2:00	1	1	1	1	1	1	11	13	
2:00	3:00	1	1	1	1	1	1	13	11	
3:00	4:00	1	1	1	1	1	1	12.5	11.5	
4:00	5:00	1	1	1	1	1	1	12	12	
5:00	6:00	1	1	1	1	1	1	4.25	19.75	
6:00	7:00									
7:00	8:00	1	1	1	1	1	1			
8:00	9:00		1	1	1	1	1			
9:00	10:00	1	1	1	1	1	1			
10:00	11:00	1	1	1	1	1	1			
11:00	12:00	1	1	1	1	1	1			
12:00	13:00	1	1	1	1	1	1			
13:00	14:00	1	1	1	1	1	1			
14:00	15:00	1	1	1	1	1	1			
15:00	16:00	1	1	1	1	1	1			
16:00	17:00	1	1	1	1	1	1			
17:00	18:00	1	1	1	1	1	1			
18:00	19:00	1			0.5					
19:00	20:00	1								
20:00	21:00	1								
21:00	22:00	1								
22:00	23:00									
23:00	0:00				1					