Report on the investigation

of a rescue boat falling from

Pride of Bilbao

into Cherbourg Harbour

injuring two people

on 1 July 2000

Marine Accident Investigation Branch
First Floor, Carlton House
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Southampton
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Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999

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

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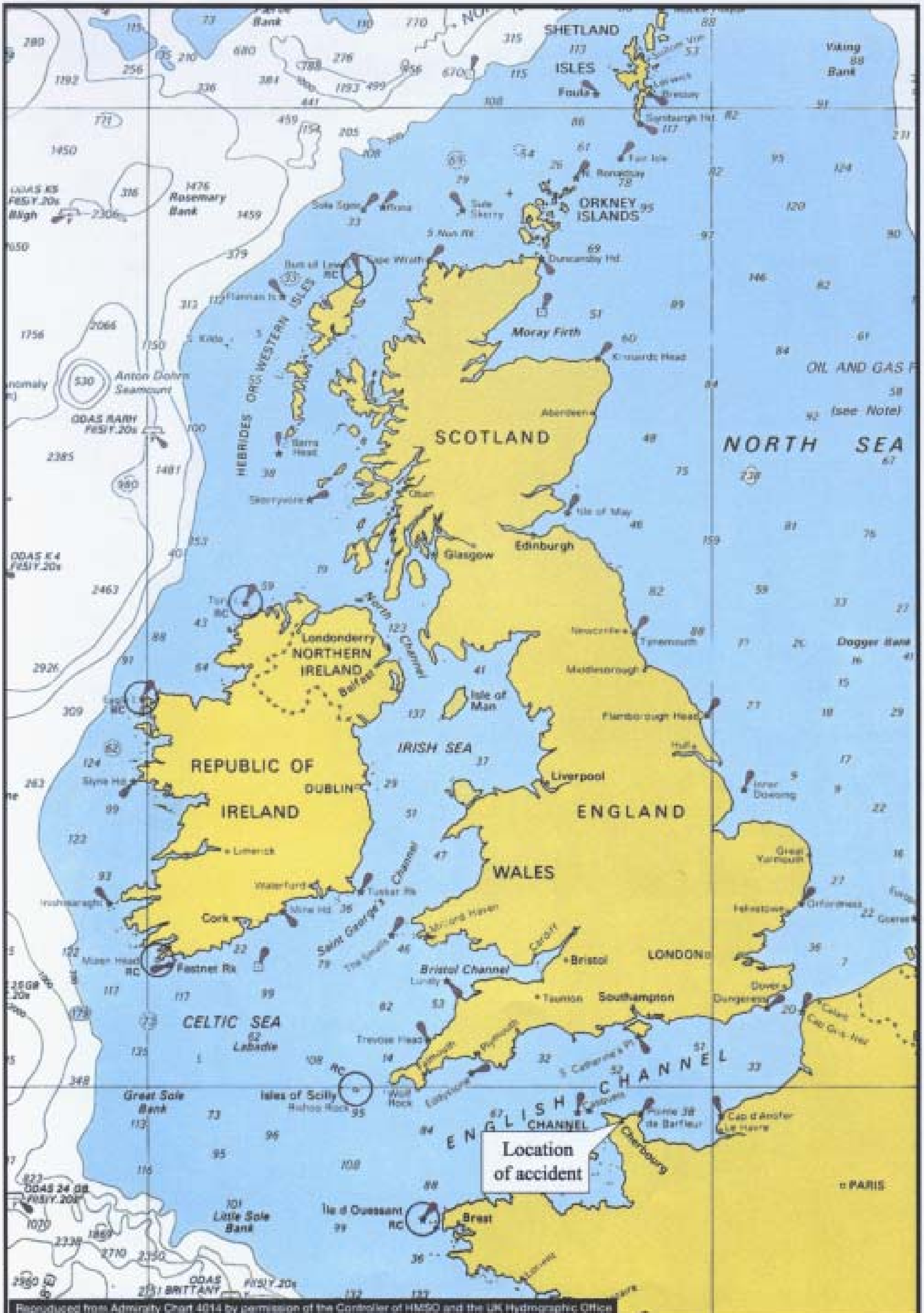
GLOSSARY OF ABREVIATIONS

AB	-	Able seaman
GRP	-	Glass reinforced plastic
IACS	-	International Association of Classification Societies
IMO	-	International Maritime Organization
kg	-	kilogram
LSA	-	Lifesaving appliances
m	-	metre
MCA	-	Maritime and Coastguard Agency
mm	-	millimetre
Ro-Ro	-	Roll-on Roll-off
SOLAS	-	Safety of Life at Sea (Convention)
UK	-	United Kingdom
UTC	-	Universal co-ordinated time


SHETLAND
ISLES
ORKNEY
ISLANDS
Moray Firth
SCOTLAND
NORTH SEA
OIL AND GAS
(see Note)
HEBRIDES
OR WESTERN ISLES
Edinburgh
Glasgow
Londonderry
NORTHERN
IRELAND
Belfast
North Channel
Isle of Man
IRISH SEA
REPUBLIC OF
IRELAND
DUBLIN
Liverpool
ENGLAND
WALES
Cork
Fastnet Rk
Saint George's Channel
Bristol Channel
Bristol
LONDON
Southampton
CELTIC SEA
Isles of Scilly
ENGLISH CHANNEL
Cherbourg
Brest
PARIS
Dogger Bank
Rosemary Bank
Anton Dohrn Seamount
Great Sole Bank
Little Sole Bank
Location
of accident
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SYNOPSIS

During the morning of 1 July 2000, the starboard rescue boat of the ro-ro passenger vessel *Pride of Bilbao* was being recovered from the water with three crewmen on board. The vessel was alongside her berth in Cherbourg, France. As its davits were reaching the fully stowed position, the boat dropped and fell into the water. Two of the crewmen were injured, one seriously.

The rescue boat is fitted with two off-load release suspension hooks, and an on-load painter release hook. The painter release hook is about 600mm forward of the forward suspension hook and is able to accept the forward suspension ring.

Recognising the possibility that the suspension ring could be fitted to the painter hook in error, the MAIB issued Safety Bulletin 4/2000 in August to alert owners, masters and crew to this potential hazard.

Further investigation and tests generated compelling evidence to indicate that during its recovery, the boat's forward suspension ring was inadvertently fitted to the painter hook. The lower blocks were then about 600mm further apart than the davit heads. As the boat was hoisted towards its stowed position, the change in lower block geometry prevented them from taking to the davit head horns.

The blocks then slipped, generating a shock load on the painter hook, and tearing it from the boat. Once support was lost at the forward end, the boat briefly swung from its aft suspension hook, before breaking away and falling to the water.

Pride of Bilbao's owners are recommended to amend the on-board training manuals for Lifesaving Appliances (LSA) to fully cover details for the launching, recovery and stowage of rescue boats, and the recovery and stowage of lifeboats.

They are advised to consider altering the dimensions of the rescue boats' painter release hooks, or make other suitable modifications, so they cannot accept the boats' suspension rings.

They are also recommended to advise the staff they employ to service their boats and davits, to use replacement parts which comply with manufacturer's specifications.

The International Association of Classification Societies (IACS) is recommended to inform its members of the immediate causes of this accident so that they can identify systems with similar potential dangers during surveys and type-approval examinations.

The Maritime and Coastguard Agency (MCA) is recommended to bring this incident to the notice of its surveyors, so that they can identify systems with similar potential dangers.

SECTION I - FACTUAL INFORMATION

1.1 PARTICULARS OF VESSEL AND ACCIDENT

Name	:	*Pride of Bilbao* (formerly *Olympia 1993*)
Type	:	Class II Ro-Ro passenger
Passenger capacity	:	2500
IMO Number	:	8414582
Official number	:	723527
Port of registry	:	Portsmouth
Tonnage	:	37,583
Length	:	176.82m
Passenger Ship Safety Certificate	:	Issued in Falmouth on 30 January 2000
Built	:	1986. Wartsila A/B (keel laid before 1 July 1986)
Owners	:	P&O European Ferries (Portsmouth) Ltd Peninsular House Wharf Road Portsmouth PO2 8TA

Rescue boat details:

Manufacturer	:	Fiskars
Length	:	7.1m
Hook distance	:	6.2m
Mass	:	2970kg
Material	:	GRP

Accident date and time	:	1 July 2000, 0945 UTC
Place	:	Cherbourg Harbour
Persons injured	:	Two

Pride of Bilbao port rescue boat (starboard boat similar)

1.2 NARRATIVE

In preparation for *Pride of Bilbao*'s arrival in Cherbourg at 0730 on 1 July 2000, members of her deck crew were alerted shortly after 0600. The vessel berthed and all vehicles were discharged by about 0800.

As part of the routine emergency training exercises, most of her staff attended a fire-fighting drill on the vehicle deck.

Following the fire drill a man overboard exercise was planned using the starboard rescue boat.

A crew of three able seamen (ABs) manned the boat, the bosun operated the winch and the chief officer supervised the launching. The three ABs wore waterproof suits, hard hats, safety boots and self-inflating lifejackets.

An initial inspection of the boat showed that the engine's cooling water level was very low, and there was a significant amount of water in the boat.

The chief engineer attended, and the cooling water system was replenished. Efforts were also made to pump out the boat, but these were not totally satisfactory.

The decision was made to launch the boat and pump it out at the vessel's bunkering station. By this stage the man overboard exercise had been abandoned.

The boat was launched with her crew of three ABs. The suspension hooks and painter hook were released remotely at the boat's control position. The lower fall blocks were raised slightly, once the suspension hooks had been disconnected. The boat was then moved to the bunkering door where a portable pump was rigged, and used to remove the water.

Once this was completed the boat was manoeuvred towards the falls, its engine was stopped, and the lower blocks were lowered slightly to the correct height for connection.

Again the bosun operated the winch, but the chief officer had other duties that prevented him observing the boat's recovery.

One AB in the boat connected the aft suspension ring to the boat's aft suspension hook. The other two were at the forward end on the cuddy top, to reconnect the forward suspension ring.

Hoisting then began with one slight pause to allow swing to die away. During hoisting the ABs were coiling the manropes and ensuring the winch brake operating wire was clear.

None of the men saw, or heard, anything unusual. They heard the lower blocks making contact with the davit heads, and a little later heard the boat make contact with the bilge chocks.

Shortly after the davit's arms began to slide up the inclined part of their trackways, the boat dropped. The aft end dropped first; the bows followed shortly after. As the boat fell it struck the lower ends of the inclined parts of the trackways and rolled to starboard. One of the ABs jumped from the boat on to the vessel's deck. The other two were thrown from the boat as it rolled.

After rolling to starboard, it partly righted itself before its bows dropped, allowing the boat to swing from only the aft falls. The two ABs fell to the water to be joined shortly afterwards by most of the boat after it tore from its transom. The boat floated inverted.

The ABs' lifejackets inflated automatically. One man was seriously injured and had difficulty breathing. The second was able to remove his own lifejacket and search the upturned boat for the third AB. Until hailed by the master, the two men in the water were unaware that the other AB had jumped on to the ship earlier.

A request for assistance was made to authorities ashore. One of the vessel's lifeboats was launched to recover survivors. However, a pilot launch was able to reach the survivors first and recover them for transfer to hospital.

1.3 VESSEL'S SERVICE AND FLAG

Pride of Bilbao has operated between Portsmouth and Bilbao, Spain, since 1993. The Maritime and Coastguard Agency (MCA) performed a survey during November 1994 to transfer her from Bahamian to UK registry.

The service schedule being followed at the time of the accident allowed her to complete two round voyages per week, leaving Portsmouth on Saturday and Tuesday evenings. On Friday evenings she made an additional single weekly return voyage to Cherbourg, returning to Portsmouth the following day.

This accident occurred while the vessel was in Cherbourg during one of these weekly visits.

1.4 LIFEBOATS

Six partially enclosed motor lifeboats are carried, each capable of carrying 144 people. These are supplemented by liferafts to give a total lifesaving appliance capacity of 2720 persons.

The lifeboats' suspension hook release mechanisms are of the off-load type.

1.5 RESCUE BOATS

Two designated rescue boats are also carried: one port and one starboard. Each has a capacity of 20 persons but, as neither contributes to the lifeboat capacity of the vessel,

is normally expected to carry no more than five persons, all crew, for the purposes of rescue or marshalling liferafts.

The boats are of glass reinforced plastic (GRP) construction, and propelled by a water jet system powered by a diesel engine. A small covered space (or cuddy) is formed at the forward end by a GRP moulding, which is secured to the hull by self-tapping screws. The column for the forward suspension hook passes through this cuddy moulding, and is secured at its lower end to the hull. Just forward of the forward suspension hook is the painter release hook, bolted directly to the forward part of the cuddy moulding.

The boats are fitted with off-load release mechanisms to their twin suspension hooks, which can be operated by a single lever at the coxswain's position. Alternatively, the hooks can be operated locally.

The painter hooks are of the on-load release type, which can also be operated either using a lever at the coxswain's position, or locally.

The suspension and painter hooks are remotely actuated from the coxswain's control position by levers attached to bowden-type cables.

1.6 RESCUE BOAT CREWS

The rescue boats have a designated crew of five: a second officer, three ABs and a repairman.

The boat was manned by only three ABs on this occasion, owing to other members of staff being either sick, or committed to other duties. All three were very experienced in the launching and recovery of the rescue boats.

1.7 OPERATION AND TRAINING MANUAL

The training manual was prepared following an audit carried out between 2 and 4 November 1994 by consultants to the owners. Copies are provided on the bridge, in the officers' mess and the crew's mess.

The manual covers instructions for the launching of lifeboats using diagrams and photographs. No instructions are given for their recovery and stowage. Notes on the capability of the rescue boats, characteristics of their water jet propulsion system, use of the winch brake operating wire, and use of liferaft painters when towing, are contained in the manual.

Although it points out that the procedure for launching rescue boats is similar to that for lifeboats, it gives no specific instructions for launching rescue boats.

No instructions are given for the recovery of rescue boats, except when employing a foul weather recovery system; a system not fitted to *Pride of Bilbao*.

1.8 MAINTENANCE RECORDS

Owner's records show that they follow a policy of employing service staff from the davit, winch and boat manufacturers, Umoe Schat-Harding Ltd., to perform specialist servicing and repair of all lifeboats, rescue boats, winches and davits on board *Pride of Bilbao*. Service staff submit reports on the work they have carried out.

Winches and davits for both rescue boats were inspected during the vessel's refit in January 2000. The only replacement part required on the starboard winch was a single oil seal on the handcrank shaft.

Both rescue boats were also inspected at this refit. Various general GRP repairs were carried out. Service staff noted that play was found in the hook side plates on both rescue boats. The note included a recommendation that these should be renewed in the near future.

Service records show that during the vessel's previous refit in January 1999, no major replacements were required on the winches and davits of the two rescue boats. Service reports included a recommendation that brake linings on the starboard rescue boat winch should be replaced during the next refit (of January 2000).

New rollers were fitted to the one-way clutch of the port rescue boat winch during refit of January 1998. The complete one-way clutch on the starboard winch was renewed. No other significant replacements were recorded.

1.9 LAUNCHING HISTORY

The starboard rescue boat has a history of regular launchings; often averaging once every two weeks.

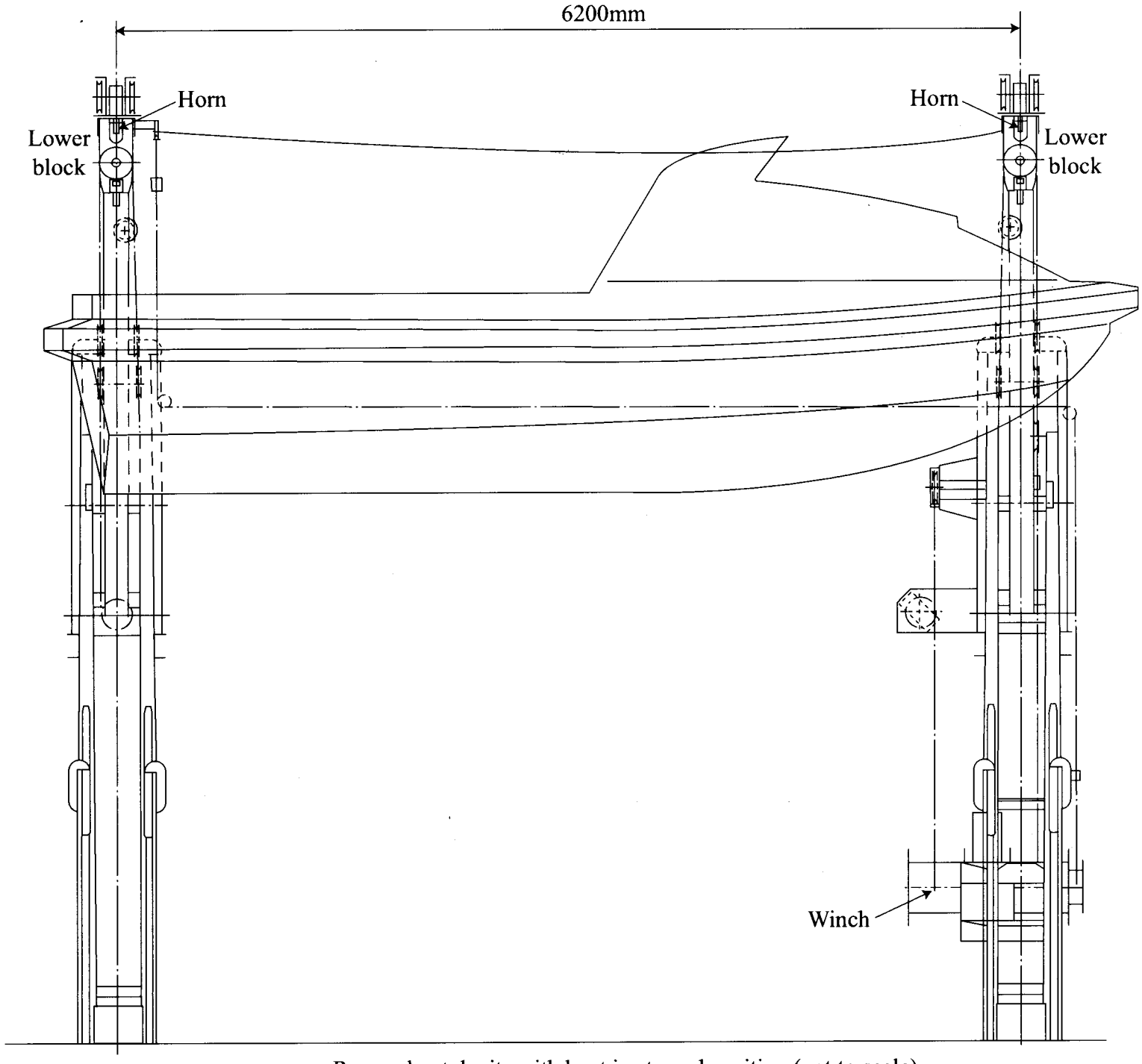
This frequency is due to the vessel usually berthing port side alongside in all three of its regular ports and the use of this boat to check draught marks and gauges.

1.10 ROLLER TRACKWAY DAVITS (Figure 1)

The davits consist of two sets of trackways, each formed by two open channel sections. The lower parts, mounted on the deck, are near vertical. The upper parts are inclined at an angle of about 35° to the horizontal, and secured at their highest level to the deckhouse. The junction of the upper and lower parts forms an elbow.

Each trackway supports a single arm fitted with rollers allowing the arm to slide within the trackway.

In the fully stowed position, the rollers of the arms sit in the upper inclined sections of the trackways. In the fully swung out, or lowered, position the lower rollers are



Rescue boat davits with boat in stowed position (not to scale)

Figure 1

within the lower, near-vertical section. The upper rollers then sit just above the elbow.

Movement of the arms is controlled by the fall wires which, in turn, are controlled by the winch. Two separate wires are fitted, one for each davit arm. Each wire runs from one of the winch's drums, over several sheaves to the davit head, and through the lower block, to which the boat's suspension rings are attached. It then returns to the davit head, to be led over more sheaves to the side face of each arm, where it is secured.

An arm can move only when the lower block is at the arm's head. This happens during lowering or raising of the arms.

At the head of each davit arm is a substantial horn. Its function is to hook into an aperture in each lower block as the arms rotate about the trackway elbows while moving to, or from, the stowed position. Whenever both sets of rollers of the arms are in the upper inclined portion of the trackways, fall wire load is less than is required to support the weight of the boat and lower blocks. The difference is supported by the horns.

1.11 LAUNCHING AND RECOVERY PROCEDURES

1.11.1 Launching

In the stowed position the boat's weight remains supported on the two suspension hooks. The painter, whose forward end is secured to the ship forward, has the eye at its aft end retained in the hook just forward of the boat's forward suspension hook. To aid recovery, this end of the painter is also secured to the forward lower fall block by a lanyard.

To prepare for lowering the boat, crew embark and the senhouse slips of the gripes are released. The boat is then ready for lowering by releasing the winch's brake. Although remote operation is possible, a person standing on deck by the winch normally controls the brake locally.

When the winch's brake is released, it allows the davit's arms to run down the trackway under gravity. As the lower rollers of the arms turn through the trackway elbows, the arms also begin to rotate and cause the horns to gradually disengage from the lower blocks. Shortly before the arms complete their rotation, the horns have been fully released. Arm movement continues until they reach their lowest, fully swung out position. Any further running out of the winch allows the lower blocks, and therefore also the boat, to descend vertically. This process will continue until the boat takes to the water, with the speed of descent automatically limited by a centrifugal brake in the winch.

Once the boat is waterborne its crew can release the off-load suspension hooks and the on-load painter hook, either locally or by using the remote controls at the steering position.

1.11.2 Recovery

To recover the boat, the crew must fit the two suspension rings to the suspension hooks, and secure the painter to its hook. However, often the painter is not refitted to its hook until after the boat has reached its stowed position. The hatch in the forward part of the cuddy is intended to provide access to the forward suspension hook and the painter hook. This hatch is rarely used for this purpose. The painter's lanyard connection to the forward lower block aids the painter's recovery from the water.

When the boat is secure on its suspension hooks, the winch operator can depress the hoist button. Hoisting can be continuous until the boat is almost fully stowed.

After clearing the water, the boat will continue to rise until the lower blocks make contact with the heads of the davit's arms. From this stage the davit arms will begin to rise in their trackways. They will also begin to rotate, allowing the horns to enter the apertures in the lower blocks. This will continue until the arms are completely on the upper, sloping part of their trackways. The boat's weight is then shared between the fall wire and the horns. The load in the wire remains sufficient only to move the arms up their trackways.

Just before reaching the stowed position, a limit switch cuts off power to the winch. The final movement to the fully stowed position is then performed by hand power, using a crank handle on the winch. The gripes are re-secured and the boat's crew disembarks.

1.12 POST-ACCIDENT INSPECTION

1.12.1 Winch and davits

The winch was partially dismantled to allow inspection of its major components. Particular attention was paid to the brake and clutch components during the inspection. None showed signs of anything other than normal and acceptable degrees of wear.

The fall wires were intact following the accident. The aft lower block was hanging from its fall about 3m below the davit head. The forward lower block was also hanging from its fall, about 0.5m below the davit head **(Figure 2)**.

Both davit arms were on the inclined portion of their trackways. The aft arm was virtually at its stowed position, approximately 2.5m higher in its trackway than the forward arm.

No damage was apparent on the davit's arms or any part of its fixed structure.

1.12.2 Starboard rescue boat

Following its recovery from Cherbourg harbour, the French Authorities released the starboard rescue boat into the custody of P&O Portsmouth on the understanding that

Figure 2

Starboard rescue boat davits after accident

the MAIB carried out an inspection before any item was disturbed. The MAIB performed this inspection, in Portsmouth docks, on 5 July 2000. The wreckage was then released for transport to workshops for a more detailed examination of the boat and its fittings.

The boat's structure had suffered serious damage **(Figure 3)**. The port side of the hull was damaged, with an area of the outer skin missing; exposing foam buoyancy material. The starboard side rubbing strip was missing; that on the port side was damaged, particularly towards the forward end.

The aft suspension hook and the boat's transom were missing and most of the cuddy top and coxswain's control position were seriously damaged and displaced. The forward hook was in place, with its column set aft by about 45°. Mounting of the column on the inner skin showed no signs of damage. The outer skin was cracked either side of the stem plate. This plate and a mounting bolt, displayed signs of external impact.

The forward cuddy structure was seriously damaged. The forward part, to which the painter hook had been attached, was torn away.

1.12.3 The forward suspension hook

All significant load-bearing components of the hook assembly are of steel: column, cheek plates, pin, balance weight and hook bill. The weight and hook bill is a single component, with an integral ring to which the release cable is attached and secured with a single bulldog clip.

The column of the forward hook was set back due to rotation about its lower fixing bolt. While the assembly remained in the boat, with the column inclined aft from the vertical, the hook and balance weight assembly was free to move throughout its normal arc, when a gentle force was applied by hand. However, the assembly was unable to swing freely under gravity alone.

The complete column and hook assembly was removed from the boat and held in its normal vertical attitude in a workshop vice. In this situation the hook and balance weight were free to move over its full arc, and could close under gravity alone. The hook was able to fully close on its corresponding suspension ring.

The forward suspension ring was then hung from an overhead crane, and the complete hook closed around the ring, in its normal closed and loaded position. A mass of 25kg was then attached to the lower end of the hook's column. Efforts were then made to release the hook, using the length of release cable that remained attached to it. These were unsuccessful.

This was repeated with the hook only partially closed around the suspension ring **(Figure 4)**. Again these attempts were unsuccessful. Several lateral shocks were then applied to the assembly. Again the hook failed to release.

Figure 3

Damaged boat after recovery to Portsmouth

Figure 4

Testing of forward suspension hook with 25kg load

During these trials it was noted that the bulldog clip securing the release cable to the hook was able to foul against one cheek plate. This clip was not original specification.

Following these trials the hook assembly was dismantled. The bearing surfaces of the pin were seen to be well lubricated. Considering the nature of the assembly's service, no damage, excessive wear or mechanical failure was apparent to either the hook, balance weight, pin, column or cheek plates. However, there were signs of abrasion between one cheek plate and the hook's ring, to which the release wire was attached. A shallow groove had been worn into the cheek plate, and a corresponding flat had worn on the ring.

The results of these tests led to the conclusion that had the hook been fully, or even partially closed, around its suspension ring, it would not have spontaneously opened under load. Neither could it have been intentionally opened using the release cable.

1.12.4 The aft suspension hook

Following the accident, the aft suspension hook, complete with its column attached to elements of the boat's transom, remained suspended from the aft suspension ring and lower block.

The column was noticeably distorted, but the hook mechanism was free to move through its normal arc. Part of the hook's release wire remained attached to the hook, and was secured with a crimp of original specification. The release wire had fractured, but the major portion of the wire remained in its sheath in the boat's hull.

As this hook had clearly not released during the accident no further examination was made.

1.12.5 The suspension rings

Following the accident, each suspension ring remained attached to its respective lower block. Both were removed for inspection.

Neither ring showed any clear signs of damage, and both were of a size suitable for the boat's suspension hooks. However, the forward ring was subjected to metallurgical examination to test the idea that it might, at some stage, have been fitted to the painter hook.

1.12.6 Painter hook

The painter release hook is an on-load release device. It is designed to be released remotely from the boat's coxswain's position by a bowden cable. The major load-bearing components of the assembly are of a bronze material.

Unlike the boat's suspension hooks, the painter hook bill, and balance weight, are separate components. The balance weight also locks the bill closed. The release wire is attached to this weight and, when activated, rotates the weight clear of the hook bill allowing it to rotate to the open position under its applied load.

The hook assembly remains attached to a small piece of the GRP laminate that had been the foremost part of the cuddy top **(Figure 5)**. Along two edges of this piece of GRP are several of the self-tapping screws that had previously secured it to the boat's hull **(Figure 6)**. The third edge is fractured and very rough. The hook's release cable remains attached to the mechanism and release lever.

All parts of the hook assembly are free to move. The mechanism can easily be released and reset by hand.

The outer edges of both cheek plates shows localised crushing damage, and the cheek plates are slightly closed in; by approximately 3mm **(Figure 7)**.

With the hook in its normal attitude, the boat's forward suspension ring was placed in the hook, which was then closed. When the ring was lifted slightly, sufficient only to remove slack, the crushing damage, mentioned above, coincided exactly with the points of contact with the ring **(Figure 8)**.

The hook assembly was not dismantled and was removed, with the forward suspension ring, for metallurgical examination.

1.12.7 Metallurgical examination

The material of the painter hook was identified as a free-cutting phosphor bronze.

A section of the steel suspension ring was cut out, and surface debris analysed as having a composition consistent with free-cutting phosphor bronze. Owing to the similarity in this composition it was considered that the samples found on the suspension ring had the same origin as the hook material.

It was concluded that the metal particles on the steel suspension ring could have originated from contact with the painter's hook.

1.12.8 Lower blocks

Both lower fall blocks were removed for examination. Both sheaves were free to turn and, considering the service conditions of these items, there was no significant mechanical damage.

However, each block had heavy marks to its surface coating on its inboard face to one side of the horn aperture. On the forward block, the mark was aft of the aperture, and on the aft block it was forward of the aperture **(Figures 9 & 10)**.

These marks were interpreted as indicating that each block had made contact with the horn on the respective davit arm during a recovery operation and that, at some stage, the lower blocks had not properly taken to the horns.

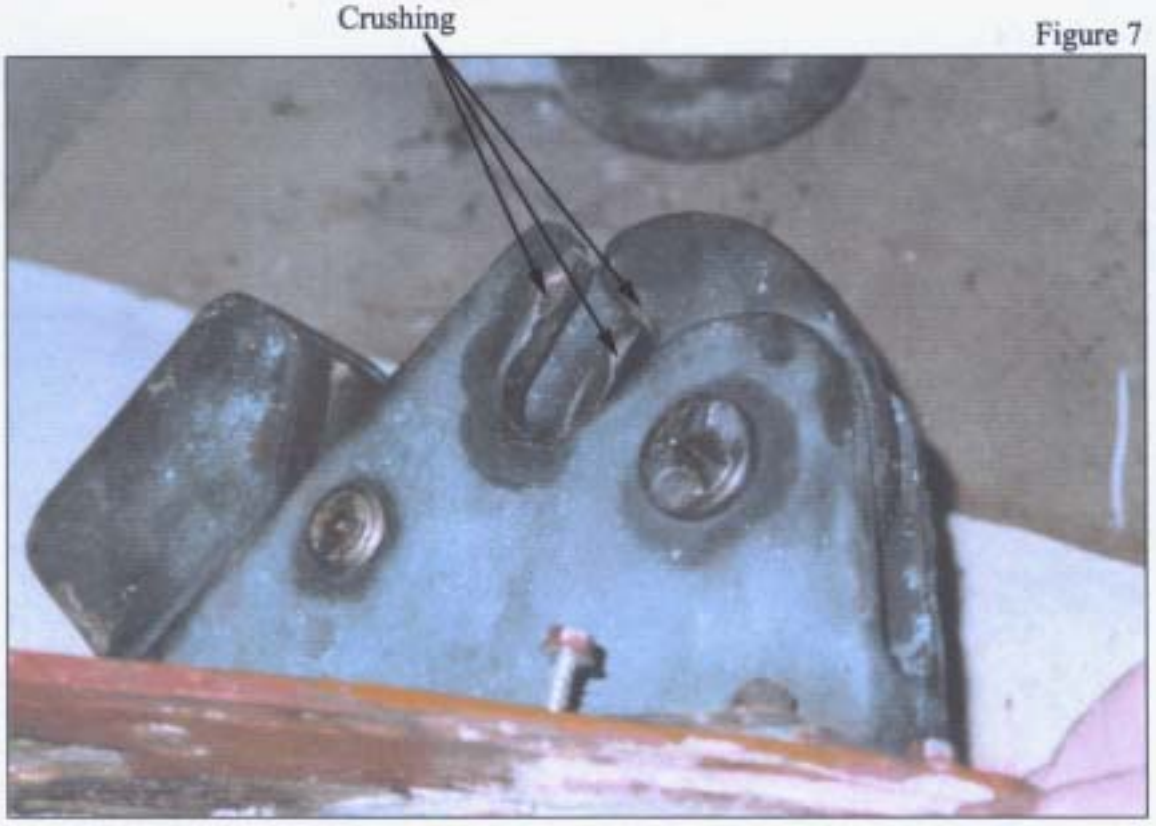
Figure 5

Painter hook and attached GRP from damaged cuddy

Figure 6

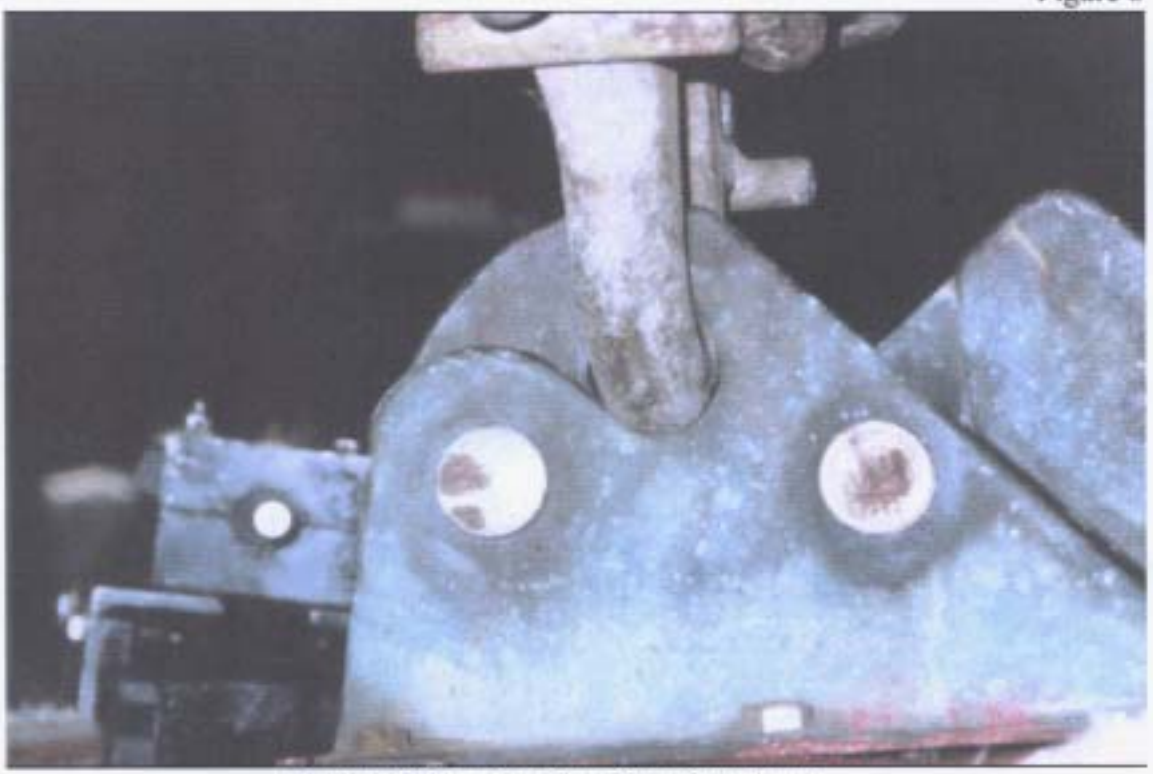
Forward part of boat from where painter hook was torn

Figure 7



Painter hook, showing crushing

Figure 8



Forward lifting ring fitted in painter hook

1.12.9 The painter

The painter is a 75mm fibre rope having a spliced eye for attachment to the boat's painter release hook. Close to the eye a lanyard is attached, made fast to the forward lower block. Following the accident, the painter remained intact, undamaged and with its lanyard still connecting it to the lower block.

1.13 IN-WATER TESTS

To explore further the idea that the forward suspension ring might have been attached to the painter hook of the boat, in-water tests were performed on the port rescue boat on *Pride of Bilbao*. The port rescue boat is similar in design, equipment and fittings to the starboard rescue boat. These tests were carried out in Portsmouth ferry port on Saturday 30 September 2000.

The objective of the tests was to identify the difficulties that might be experienced by a person attempting to fit the boat's forward suspension ring to the painter hook while the boat was afloat.

The boat was lowered to the water, with a crew of three, until both falls became slack. The painter and the forward suspension ring were then released from their hooks. The aft suspension ring remained attached to its hook.

Two crewmen were then able to fit the suspension ring to the painter hook. However, as three discrete, and almost simultaneous actions were necessary, both men had to take a positive role.

One was required to hold and position the suspension ring in the throat of the hook. The other needed to lift the hook's weight with one hand, while he closed the hook around the suspension ring with the other.

The painter hook was then opened to release the suspension ring. It was discovered that it was not necessary to open the hook fully to release the suspension ring. The hook had an intermediate open position and another attempt was made to fit the suspension ring to the hook in this state.

Again two crewmen carried out the operation. However, it proved necessary for only one man to hold the lower block steady, while the other dropped the suspension ring into the hook's throat, at which point it closed. No separate lifting of either the hook or its weight was required.

It was concluded that the tests had demonstrated that the suspension ring could, in fact, be fitted to the painter hook. If at the start of their efforts the painter hook was fully open, two men would be required to take an active role. However, if, initially, the painter hook was in the intermediate half open state, the operation needed only one person, and could be performed comparatively easily.

SECTION II - ANALYSIS

2.1 BOAT DAMAGE

Substantial damage was caused to the boat, as the aft suspension hook and transom separated from the remainder of the boat's structure. It is clear that the boat was briefly suspended by only its aft hook, due to loss of support forward. This type of structural failure to GRP boats has occurred in all incidents the MAIB has investigated where a boat, designed for use with two suspension hooks, has been accidentally suspended by only one suspension hook.

As suspension hooks, and the surrounding structures, are designed and tested to withstand only vertical loads, this feature of the accident is seen as no more than a point of observation. There is seen to be no advantage in suggesting that boats' structures should be able to withstand the oblique, and generally dynamic, forces generated during this type of accident.

2.2 MANNING

Due to the accumulation of water in the boat, and lack of engine cooling water, the initial objective of performing a manoverboard drill was abandoned before the rescue boat was launched. Once the cooling water had been replenished, the purpose of the launching was to take the boat to the vessel's bunkering door to ease the task of pumping it out.

The normal complement of rescue boat crew was not available due to sickness and other duties. However, the three ABs who crewed the boat were all qualified and well versed in boat launching and recovery operations, and would normally be part of the boat's crew.

Had five people been available to make up the normal crew, the same three ABs would probably still have performed major roles in the launch and recovery operations. Therefore, there can be no certainty that this accident would have been avoided had the boat contained its full and normal complement of five.

2.3 SUSPENSION HOOKS

The forward suspension hook was found without its associated ring engaged. The aft hook was still closed on its suspension ring, and supporting the weight of the boat's damaged transom.

As a result of the state of these hooks, initial suspicions centred on the possibility that the forward suspension hook had opened, allowing the boat to fall. Simple tests were arranged to test this possibility.

These tests were performed with a load of only 25kg suspended from the hook. The usual load would be in the order of 1500kg, about half the boat's mass. It proved impossible to apply sufficient effort to the release wire, by hand, to open the hook

with 25kg suspended. The self-closing characteristics of the hook make the opening effort with the usual load of 1500kg very much larger. Intentional opening of the hook by hand, under normal loading, would be impossible, unless it had been improperly reset.

Attempts to replicate a spontaneous opening of the forward hook also proved unsuccessful. Tests showed that the forward hook could not open spontaneously when under load, unless it had not been properly closed on the suspension ring. The degree of improper resetting required for this to happen is very large.

Owing to its self-closing characteristics, it is considered almost inconceivable that the hook could have been reset so poorly that it opened spontaneously. Further, incorrect setting to such a degree, would probably have resulted in the hook releasing much sooner in the boat's recovery sequence, possibly even before the boat cleared the water.

The bulldog clip attached to the release wire was able to foul the hook's side plate. However, unless the wire was under tension, any contact was unable to generate a force sufficient to restrict the movement, or influence the proper resetting, of the hook. As this wire is tensioned only when the hook release lever is actuated, it is unlikely that the bulldog clip fitting had any influence on the hook's performance.

Bulldog clips are not the specified fitting for this application. Therefore, in spite of the above conclusion, the owners should advise the service staff they employ, that replacement parts should comply with manufacturer's specifications.

2.4 AFT LOWER FALLS BLOCK

Immediately following the accident, each block was found hanging clear of its respective davit arm horn, and suspended from its fall.

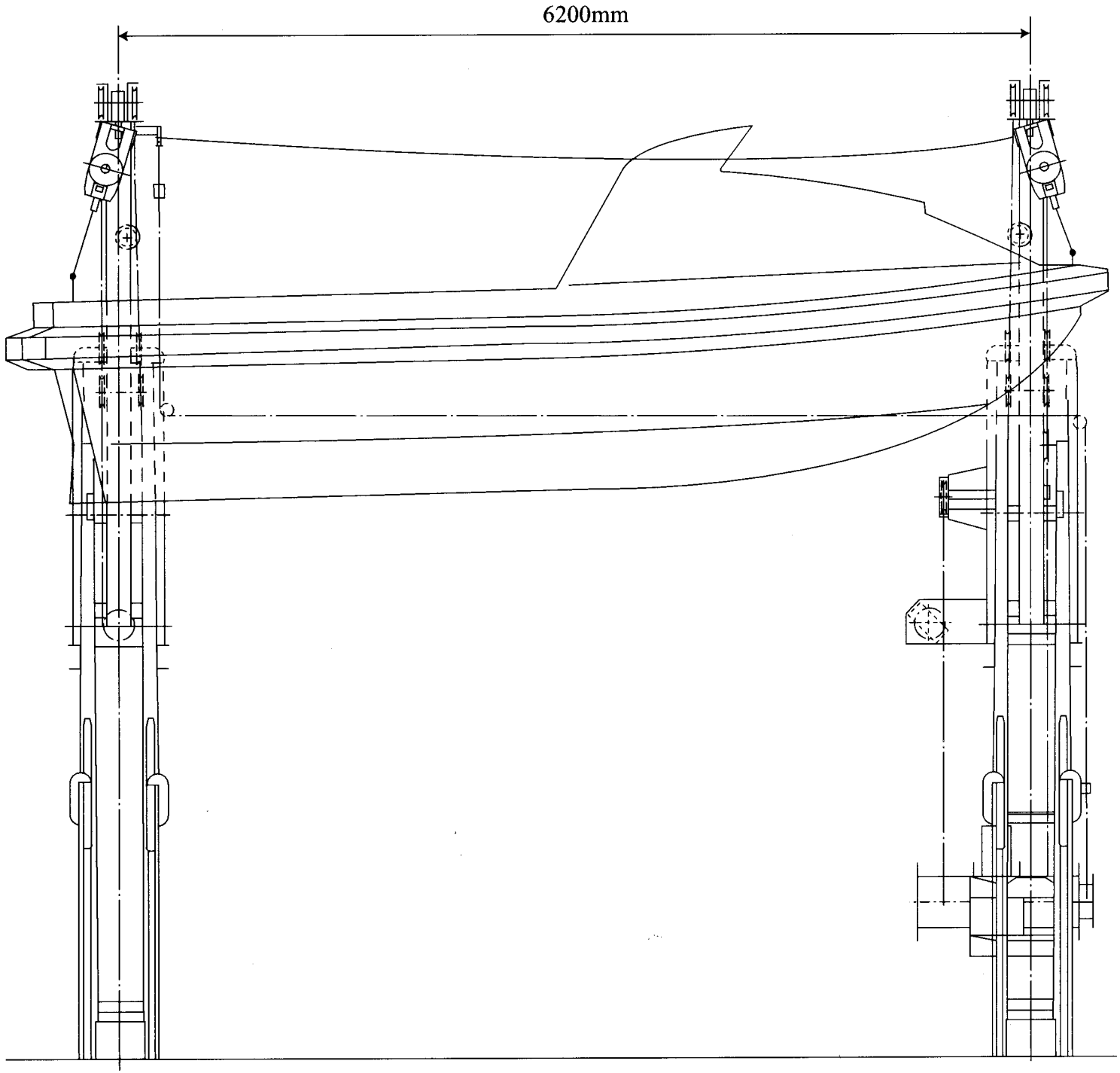
As each arm had passed the trackway elbow, and reached the inclined section, the blocks would normally be expected to have taken to the horns, and be partially supported by them.

This suggests that the blocks did not properly take to the horns as the davit arms were rising.

Witnesses recall that the aft end of the rescue boat dropped before the bows. Since the aft suspension hook did not open, the only way in which the aft end of the boat could have dropped was for the aft block also to have dropped. Again, this required the aft block not to have taken to the horn while the davit arm was rising.

Heavy marks at the forward edge of the horn aperture in the block are consistent with it making heavy contact with the horn, without entering the aperture. Inadequate alignment between the lower blocks and the horns is indicated.

These features suggest that the aft block did not take to its horn, slipped down as the arm was rising, and that this movement was the first to be detected by witnesses. It



Rescue boat davits with boat stowed on lifting points 6.8m apart showing lower block misalignment (not to scale)

Figure 11

Normally the difference between the boat's weight, and the fall wire load, is taken by the davit horns. It has been concluded that the lower blocks did not properly take to their horns. An indeterminate friction force between the nose of the horns and the blocks then probably supplied the normal horn load. The indications of hard points of contact on the blocks support this suggestion.

In this state, the lower blocks would have been poised precariously. Any disturbance might have resulted in one, or both, of the blocks slipping.

It is known that, during its recovery, the boat had already made contact with its bilge blocks on the davit arms. This comparatively small impact might have been sufficient to dislodge the blocks, resulting in slipping. However, the boat's crew recall other numerous small shocks that they considered to be normal. Any of these could have caused the blocks to slip.

None of these shocks would have had any significant effect if the lower blocks had been properly sitting on their horns. The blocks did not take to their horns because they rose to the davit heads, misaligned to a degree indicated by the markings adjacent to their horn apertures.

2.8 DAVIT ARM MOVEMENT

While the arms are on the inclined portion of their trackway, unless the lower blocks are partially supported by the horns, a resultant force is generated which has a component tending to act so as to move the davit arms up their trackways.

This force system is the mechanism that caused the davit arms to rise as the lower blocks dropped during this incident.

The aft davit arm came to rest higher on its trackway than did the forward arm. This corresponds to the greater length of fall wire found hanging free from the aft davit head.

2.9 PAINTER AND HOOK

Heavy crush markings on the throat of the painter hook exactly coincide with points of contact with a suspension ring placed in the hook during post accident tests.

The rescue boat's painter was fitted with a soft eye for attachment to the release hook. It is inconceivable that the fibre material of this eye could have caused the crushing damage seen on the hook's cheek plates; certainly not without itself failing.

The painter was not damaged as a result of the boat's fall, suggesting that either it was not secured to the boat, or that its hook opened before the painter became overloaded. The crew's recollection is that the painter had not yet been secured during the boat's recovery.

The painter was almost certainly not connected to the painter hook during the boat's recovery. The hook was thus available for the inadvertent fitting of the suspension ring.

2.10 PAINTER HOOK

The painter hook bore heavy markings in areas coincident with contact with a suspension ring.

Metallurgical tests on the forward suspension ring and painter hook point to this ring having been fitted to the hook and subjected to a significant load.

There are no records or recollections suggesting that the forward suspension ring and painter hook had been in contact for any purpose before the accident.

Arrangements for securing the painter hook to the boat's cuddy consisted of through-bolts on to a backing plate. Thus the surrounding GRP material was required to withstand all normal painter loading. However, the hook and backing plate were torn from the cuddy structure, complete with the forward part of the GRP cuddy.

It has proved impossible to formulate a mechanism which would apply sufficient load to cause this failure, unless it is accepted that the forward suspension ring was fitted to the painter hook.

2.11 PAINTER HOOK MOUNTINGS

The painter hook, and its securing arrangements, had apparently been able to support the forward end of the boat during hoisting from water level. The load applied was steady and essentially vertical, having only a small component towards the stern due to misalignment of the lower blocks.

Loading on the GRP material surrounding the hook, and the self-tapping screws at its edges, would also have been approximately symmetrical, port and starboard. However, during the early part of the boat's drop it rotated to starboard after striking the lower parts of the davit trackways. Two effects on the hook's mountings are likely: loading was temporarily removed or reduced and then re-applied, so inducing a shock load and the hook's load was applied obliquely to the boat's centreline.

The magnitude and direction of the shock load is not known. However, this load was certainly far more aggressive to the hook's mountings than was the steady vertical load experienced during hoisting.

It is concluded that the painter hook tore from the boat after the boat began to drop. This was, therefore, a consequence of the boat's initial movements rather than the cause.

2.12 RELEASE OF PAINTER HOOK

As the painter hook was torn from the boat's structure, it follows that a mechanism must exist to explain why the hook did not remain hanging from the suspension ring.

Unlike the boat's two suspension hooks, the painter hook is an on-load release device. It is capable of being opened while supporting a load.

After the boat was recovered, the painter hook remained attached to its operating wire. As the forward end of the boat fell after the painter hook was torn away, leaving the hook on the suspension ring, the wire would have been tensioned as it was pulled from its securing arrangements in the boat. This force opened the hook, releasing it from the suspension ring and allowing it to drop with the boat.

2.13 SEQUENCE OF EVENTS

So many features point to the likelihood that the forward suspension ring was fitted to the painter hook, that this explanation becomes unavoidable. Indeed, other than the recollection of one witness, there is insignificant evidence supporting any other explanation.

The events of 1 July, before the rescue boat was re-attached to its falls for recovery, are considered to be of not great significance. There also appears to be general agreement among witnesses of these events, which are set out in the Narrative, Section 1.2, of this report. However, from the stage where the boat was returned to a position beneath the falls, witness evidence becomes less consistent, partly due to the speed of some events.

As a result, many details have had to be inferred from the state of the hardware following the accident. Interpretation of this data has resulted in the compilation of the following sequence of events:

- After manoeuvring the boat beneath the falls, the aft suspension ring was attached to the aft suspension hook, but the forward suspension ring was attached to the painter release hook.

- The boat was hoisted, without incident, until the lower blocks contacted the davit heads.

- As the suspension rings were attached to points further apart than the boat's suspension hooks, the lower blocks were correspondingly misaligned.

- Misalignment of the lower blocks prevented them taking to the davit horns.

- As the davit arms began moving up the inclined part of the trackways the fall wire loads reduced, and the lower blocks maintained their position largely due to friction forces.

- Slight shock caused the aft lower block to slip from the davit head.

- The aft block dropped, causing the aft davit arm to rise correspondingly on its trackway, and the stern of the boat also dropped.

- The forward lower block then also slipped from its davit head, allowing the forward end of the boat to drop, and causing the forward davit arm to rise slightly in its trackway.

- One crewman jumped on to the vessel's deck at, or shortly after, this stage.

- As the complete boat dropped, it struck a lower part of a davit trackway and rolled to starboard, tipping the two remaining crewmen into the water.

- The boat probably returned briefly to the upright state, at about the time the painter hook tore from the boat's structure allowing the bows to fall.

- As the forward end of the boat fell, the painter hook's operating cable was tensioned causing the hook to open.

- The boat was then free to swing about the aft falls.

- After briefly swinging by the stern, most of the boat's structure tore from the aft suspension hook and transom, falling to the water inverted.

2.14 DESIGN AND SPECIFICATION

The immediate error leading to the accident was the fitting of the forward suspension ring to the painter hook. Neither the suspension hooks, nor the painter hook, appear to be in any way defective or unsuitable for their purpose.

However, their dimensions corresponded exactly, in as much as the suspension ring was a perfect fit in the painter hook; a condition that contributed to the error of connecting the suspension ring to the painter hook.

As an initial response to this accident, the owners have introduced operational procedures requiring the boat's painter to be fitted to its hook before the boat is lifted from the water. This is a sensible precaution that should reduce the risk of this error being repeated.

However, to remove totally the potential for a similar accident occurring, hook dimensions should be altered. One way would be to fit a smaller painter hook which will not accept a suspension ring. The owners are recommended to consider this alteration.

As this type of rescue boat may be in use on other vessels worldwide, and be fitted with a similar combination of suspension and painter hooks, classification societies, the MCA and the boat's manufacturers should be informed of the details of this accident.

2.15 TRAINING MANUAL

An outline of the contents required of a training manual is contained in Regulation 51 Chapter III of the Safety of Life at Sea Convention (SOLAS). The requirements are repeated in Schedule 14 of Merchant Shipping Notice (MSN) 1676(M). In particular both documents set out the requirement, depending on the lifesaving appliances provided on the ship, that: *Recovery of the survival craft and rescue boats, including stowage and securing shall be explained in detail.*

Pride of Bilbao's training manual contains instructions for the launching of lifeboats. However, although it states that the operation is similar, it does not give specific instructions for launching rescue boats. It gives no information for recovering lifeboats or rescue boats, but there are instructions for recovering rescue boats in foul weather, using a pendant recovery system.

It states that *many emergency boats are fitted with what is known as 'foul weather pendant recovery systems'* without making it clear whether such a system is fitted to those rescue boats on board *Pride of Bilbao*. No system of this type is fitted to the rescue boats, and, so, any information contained in the training manual on the recovery of rescue boats, is superfluous.

There may be various factors in the recovery process, such as poor weather and engine failure, where attachment of the painter might be important to the boat's safety. For these reasons the training manual could reasonably have included advice to connect the painter to the craft before connecting the suspension hooks; the procedure introduced by the owners following the accident.

Therefore, notwithstanding the recommendation to modify painter hook dimensions, the owners are recommended to amend the training manual to cover the launching of the rescue boats, and the recovery and stowage of lifeboats and rescue boats. This would make it clear to crews the methods which the owners wish to employ, both to ensure safety and to satisfy the regulation mentioned above.

2.16 LIFEJACKETS

Each crewman was wearing working clothing, including boots and waterproof overalls. Once they had fallen into the water, each man's clothing became a significant burden. They each fell from a great height, about 20m, causing them to sink some distance beneath the surface. Without the benefit of their self-inflating lifejackets, they would both have had great difficulty swimming to the surface. Both men readily recognise the contribution the lifejackets made to their survival.

SECTION III - CONCLUSIONS

3.1 FINDINGS

1. The boat was torn from its transom and aft suspension hook by a loading regime it was not designed to withstand. [2.1]

2. Qualified crew, familiar with its launching and recovery, manned the boat. [2.2]

3. No mechanism can be found which would cause the boat's on-load release suspension hooks to open spontaneously [2.3]

4. No mechanism can be found which would allow the boat's on-load release suspension hooks to be opened inadvertently. [2.3]

5. The boat's forward suspension hook had no defects that could have caused it to open spontaneously [2.3]

6. As the davit was raised the lower blocks did not take to their horns due to misalignment. [2.4, 2.5]

7. Lower block misalignment was caused by an increase in centre line distance of the boat's lifting points [2.6]

8. Without support from the horns, the lower blocks slipped largely due to the normal reduction in fall wire load. [2.7]

9. The davit arms moved up their trackways due to the influence of forces generated as a result of the lower blocks lacking the support of the horns. [2.8]

10. The painter was not attached to its hook during the boat's recovery. [2.9]

11. The forward suspension ring was inadvertently fitted to the painter hook during the boat's recovery. [2.10]

12. The painter hook tore from the boat after the boat began to drop. [2.11]

13. The painter hook tore from the boat as a consequence of the sudden and probably oblique load applied to its mountings. [2.11]

14. The painter hook was released from the suspension ring by tension applied to its release wire by its attachments to the falling boat. [2.12]

15. Specifications of the suspension and painter hooks gave them common dimensions. [2.14]

16. The vessel's LSA training manual does not fully describe the launching and recovery of rescue boats. [2.15]

17. Lifejackets made a significant contribution to the survival of the two men who fell into the water. [2.16]

3.2 CAUSES

The direct cause of this accident was the error of inadvertently fitting the forward suspension ring to the painter release hook during the boat's recovery.

The specification that allowed the painter and suspension hooks to have similar dimensions contributed to this error.

The lack of instructions for rescue boat launching and recovery, particularly with respect to painter connection.

SECTION IV - RECOMMENDATIONS

The owners of *Pride of Bilbao* are recommended to:

1. Amend the on-board training manuals for LSA to fully cover details for the launching, recovery and stowage operations of rescue boats and the recovery and stowage of lifeboats.

2. Consider altering the dimensions of the rescue boats' painter release hooks, or make other suitable modifications, so they cannot accept the boats' suspension rings.

3. Advise the staff they employ to service their boats and davits, that replacement parts should comply with manufacturer's specifications.

The IACS is recommended to:

4. Inform its members of the immediate causes of this accident, in order that they can identify systems with similar potential dangers during surveys and type-approval examinations.

The MCA is recommended to:

5. Bring this incident to the notice of its surveyors in order that they can identify systems with similar potential dangers.

Marine Accident Investigation Branch
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