ACCIDENT REPORT

Report on the investigation of the

fatal accident of a crew member

on the Woolwich ferry

Ernest Bevin

on the River Thames, London

3 August 2011

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 22/2012 August 2012

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2012 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

BML	-	Boatmasters' licence
DSMC	-	Merchant Shipping (Domestic Passenger Ships) (Safety Management Code) Regulations 2001
IMS	-	Integrated Management System
ISM	-	International Safety Management Code
kt	-	One nautical mile per hour
kW	-	kilowatt
LOA	-	Length overall
LPV	-	Large passenger vessel
LRS	-	London River Services
m	-	metre
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
mph	-	Miles per hour
N	-	North
PA	-	Public address
"Pan Pan"	-	The international urgency signal (spoken)
PLA	-	Port of London Authority
rpm	-	revolutions per minute
S	-	South
SDH	-	Senior deckhand
SLMS	-	Serco Limited Marine Services
TfL	-	Transport for London
UTC	-	Universal Time, Co-ordinated
VHF	-	Very high frequency
VTS	-	Vessel Traffic Services

Times: All times used in this report are UTC + 1 hour unless otherwise stated

SYNOPSIS

A deckhand working on board the River Thames Woolwich Free Ferry, *Ernest Bevin*, sustained severe head injuries and drowned when he was dragged overboard by a mooring rope while releasing lines that were securing the ship to a mooring buoy. Although the casualty was wearing a lifejacket and was recovered to a workboat within minutes, waiting paramedics were unable to save the badly injured crewman.

The unmooring operation required members of *Ernest Bevin*'s crew to work on the mooring deck situated directly above the vessel's Voith Schneider propellers. As the final mooring rope was being recovered onto the mooring deck, it became caught in the rotating propeller blades. It is most likely that the casualty was standing in a bight of the mooring rope so that as the rope tightened, he was pulled hard against the ship's bulwark and then overboard.

The unmooring operation was a routine task but it had not been captured by the company's safety management system. Consequently no risk assessment for the operation had been conducted to assess and mitigate the hazards faced by the crew, and the very real hazard posed by the rotating propeller blades during the task had not been formally recognised. This situation was compounded by a lack of suitable oversight at the time of the accident.

An internal investigation and a broad review of its safety management system were conducted by the ferry operator, Serco Limited Marine Services, which resulted in a number of control measures being taken to prevent a similar accident in the future and which address the relevant safety issues identified in this report.

The MAIB investigation identified that some difficulty was experienced in recovering the unconscious casualty from the water. A recommendation has therefore been made to Serco Limited Marine Services designed to ensure that its fleet of workboats provide a more suitable platform for this purpose. The Chief Inspector of Marine Accidents has written to the UK port associations bringing the findings of this investigation to their attention.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *ERNEST BEVIN* AND ACCIDENT

SHIP PARTICULARS

Vessel's name	*Ernest Bevin*
Flag	United Kingdom
Classification society	Not applicable
IMO number	5426998
Type	Ro-ro passenger ferry
Registered owner	Transport for London (TfL)
Manager(s)	Serco Limited Marine Services
Construction	Steel
Length overall	56.6m
Registered length	Not applicable
Gross tonnage	738
Minimum manning	6
Authorised cargo	Passengers and road vehicles
Engine power	2 Mirrlees National diesel engines, Total power 736kW at 600rpm.
Propulsion	2 Voith Schneider cycloidal propellers with 6.8:1 reduction gearing

VOYAGE PARTICULARS

Port of departure	Woolwich Free Ferry mooring buoys
Port of arrival	Woolwich Free Ferry N terminal
Type of voyage	Not applicable
Cargo information	None on board
Manning	7 on board plus 1 in the workboat

MARINE CASUALTY INFORMATION

Date and time	3 August 2011 at 0600
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	Woolwich, River Thames, UK
Place on board	Mooring deck
Injuries/fatalities	One fatality

Damage/environmental impact	None
Ship operation	Class V passenger
Voyage segment	Unmooring
External & internal environment	Daylight, Good visibility, calm. 1.65kt easterly setting tide
Persons on board	7

Image courtesy of Ship Nostalgia.com

Ernest Bevin

1.2 NARRATIVE

1.2.1 Background

London City Council operates a toll-free ferry service between the north (N) and south (S) banks of the River Thames in the parish of Woolwich, which is the primary connecting link between London's inner orbital roadways (N and S Circular).

In its heyday, the ferry was a major transport link in the capital city for both foot commuters and vehicles. Improved infrastructure within the city had since caused a decline in foot passengers, with vehicles now the major user of the service. The provider of the service was Transport for London (TfL), operating through its wholly owned subsidiary, London River Services (LRS). In 2008 LRS awarded management and operation of the ferries to Serco Limited Marine Services (SLMS) after the previous operator of the service exercised its option to not renew its contract.

The service usually comprised two vessels plying between the N and S terminals. For several months prior to the accident, Woolwich Free Ferry had been operating an extended service to provide additional crossing capacity while the nearby Blackwell Tunnel was undergoing repairs. This extended service consisted of a single ferry operating for an extra 2 hours from 2000 until 2200 hours. Since this extra service required both N and S berths to be available, the ferry not in use from 2000 (*Ernest Bevin*) was secured overnight to river mooring buoys about 250m upriver from the S terminal **(Figure 1)**. Once the last run of the day was complete, the ferry that had been conducting the extended service moored overnight at her normal berth on the S side terminal.

1.2.2 Environmental conditions

At the time of the accident it was daylight, the visibility was good, and the wind strength was light. The tide was ebbing with a 1.65 knot tidal stream setting east.

1.2.3 Preparing to let go

At about 0525 on 3 August 2011, seven members of *Ernest Bevin*'s eight-man crew joined the company's workboat at the S terminal to be transported to the ferry; they all wore inflatable lifejackets in the workboat as required by SLMS. *Ernest Bevin*'s mate was late in arriving for work that morning, but had notified the master that he would join the ferry at the N terminal in time for its first river transit at 0610. In consideration of the mate's absence, it was the master's belief that he tasked a senior deckhand (SDH) to an acting mate's role by asking him to "keep an eye on things" until the mate arrived. This is in dispute and cannot be verified.

The workboat conveyed the master, engineer, two senior deckhands and a deckhand to the ferry. The workboat, crewed by *Ernest Bevin*'s bosun and another deckhand, then crossed the river to the N terminal where they picked up the crew for the sister ferry, *James Newman,* plus an additional deckhand to provide temporary cover for *Ernest Bevin*'s absent mate. The workboat transferred *James Newman*'s crew to the S terminal, and then headed back towards *Ernest Bevin*.

While the workboat was delivering *James Newman*'s crew, the five crew members on *Ernest Bevin* got the vessel ready for service. The master went to his control position, known as the wheel-box, made various checks and prepared for the day

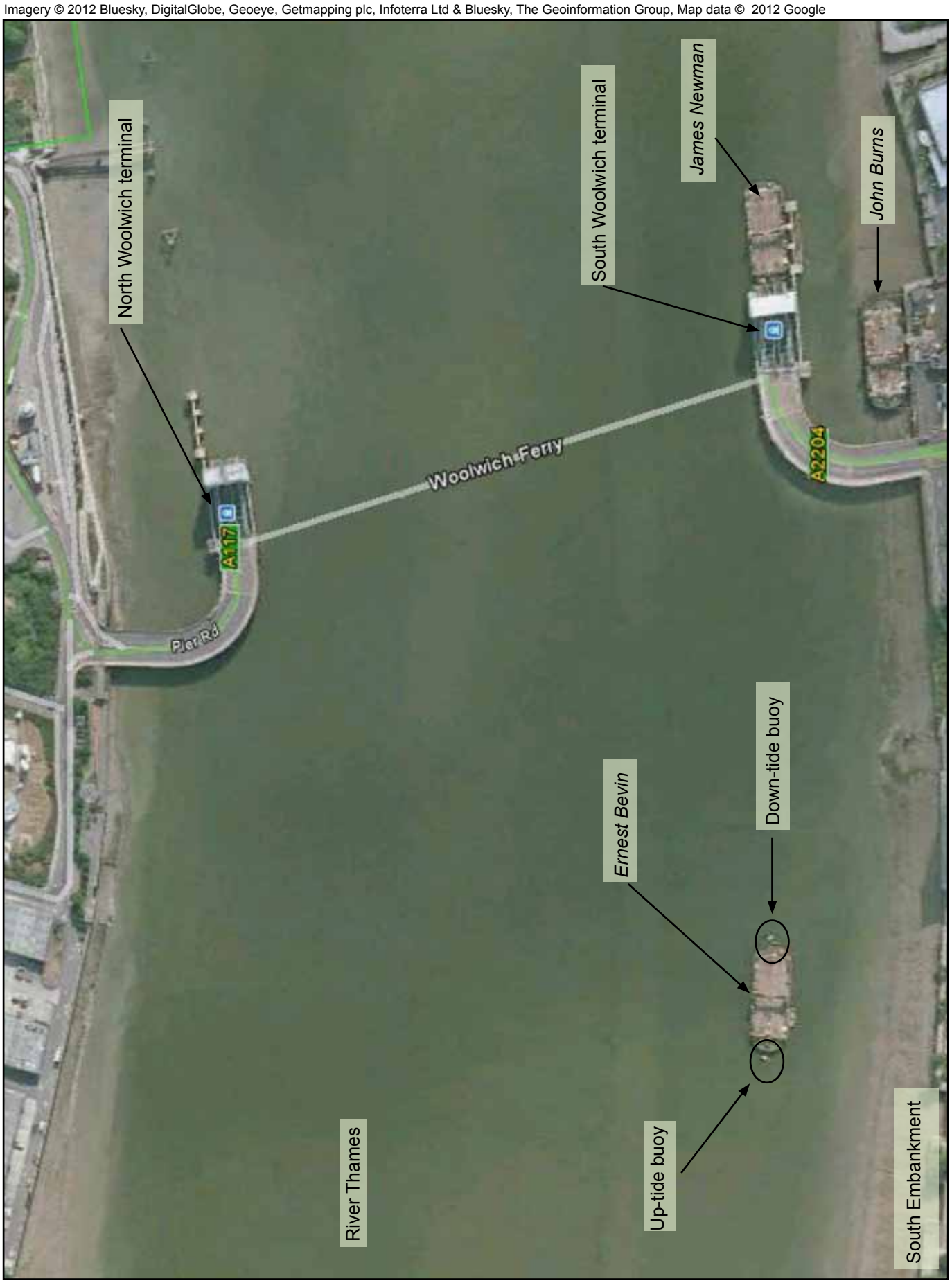


Figure 1: *Ernest Bevin*'s position on the mooring buoys relative to Woolwich Ferry terminals

ahead; the engineer went to the engine room to prepare and start the engines. The two senior deckhands removed their inflatable lifejackets and along with the deckhand, Benjamin James Woollacott (who kept his lifejacket on), made preparations for the release of the fore and aft buoy mooring lines.

Ernest Bevin's engines were started and, as they warmed up, the process of handing over propulsion control from the engine room to the wheel-box was carried out.

1.2.4 Unmooring

The workboat arrived back at *Ernest Bevin* and was positioned by the bosun between the ferry and each of the two mooring buoys in turn **(Figure 2)**. At each end of the ferry, the deckhands released two mooring wires and an insurance wire from the buoys **(Figure 3)**, and these were then pulled on board the ferry. This left *Ernest Bevin* tethered between the buoys by slip ropes[1] **(Figure 4)** fore and aft, which were normally released from the vessel at the master's instruction.

The master saw Benjamin release and retrieve the down-tide slip rope on his own, while the two senior deckhands, SDH1 and SDH2, stood in readiness to release the up-tide end of the ship. SDH1 made a hand signal to the master to check that he was ready for the up-tide slip rope to be cast off, but the master responded negatively as he needed to ascertain the whereabouts of the workboat relative to the ferry before proceeding.

Figure 2: Mooring ropes and insurance wire being released by workboat

[1] Slip rope: a 40mm diameter rope secured to the mooring bitts, led out through the fairlead then turned through an eye upon the buoy, back inboard and onto the bitts again. By releasing one tail from the bitts, the slip rope could be pulled through the eye on the buoy, thus casting that end of the ferry adrift.

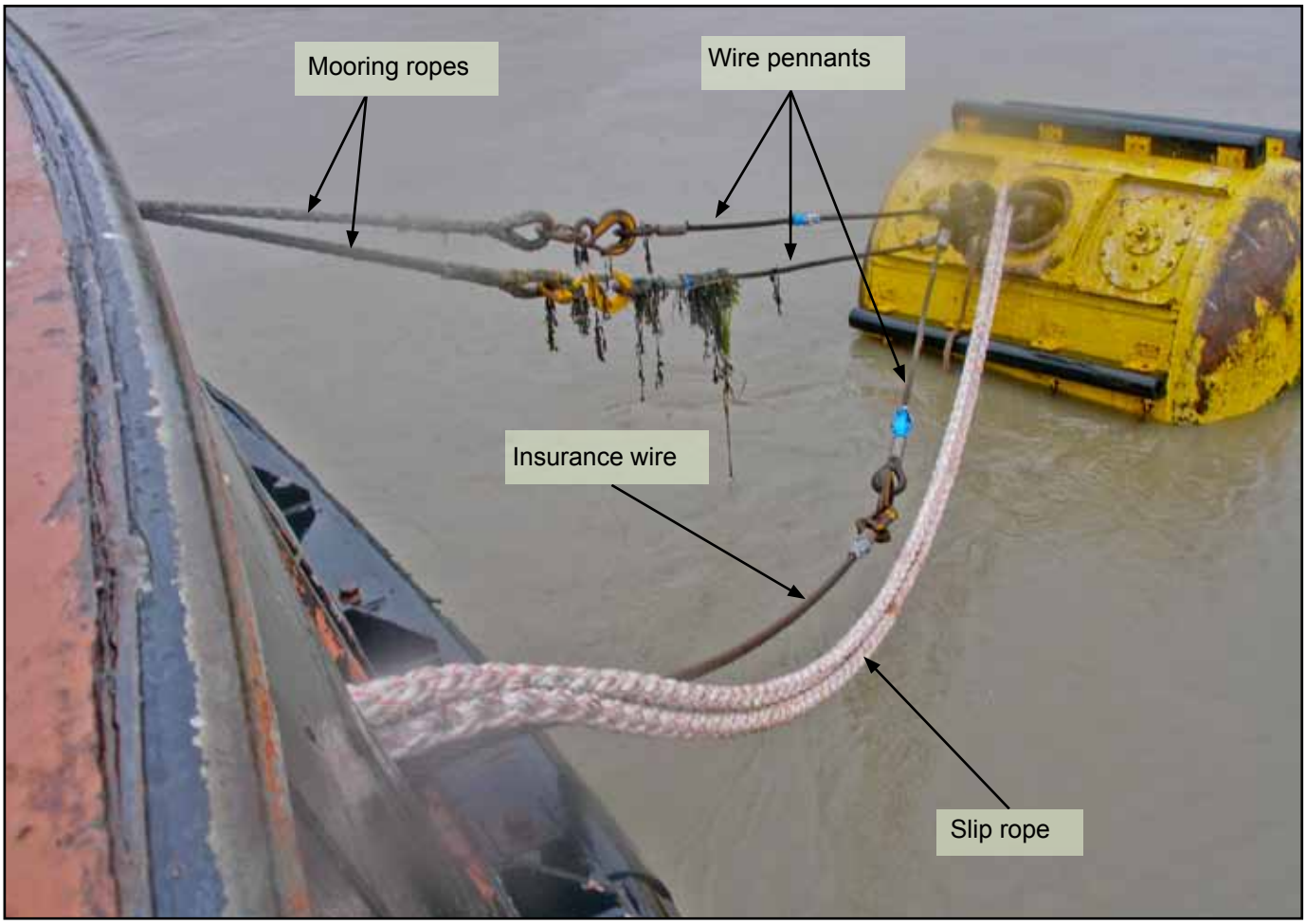


Figure 3: Various securing devices between *Ernest Bevin* and mooring buoy

Figure 4: *Ernest Bevin* tethered by up-tide slip rope only

During this time, the bosun manoeuvred the workboat back round to the crew embarkation gate, the remaining two deckhands boarded *Ernest Bevin*, and the bosun then headed for the S terminal. One of these deckhands went to the down-tide mooring deck where he tidied up the slip rope that Benjamin had left lying on the deck, and the other went to the galley carrying his colleagues' bags from the workboat. There he met the engineer who had come up from below decks having transferred propulsion control to the master in the wheel-box.

The master moved to the port wheel-box to check that the workboat was clear and noted two yachts slightly upriver of *Ernest Bevin*'s position that were motoring slowly downstream. Satisfied that the workboat was clear of his vessel, he returned to the central conning position from where he could see that Benjamin was now at the up-tide end of the ferry with SDH1 and SDH2.

1.2.5 The accident

The master manoeuvred the ferry slowly towards the up-tide buoy to take the tension off the slip rope. He then signalled SDH1 to cast off the slip rope; he in turn conveyed this message to Benjamin and SDH2 then promptly left to go to the toilet (without notifying the master), content that three people were not required to let go and retrieve the slip rope.

The positions of all crewmen at this time are indicated on **Figure 5**.

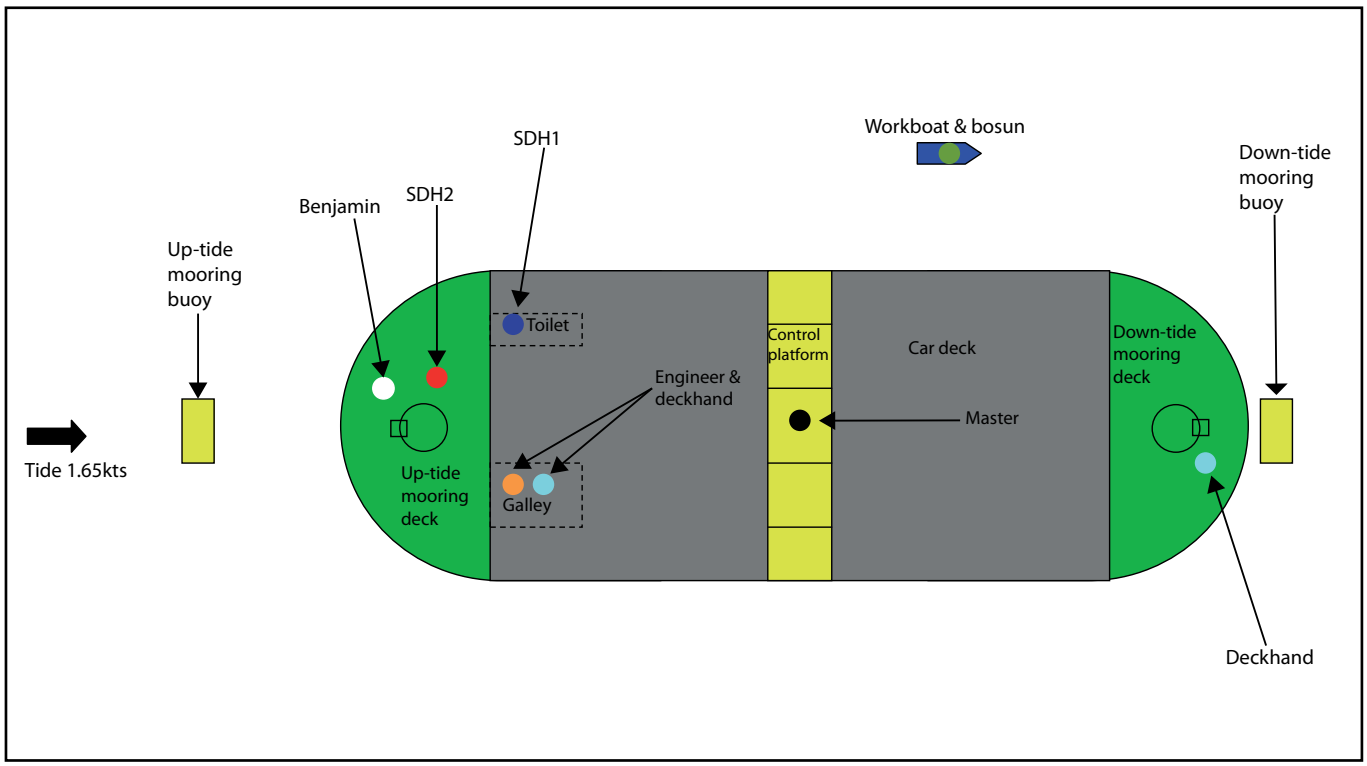


Figure 5: Diagram showing position of crew shortly before the accident

Benjamin and SDH2 released one tail of the rope from the bitts and SDH2 reached over the bulwark and grasped the rope from outboard of the fairlead. He then proceeded to pull it inboard over the bulwark, coiling it on the deck as he did so. To assist, Benjamin lifted the rope from the bulwark rail, placed it over his shoulder and walked it smartly towards the accommodation bulkhead some 6 metres distant, pulling the rope from his colleague's hands in the process.

The two deckhands continued to pull in the rope, but it quickly came under tension, causing them to conclude that it might have become entangled in the wire pennants attached to the buoy. In an attempt to free the rope, the two men used both hands to pull on it. However, the rope did not come in freely, so they stopped pulling and looked over the bulwark to see what was causing the resistance. From his position in the wheel-box, the master was not able to clearly see the men where they were now standing.

SDH2 saw that the ferry had moved up-tide, trapping the rope between the ferry and the buoy, so he turned his back on the bulwark and Benjamin and moved across the deck to a position where the master could see him. He intended to signal the master to manoeuvre the vessel clear of the buoy. SDH2 then heard an unusual noise and he turned around to find Benjamin was no longer on the mooring deck.

The unmooring process was observed from the approaching yacht *Oie,* which was slowly motoring downstream about 40m from *Ernest Bevin*. *Oie*'s skipper heard a loud metallic clang, immediately before seeing Benjamin falling through the air head-down, hitting the buoy and ending up in the water.

1.2.6 Post-accident

At 0602, immediately after witnessing the accident, *Oie*'s skipper transmitted a radio call to the Port of London Authority (PLA) Vessel Traffic Services (VTS) informing them of a man overboard from the Woolwich Free Ferry. VTS relayed this information to river traffic by a "Pan Pan" urgency message.

Simultaneously, on board *Ernest Bevin*, SDH2, realising that Benjamin must have gone overboard, shouted this to the master. The master immediately activated the 'up-tide' engine emergency stop control to prevent Benjamin being taken into the propeller. SDH2 rushed to the bulwark to look for Benjamin. After a few seconds Benjamin came to the surface, by the port side of the ferry, in his inflated lifejacket. However, the lifejacket was seen to be riding high around Benjamin's head. The master shouted to the bosun on the departing workboat and instructed him to return to *Ernest Bevin*. As the workboat returned to *Ernest Bevin,* it passed what appeared to the bosun to be just a floating lifejacket, as he was unaware that Benjamin was in it.

SDH2 jumped on the workboat as soon as it came alongside, and he and the bosun immediately set off towards Benjamin. On reaching him they could see that Benjamin appeared unconscious and his lifejacket was not keeping his face clear of the water. Having pulled Benjamin alongside the workboat using a boathook, the two crew men attempted to recover him on board. However, they were not able to lift him over the workboat's high bulwark **(Figure 6a** and **b)** and were concerned that he might slip out of his lifejacket entirely. A few minutes later the PLA vessel, *Kew,* arrived on scene in response to the VTS's urgency message. A crewman crossed from *Kew* to the workboat and together the three men were then able to pull Benjamin on board.

The master saw the rescue from his position in the wheel-box and he immediately notified Woolwich Free Ferry's duty manager of the accident by telephone and requested that he arrange for an ambulance to meet the workboat. At 0607 the ambulance service was informed of the accident and paramedics were despatched from the ambulance station adjacent to the ferry terminal.

Figure 6a: Workboat and *Ernest Bevin*

Figure 6b: Workboat deck and relative height of bulwark for manoverboard recovery

In the workboat, Benjamin appeared to be unconscious but breathing, and the crew ensured that his airway was kept clear until the workboat arrived alongside the Woolwich Free Ferry's S terminal, where paramedics took over. Unfortunately Benjamin did not regain consciousness and, despite the paramedics' best efforts, he was confirmed dead at the scene.

1.3 VESSEL DESCRIPTION

Ernest Bevin was a Class V, Category C passenger vessel, authorised to operate on restricted waterways such as the River Thames, but not on the open sea.

Ernest Bevin was one of three identical double ended[2] ferries (the others being *James Newman* and *John Burns*) built in 1963 for London City Council's Woolwich Free Ferry.

The ferries were powered by twin 368kW, 600 revolutions per minute (rpm) Mirrlees National engines driving fore and aft Voith Schneider cycloidal propulsion units. Voith Schneider propulsion is favoured by ferries and harbour tugs because it offers good manoeuvrability, efficiency and longevity. These units had deck housings immediately above the propellers **(Figure 7)** which covered the gearbox, leading down to a propeller well and out through the hull to five controllable pitch blades protruding vertically from the vessel's counter **(Figure 8)**.

Ernest Bevin's Voith Schneider propulsion units had integral reduction gearing of 6.8:1, decreasing the main engines' normal operating shaft speed of 600rpm down to the propeller shaft speed of 88rpm. The propellers operated at a constant speed, and the ship's speed and direction were controlled by altering the propulsion units' blades pitch and thrust deflection. The blade sweep of the propellers in one rotation was 6.3 metres (m), equating to 9.2m per second, or 20.6 miles per hour. The propellers rotated continuously with the engines; there was no system of disengaging them from the engine drive shafts.

Ernest Bevin had two public decks: an accommodation deck (with crew-only mooring decks at either end) above which was a car deck, the two decks being connected by stairwells. The car deck was straddled amidships by an athwartships control platform.

The master controlled the vessel from a central wheel-box sitting atop of the raised athwartships platform with subsidiary wheel-boxes positioned on the outboard port and starboard wings of the platform. While this afforded him a good view of the main car deck, his view of the mooring decks was restricted by the car deck's traffic control huts **(Figure 9)**. By walking between the wheel-boxes, the master could improve his view of the mooring decks to a limited extent. Due to this restricted view, when mooring and unmooring, the master was reliant on the mate and deck crew passing him information on the distances and directions between the ship and the mooring buoys. To provide the master with this guidance, the mate either positioned himself on the mooring deck with the deckhands, or at the edge of the car deck, in clear view of the master and with an unobstructed view of the mooring deck below him **(Figure 10)**.

[2] Double ended: craft with no apparent differentiating bow or stern and, to all intent and purpose, looking identical forward and aft.

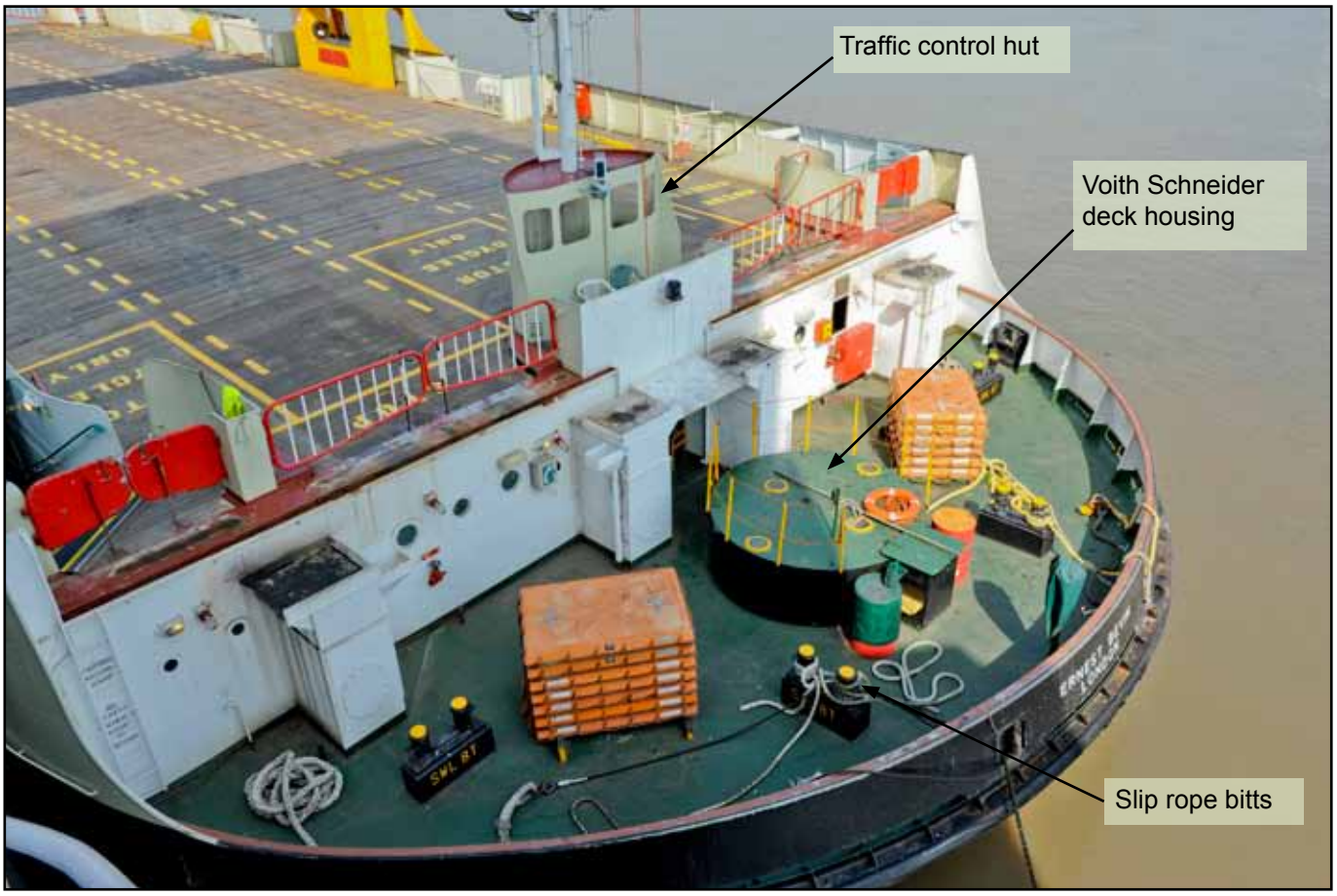


Figure 7: Car deck and mooring deck arrangement with bitts and Voith Schneider deck housing

Figure 8: Sister ship *John Burns* showing Voith Schneider propeller below the counter

Figure 9: Master's view from control platform towards the mooring deck while moored to buoys (**Note:** The obstruction posed by the traffic control hut and the lack of visibility of the mooring buoy)

Figure 10: Mate positioned by edge of car deck to facilitate monitoring of deckhands and direct communication with master

The communications methods available to masters and mooring deck crews included:

- Hand signalling
- A one-way public address (PA) system from the wheel-box to deck
- Two-way telephones between the wheel-box and the mooring decks, and;
- Hand-held very high frequency (VHF) radios.

The most commonly used method of communication, and that in use at the time of the accident, consisted of hand signals between the master and the deck crew. These hand signals were not specified or standardised across the fleet and individuals often used their own unconventional signals.

1.3.1 Crew structure and ferry operating patterns

Minimum manning for the ferries was six persons. However, each ferry crew normally comprised nine members: master, mate, bosun, engineer, two senior deckhands[3] and three deckhands. Woolwich Free Ferry generally operated two ferries at any given time, with a third out of service for planned maintenance or available for contingency service. The ferries were manned by five crews, designated Crew 1 to Crew 5. This enabled a daily two shift pattern on two ferries while the fifth crew took rest days. Crews alternated between the ferries depending upon their shift pattern. Normally, crews stayed together as a team, however during leave periods or other absence individuals would stand in for colleagues on other ferries. Over time, crew members would eventually work within all five crews.

Crew shifts were from 0440 to 1240 hours and from 1240 through to 2040 hours daily. Historically, the morning shift had commenced at 0440, following an agreement between LRS and the trade unions to allow time for crews to change into their work clothes upon arrival at the ship. However, over time this had become an approximate 0520 start, as crews elected to arrive at the ferries dressed for work and were able to have the ferries operational and alongside for their first scheduled crossings at 0610.

When not running the extended service, at the end of each working day the two ferries would be moored at their berths on the N and S terminals in readiness for the next day's operations.

1.4 KEY PERSONS

1.4.1 The master

Ernest Bevin's master was aged 40 and had worked on various Thames river craft all his working life. He had worked his way up through the ranks to his current post of ferry master, a position he had held for 10 years. He held a boatmasters' licence (BML) tier 1, level 2, with a large passenger vessel (LPV) endorsement.

[3] Senior deckhands: senior deckhand status was attained through time served on the ferry; no extra qualifications were required. The Woolwich Free Ferry had 10 such posts, and only when a vacancy became available could it be filled by an existing deckhand.

1.4.2 Senior deckhand number 1

SDH1 was aged 36 and had spent his working life on various passenger vessels on the River Thames, with 7 years on the Woolwich Free Ferry. He held a BML tier 1, level 2, with an LPV endorsement, qualifying him to sail as master. Occasionally, if a mate was absent for any reason, he would be promoted temporarily to fill that post (see paragraph 1.5.4).

1.4.3 Senior deckhand number 2

SDH2 was aged 32 and had spent his working life on various passenger vessels on the River Thames, with 3 years on the Woolwich Free Ferry. He also held a BML tier 1, level 2, with an LPV endorsement. Like his colleague, he too would stand in for the mate if required. Generally the two senior deckhands alternated any temporary promotions between them.

1.4.4 The casualty

Benjamin James Woollacott was aged 19. He was a sixth generation Thames Waterman[4] serving an apprenticeship with, and bound to, the Company of Watermen and Lightermen. Benjamin's mentor and master for the Waterman's apprenticeship was his father, from whom Benjamin had gained river and boat-handling skills before joining Woolwich Free Ferry.

The Company of Watermen and Lightermen's apprenticeship was one of structured training and 5 years' river experience with an employer. The major thrust of an apprentice's training was attainment of the BML. Although the BML could be attained in 2 years, it was the Company's philosophy that apprentices should gain 3 years' additional practical experience on the river before becoming qualified Watermen and Freemen of the Company.

Benjamin was initially employed as an apprentice deckhand with Woolwich Free Ferry when he left school at the age of 16. As an apprentice with Woolwich Free Ferry, Benjamin gained work experience on various types of river vessels, thus obtaining a rounded knowledge of river working. Both the Woolwich Free Ferry and the Company of Watermen and Lightermen apprenticeship schemes required Benjamin to attend North West Kent College to attain the mandatory training required to hold a BML. Benjamin completed all necessary training and gained his BML tier 1, level 2, in September 2010 and was subsequently appointed as a fully qualified deckhand with Woolwich Free Ferry on 11 April 2011 following the retirement of a long-standing crew member. In addition to BML certification, Benjamin received vessel specific induction training, training in conflict management, crowd control and working at heights (see paragraph 1.5.4).

Since becoming a qualified deckhand, Benjamin had carried out 13 mooring and 16 unmooring operations from the buoys. Additionally, he had carried out numerous similar operations during his apprenticeship period. Woolwich Free Ferry management recognised Benjamin's abilities, and he was considered by all to be eager and quick to learn.

[4] Thames Waterman: The title for river workers employed in transporting passengers on the River Thames and belonging to the historic Company of Watermen and Lightermen.

The lifejacket worn by Benjamin was a Crewsaver Crewfit, capable of generating 150 Newtons buoyancy from an inflatable chamber. Air for the chamber was provided from a compressed gas cylinder, which was opened automatically by a Hammar hydrostatic automatic inflating unit once the lifejacket was immersed in water. The lifejacket was supplied new to Benjamin in May 2011.

In the accident, the lifejacket suffered an impact in way of the operating head sufficient to cause a 5mm hole in the lifejacket's chamber **(Figures 11a and 11b)**, and there was paint residue on the outer cover and buckle **(Figure 12)**, consistent with the paint on the bulwark top rail. A zip toggle from Benjamin's lifejacket, and a set of nail clippers from his pocket, were found on the rubbing strake[5] outboard of the bulwark that Benjamin crossed when he went overboard **(Figures 13a** and **13b)**.

The postmortem examination determined that Benjamin's death had been the result of drowning following a head injury. The toxicology report showed that there were residual levels of cocaine metabolites, including cocaethylene, in his urine and blood.

Figure 11a: Lifejacket puncture

[5] Rubbing strake: the strengthened projecting strake to which fendering was attached all around the ferry, also known as belting.

Figure 11b: Lifejacket puncture

Figure 12: Bulwark rail paint residue on lifejacket

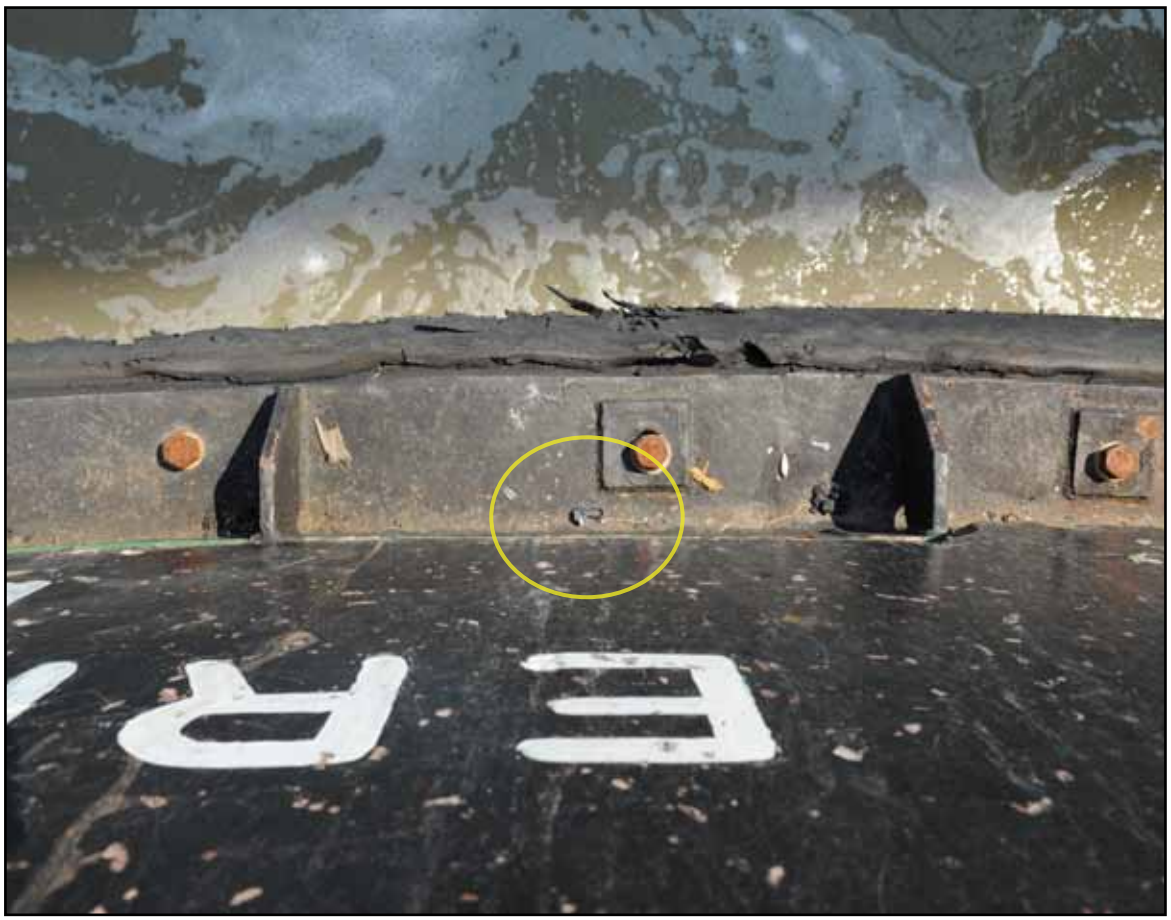


Figure 13a: Zip toggle from Benjamin's lifejacket

Figure 13b: Nail clippers repositioned where it was found after the accident

1.5 WOOLWICH FERRY OPERATION

1.5.1 Serco Limited

Serco Limited is an international provider of services to both private industry and public sectors, with a primary focus on supplying improved efficiency and quality to its clients.

SLMS is a business unit, which is part of Serco Limited's Defence, Science and Nuclear Division specialising in marine operations at several locations throughout the UK.

SLMS was awarded the contract to manage and operate the Woolwich Free Ferry for an initial 18 month period on 1 October 2008, after being the preferred bidder in a tendering process. Since that time, LRS had reviewed SLMS's performance and extended its contract on two occasions, the most recent extension being from 1 July 2011, for a further 21 months.

As part of its bid for the Woolwich Free Ferry service, SLMS demonstrated to LRS that it had a suitable safety management system in place to run such an operation. SLMS's safety management system complied with the International Safety Management (ISM) Code for its ocean fleet operations and the Merchant Shipping (Domestic Passenger Ships) (Safety Management Code) Regulations 2001 (DSMC) for its internal UK passenger fleet operations. Where there was no legal requirement for compliance with either of the above Codes, then SLMS's own Integrated Management System (IMS) was applied; the IMS was a hybrid system developed to meet the combined requirements of a number of international standards and both the DSMC and ISM Code. The three ferries of the Woolwich Free Ferry operation were all DSMC certificated and therefore were not operated under the company's IMS.

Before tendering for the contract, SLMS carried out a comprehensive audit of the Woolwich Free Ferry operation, focusing mainly on the arrangements for shore-side health and safety and protection of the environment. This identified over 80 actions required to bring the operation in line with SLMS's operating standards. These included the provision of enhanced training in risk assessment procedures and a revision of the existing risk assessments and operational procedures.

It was a condition of LRS's contract with SLMS that ships' personnel be reduced from ten down to nine in each of the five crews. This was achieved through natural wastage and voluntary redundancy, and did not detract from the minimum manning of six persons required by the vessels' passenger certificates. At, or around the same time, SLMS introduced two new posts ashore: a Senior Services Manager (replacing both the roles of Principal Ferry Manager and Assistant Manager) and a Marine Services Assurance Co-ordinator. Since neither of the appointees for these two new posts had a marine background, operational procedure reviews and risk assessments for marine operations continued, as before, to be completed by two Marine Operations Managers who had come up through the ranks on the Woolwich Free Ferry.

1.5.2 Operational procedures and risk assessments

The DSMC required that, *there shall be procedures in place for key shipboard operations with regard to safety. The tasks involved in these procedures shall be assigned to designated personnel.* Marine Guidance Note (MGN) 158 (M), which gave guidance on those regulations, advised operating companies to, *draw up simple procedures to ensure that safe working practices are carried out in the operation of the ship.*

SLMS's operational procedures for the Woolwich Free Ferry included standardised procedures for various operations including "Mooring to the Buoys" **(Figure 14)**. This detailed the process to be used and the roles of crew members during this operation, and included designating the mate to direct the master while he was manoeuvring the ferry to the buoys and to supervise the deck operation. A standardised procedure for the unmooring operation was not issued by SLMS managers because it was considered to be the reverse, but less complex, operation to the mooring process. In the absence of a standard operating procedure, the five ferry crews had devised their own systems for unmooring, which were broadly similar but not identical.

The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 required that: *A suitable and sufficient assessment shall be made of the risks of the health and safety of workers arising in the normal course of their activities or duties.* In line with those regulations, SLMS carried out a risk assessment review in June 2009 which identified the possible hazards of rope/people entanglement with the capstan, but not with the Voith Schneider propulsion units during mooring. There was no dedicated risk assessment for unmooring as, like the operational procedures, it, too was considered the reverse operation, and therefore covered by the risk assessment for mooring.

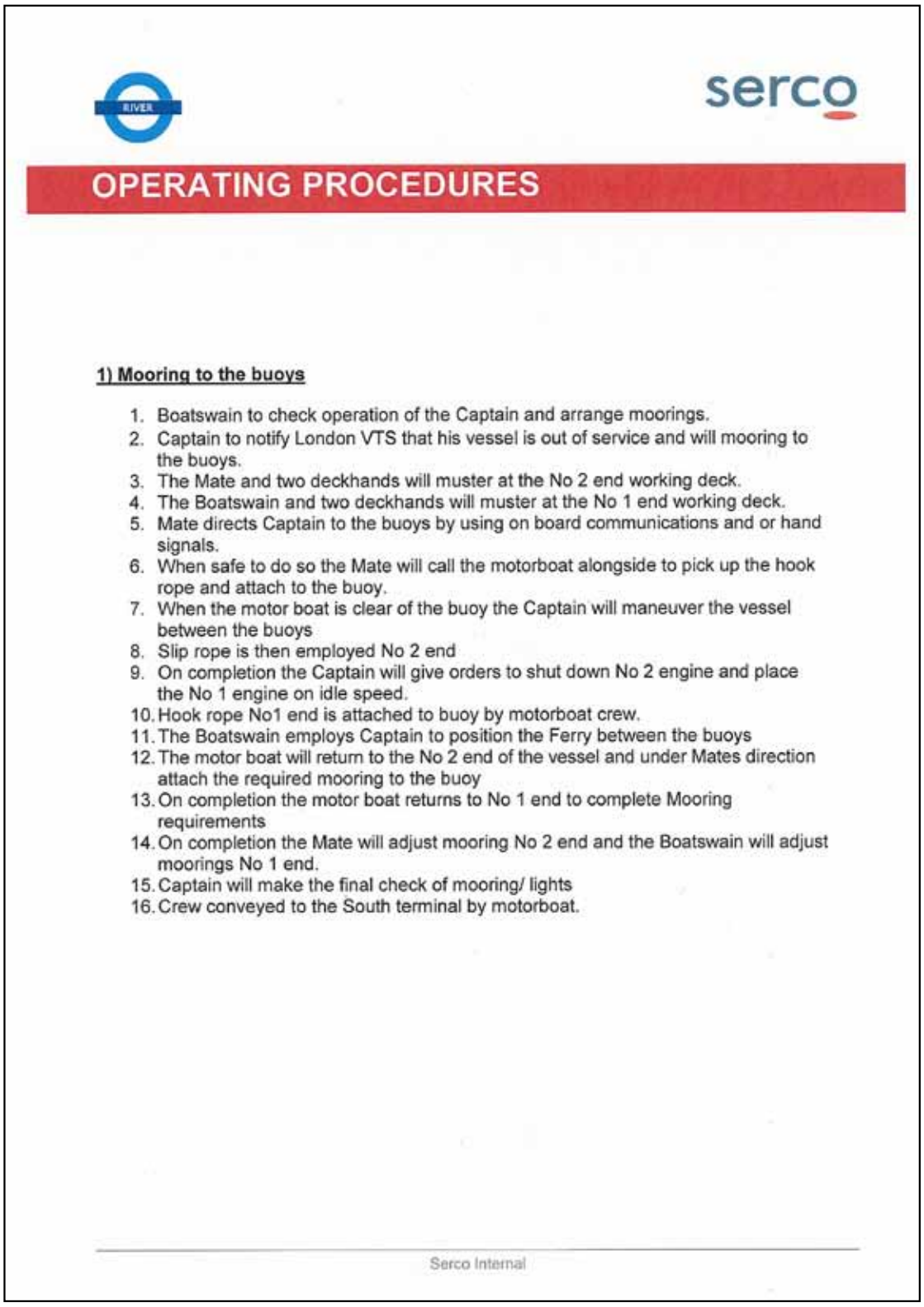
1.5.3 Auditing

Ernest Bevin was licensed by the MCA and was issued with a Passenger and Domestic Safety Management Certificate in March 2011. The Domestic Safety Management Certificate was in place when SLMS took over the operation of the Woolwich Free Ferry, and it had been revalidated as required.

Annual external audits were carried out by the MCA to check that *Ernest Bevin* complied with the requirements of the DSMC. Deficiencies identified during these audits tended to be relatively minor, and mostly related to equipment and machinery; these deficiencies were rectified as required to ensure continuity of certification.

External audits of the Woolwich Free Ferry service were also carried out annually by TfL. One year after SLMS had taken over the operation, TfL audited the company and noted that the company had made substantial changes and improvements to the health and safety culture within the ferry operation. This audit made 15 recommendations relating to shore processes and procedures. The follow-up audit 1 year later noted that 10 of the recommendations had been addressed, with the remaining 5 being progressed. TfL's audit of October 2010 focused on the land-based areas of the operation; mainly the office, workshop and yard activities.

A Woolwich Free Ferry DSMC internal audit of June 2010 made a positive observation regarding the vessel's plans for shipboard operations such as "Mooring to the buoys". In addition to the internal audits required by the DSMC, the ferry operations manager or his deputy carried out informal ad hoc ship audits, which usually consisted of sailing on board for a few river crossings. Any concerns or non-conformities observed during these were addressed at the time, but were not recorded.



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OPERATING PROCEDURES

1) Mooring to the buoys

1. Boatswain to check operation of the Captain and arrange moorings.
2. Captain to notify London VTS that his vessel is out of service and will mooring to the buoys.
3. The Mate and two deckhands will muster at the No 2 end working deck.
4. The Boatswain and two deckhands will muster at the No 1 end working deck.
5. Mate directs Captain to the buoys by using on board communications and or hand signals.
6. When safe to do so the Mate will call the motorboat alongside to pick up the hook rope and attach to the buoy.
7. When the motor boat is clear of the buoy the Captain will maneuver the vessel between the buoys
8. Slip rope is then employed No 2 end
9. On completion the Captain will give orders to shut down No 2 engine and place the No 1 engine on idle speed.
10. Hook rope No1 end is attached to buoy by motorboat crew.
11. The Boatswain employs Captain to position the Ferry between the buoys
12. The motor boat will return to the No 2 end of the vessel and under Mates direction attach the required mooring to the buoy
13. On completion the motor boat returns to No 1 end to complete Mooring requirements
14. On completion the Mate will adjust mooring No 2 end and the Boatswain will adjust moorings No 1 end.
15. Captain will make the final check of mooring/ lights
16. Crew conveyed to the South terminal by motorboat.

Serco Internal

Figure 14: Woolwich Free Ferry's procedures for "Mooring to the buoys"

1.5.4 SLMS staff development and training

SLMS required that all their deckhands held boatmasters' licences (BML) and was committed to them attaining the superior tier 1, level 2 BML qualification, with endorsements for large passenger vessels once they reached the age of 21. This ensured the availability of contingency staff when required and provided a pool of qualified staff from which to recruit when promotion opportunities arose.

The BML training syllabus **(Annex A)** specifies the means by which candidates can demonstrate the competencies required to attain the licence. These include basic seamanship and rope-handling. Section 1, paragraph 5 (Mooring and Unmooring a Vessel) of the syllabus requires that a candidate:

a) *Demonstrates a knowledge of the safety precautions and safe working practices to be observed in securing the vessel when mooring/unmooring including mooring terminology.*

c) Explains the need for personal safety equipment during mooring and safe positions when towing and mooring ropes under strain. [sic]

d) Explains the dangers of rope bights during towing, securing and mooring operations.

i) Explains the need to keep moorings clear of thrusters and propellers. [sic]

Additionally the BML syllabus requires that a candidate:

Demonstrates a knowledge of legislation, Codes of Practice and M Notices.

All SLMS crew members were issued with their own personal copies of the Code of Safe Working Practices for Merchant Seamen; the section relevant to this accident states:

25.3.1 During mooring and un-mooring operations a sufficient number of personnel should always be available at each end of the vessel to ensure a safe operation. A responsible officer should be in charge of each of the mooring parties, and a suitable means of communication between the responsible officers and the vessel's bridge team should be established. If this should involve use of portable radio, then the ship should be clearly identified by name to prevent misinterpretation. All personnel involved in such operations should wear suitable protective clothing (see Chapter 4).

25.3.9 Personnel should not in any circumstances stand in a bight of rope or wire. Operation of winches should preferably be undertaken by competent personnel to ensure that excessive loads do not arise on moorings.

In addition to attaining BML qualifications, Woolwich Free Ferry crews received further training to satisfy the requirements of the DSMC. This emulated the guidance in the MCA's MGN 203 and included certification and role training in:

- Crowd management
- Fire prevention and firefighting
- Personal survival techniques
- Personal safety and social responsibility.

SLMS maintained a training matrix to ensure statutory training requirements for each crew member was completed and in date.

The above certificated training was consolidated by crews drilling regularly in vessel anchoring, firefighting and manoverboard emergencies. Manoverboard drills did not extend to rescue of persons from the water by workboat.

To further enhance their development and experience, senior deckhands were occasionally promoted to stand in for ferry mates. When temporarily promoted in this way they were given a wage increment commensurate with the period of the promotion, which was for seldom less than a day.

1.5.5 Woolwich Free Ferry staff retention

Crew turnover was generally not a problem for the Woolwich Free Ferry operation. Workforce retention was high, and senior ferry and operations staff had typically been with the Company for many years.

The ferries were historically crewed by Thames Watermen, and operational management posts ashore were typically filled by ex-Woolwich Free Ferry masters with many years' experience of the ferries.

1.5.6 Corrective actions

Immediately after the accident, SLMS took initial steps to prevent a recurrence.

- A memo was issued to all crew members informing them that, with immediate effect, they were required to wear lifejackets for all mooring and unmooring operations both on board the ferries and on the workboats.
- An SLMS superintendent, external to Woolwich Free Ferry, was tasked to review the company's procedures and identify possible shortcomings. As a result of this initial review two major changes were implemented: slip ropes were no longer permitted to be recovered over the bulwark, but instead retrieved through the fairleads and, once on board, all ropes were required to be stowed clear of the mooring decks.
- A full review was undertaken of the company's safety management system, including procedures and risk assessments.

1.6 SIMILAR ACCIDENTS

On 18 May 1999 a crew member on board the ro-ro cargo vessel, *Sea Centurion,* suffered a fatal accident during an unmooring operation. The casualty was struck by a mooring rope after it became entangled in the Voith Schneider propeller of a Serco operated tug that was in attendance during the unmooring process. Although the crewman was not taken overboard, he was struck forcefully by the violently moving rope tail, resulting in his death.

The MAIB investigation report concluded that neither vessel had appropriate monitoring in place during the unmooring operation.

The MAIB investigation made a recommendation to Serco Denholm (now Serco Limited Marine Services) and the Royal Fleet Auxiliary:

> *To ensure adequate monitoring of operations and the situations surrounding those operations.*

Both operators accepted this recommendation and promulgated the information internally.

On 13 March 2011 a seaman was fatally injured during a mooring operation when he was dragged overboard by a bight of wire from the landing craft *Forth Guardsman*[6]*.* The mooring operation was carried out by only two crew members on a deck with restricted visibility from the conning position.

The ensuing investigation identified a need for improved supervision, seamanship and vessel position monitoring during mooring operations. The vessel's operators, Briggs Marine Contractors Limited, put measures in place to reduce the chances of a similar accident happening again.

[6] MAIB Report 16/2011

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 OVERVIEW

It is most likely that Benjamin Woollacott was dragged violently against *Ernest Bevin*'s bulwark prior to being carried overboard by a mooring rope which had become entangled in the vessel's propeller and was being wound in at a speed in excess of 20mph. He suffered severe facial injuries and was almost certainly unconscious when he entered the water. Benjamin subsequently drowned, despite his lifejacket bringing him to the surface and the quick actions of his colleagues. A diagrammatic representation of the likely accident sequence is shown in **Figures 15a** to **15e**.

2.3 UNMOORING OPERATION

In the absence of a written procedure, the five ferry crews had each developed their own systems for unmooring which, although similar, were not identical:

- Some mates positioned themselves by the car deck barriers where they could oversee the mooring deck and also have clear line of sight to the master; others preferred to be on the mooring deck closer to the deckhands.

- Some deck crews worked as a unit with all hands letting go the down-tide end before moving to the up-tide end; others would split into a down-tide and up-tide team. This could result in the number of crewmen participating in the release and recovery of a slip rope varying between one and four.

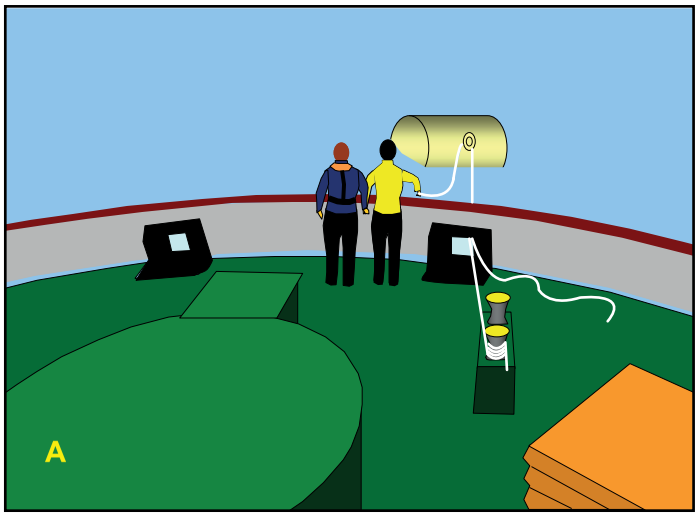
On the morning of the accident, the deck crew on *Ernest Bevin* had split themselves between the fore and aft mooring decks, but once the down-tide rope had been recovered, Benjamin quickly made his way to the up-tide end to assist. This might have been a result of his general eagerness, or he might have been aware that the deck crew was without a mate and therefore shorthanded at the more critical up-tide station.

Other aspects of the unmooring operation that varied across the fleet included:

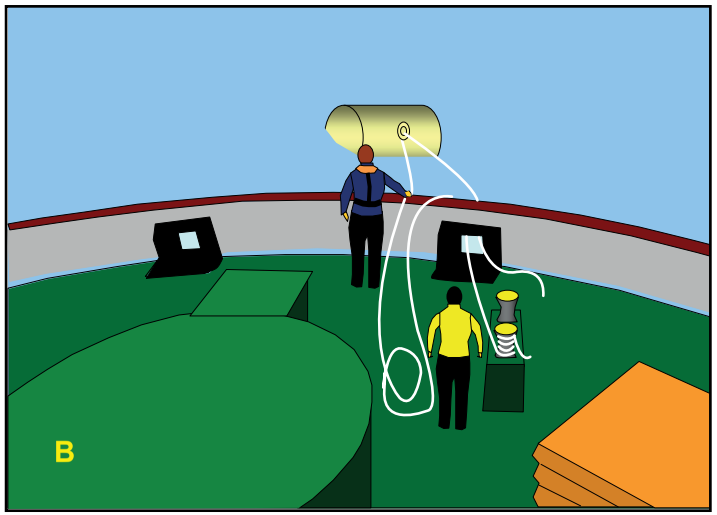
- The method of bringing the slip rope on board: some crews brought the rope over the bulwark, others recovered the rope through the fairlead.

- The means of hauling the ropes in: some crews hauled hand over hand, others put the ropes over their shoulder and "walked" them towards the bulkhead.

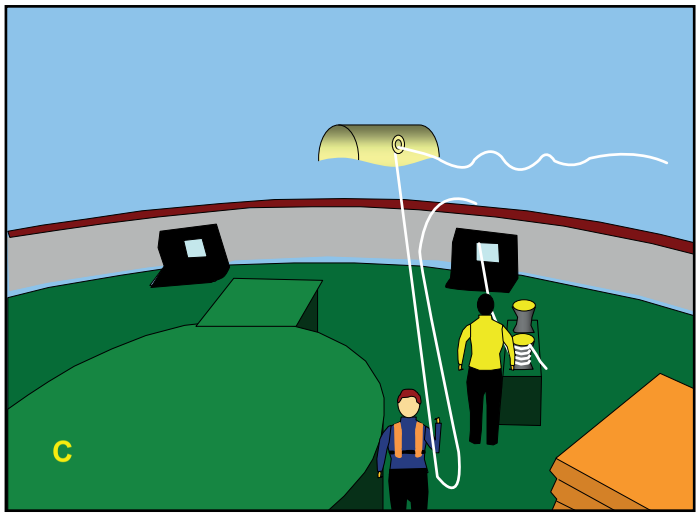
- Releasing the mooring ropes and insurance wire from the buoy: this task was recognised by all as needing at least two men on the workboat, but in practice varied between two and three.



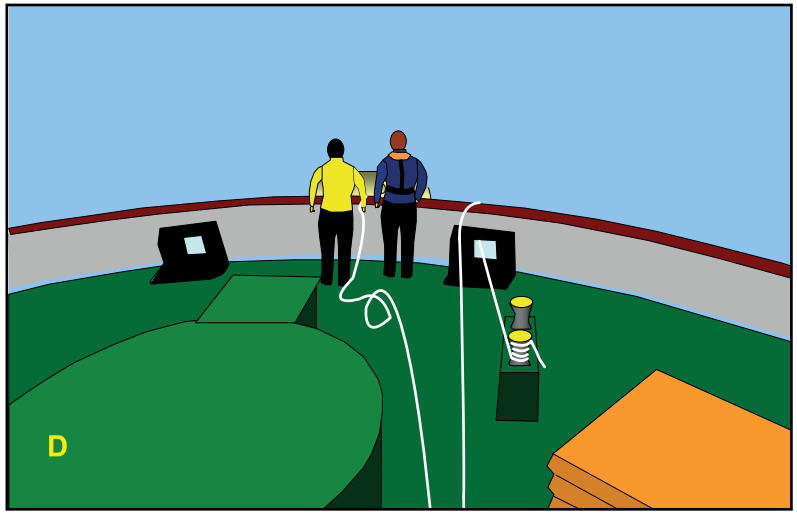
Rope being taken over bulwark from outside of fairlead



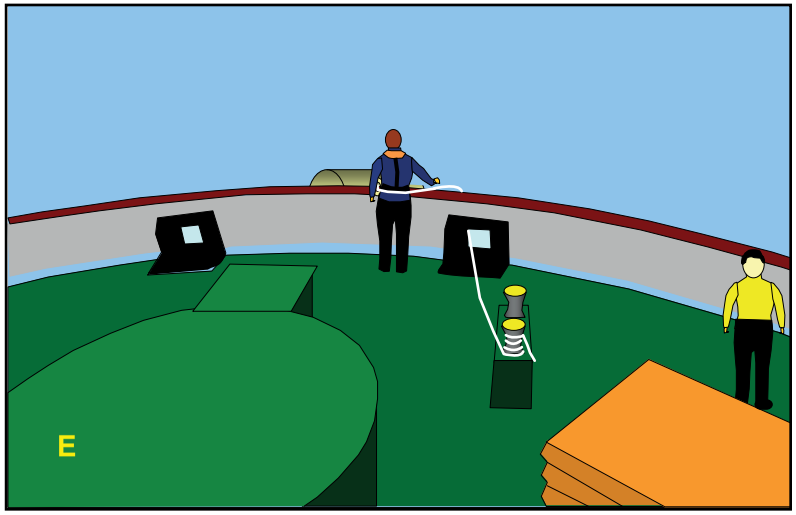
Rope being coiled on deck by SDH2 and picked up by Benjamin



Benjamin walking rope towards bulkhead



Rope jammed between buoy and ship, investigated by SDH2 and Benjamin



SDH2 repositioned to get eye contact with the master just before the rope is pulled overboard by the propeller

Figures 15a-e: Diagrammatic representation of the likely accident

2.4 SUPERVISION AND COMMUNICATION

The master's view and line of sight towards the mooring deck and buoy were impaired by the traffic control huts and car decks **(Figure 9)**. Generally, mates would either supervise the unmooring from the edge of the car deck, which gave a good view of the buoys, the deck crew and the master, or, they joined the deckhands on the mooring deck and moved into the master's line of sight as necessary for signalling.

The mate of *Ernest Bevin* was late for work on 3 August and missed the workboat transfer from shore to ferry; he notified the master of his intention to join the ferry at her first berthing at the N terminal. It was the master's belief that he instructed SDH1 to temporarily "keep an eye on things" until the mate joined the ship some 30 minutes later, briefly promoting SDH1 up to acting mate. However, this could not be verified. The master did not see any need to inform the operations manager that the mate was missing as there were adequate crew on board for the short trip to the terminal. This short period without a mate created an unusual situation as, ordinarily, if a mate was absent for a day, a senior deckhand would be temporarily promoted for that entire day, removing any uncertainty over supervisory roles.

On the morning of the accident, the SDHs were aware of the mate's short-term absence and the need for them to communicate positional information directly to the master. The master was expecting this guidance as he nudged the ferry into the tide towards the buoy. Unknown to the master, SDH1 left the mooring deck to go to the toilet immediately after relaying the master's signal to release this slip rope on to SDH2 and Benjamin. The master lost direct sight of the buoy when it was a few metres from the vessel as the remaining two men on the mooring deck were both hauling in the slip rope. Seconds later, the rope became jammed between the buoy and the ship, and SDH2 moved out of the master's vision to investigate the problem. At this point there was no-one available to guide the master, and he was left effectively "steering blind".

The master held station in the belief that SDH1 or SDH2 would soon appear to guide him or signal that the slip rope had been retrieved. Although questioning himself as to their whereabouts, he did not demand instruction from the man he believed was acting up as mate by using the PA system.

Although the PA system could have been used, communications would have been greatly improved by the use of hand-held radios. Further, the master handing a radio to a nominated acting mate would have removed any ambiguity and uncertainty as to that person's role, and what was expected of him.

There was a lack of recognition by the master and the deck crew, at this time, of the dangers associated with unmooring without supervision and without effective communications between them. Without such adequate supervision and effective communications, the unmooring process was inherently unsafe, and this should also have been recognised through SLMS's risk assessment.

2.5 ROPE RECOVERY

Releasing the slip rope from the buoys was a swift process and not arduous. It was not unusual for only one man to release and pull the rope in, just as Benjamin did with the down-tide slip rope a few minutes before the accident. It was known within

Woolwich Free Ferry management, and by crews, that down-tide slip ropes were occasionally let go by one person. When two people were in attendance, it was regarded as an even simpler task, hence SDH1's decision to leave the deck when Benjamin arrived.

Whether slip ropes were recovered through the fairlead or over the bulwarks had become a matter of personal preference among deckhands. There was no recognition that recovering the rope over the bulwark created a bight in the rope that, should the line become snagged, had the potential to pull persons over the bulwark into the river. Benjamin's injuries, the damage to his lifejacket, and the location post-accident of the zip fastener and nail clippers on the rubbing strake, all indicate that Benjamin was ensnared by the slip role and dragged violently against the bulwark before being literally folded over the bulwark top rail and into the river. It is likely that the hole in the chamber of Benjamin's lifejacket was caused by the operating head being pressed in to his torso as he impacted the top rail. Although pulling the rope through the fairlead could also create a bight that the unwary could become caught in, there would be far less potential to be pulled overboard. However, it should be noted that being caught by such a bight would probably result in being knocked violently to the deck, with associated potential for serious injury.

Once ropes were initially retrieved inboard and the ferry was underway, crew members could take their time to tidy them up on deck. Although it was practice to coil the ropes, they were invariably left on the mooring deck with their tails rove through the fairleads in preparation for mooring up again at night. The act of leaving the ropes in this position was potentially dangerous and unseamanlike, and although not condoned by marine operations management, they too had often adopted this procedure during their time as deckhands and ferry masters.

2.6 PROPELLER FOULING

As Benjamin and SDH2 pulled in the slip rope it became stiff to pull, requiring the two men to use both hands in an effort to free it. Post-accident investigation revealed that *Ernest Bevin* had come up against the buoy, jamming the rope between the two. At that point, they had been pulling on the section of the rope between the mooring bitts and the mooring buoy ring, the released tail of the rope had not yet been pulled out through the ring on the buoy. Immediately prior to Benjamin going overboard a loud metallic clang was heard by the skipper of *Oie*. This would indicate that the slip rope had not been pulled free of the mooring buoy ring before its tail was swept under *Ernest Bevin* by the tidal stream and suction of the propeller. The metallic clang was probably the mooring buoy itself being dragged hard against the ship's hull by the force of the propeller acting upon the rope leading up through the mooring buoy ring, and onwards to the mooring bits, where the other end was still made fast.

It is unknown why the slip rope became trapped between *Ernest Bevin* and the buoy. However, this could have occurred for one or more of the following reasons:

- *Ernest Bevin* came ahead further and faster than usual because the master was not receiving feedback from the deck party.
- The slip rope was being recovered more slowly than was usual.
- The slip rope became entangled with the wire pennants hanging from the buoy.

Whatever the reason, the result was that the tail of the slip rope was allowed to lie in the water, whereupon it was sucked into the Voith Schneider propeller, with tragic consequences. A vigilant supervisor monitoring the operation and giving appropriate guidance/feedback to the master and deckhand could have prevented the dangerous situation developing, and warned the deckhands about standing in bights. However, it is important that the hazard of allowing ropes to enter the water in way of the propellers is included in the vessel's risk assessments, that control measures are identified, and that these are included in the procedures for mooring and unmooring.

2.7 LIFEJACKETS

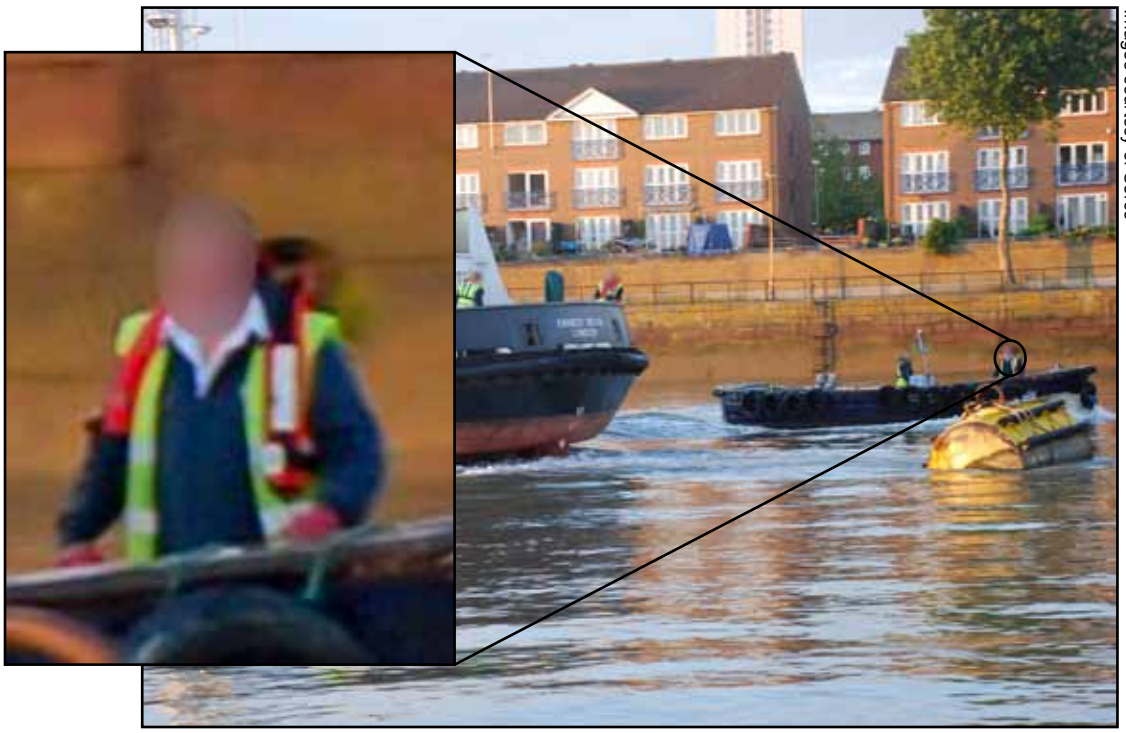
While the wearing of lifejackets was mandatory for crews transiting in the workboats, they were not required to be worn on the deck of the ferries at any time. After boarding the ferry on 3 August, most of the crew removed their lifejackets and made preparations for the day ahead. However, Benjamin kept his lifejacket on. It is unknown why he did so on this occasion as, like the rest of the crew, he normally removed his lifejacket while working on board the ferry.

Benjamin wore his lifejacket with the crotch strap removed; this was not uncommon practice among crews of the Woolwich Free Ferry, which was noticed by MAIB inspectors during the investigation **(Figure 16)**. However, that less than 2 weeks after the accident MAIB inspectors witnessed a crewman on the workboat wearing a lifejacket that was not secured together at the waist belt, was of even greater concern **(Figure 17)**.

The lifejacket brought Benjamin to the surface, but even before it began to lose pressure due to the small puncture, it was seen to be riding high around his head and not fully supporting his face from the water. Had Benjamin been wearing his

Images courtesy of Serco

Figure 16: Serco staff member wearing lifejacket without crotch strap fitted



Images courtesy of Serco

Figure 17: Woolwich Free Ferry staff member with unsecured lifejacket

lifejacket with the crotch strap connected, under different circumstances (such as falling into the water without receiving additional life threatening injuries) it might have saved his life.

The incorrect wearing of lifejackets by senior crew, which included lifejackets being worn with the crotch straps removed and, in some instances, without the waist belt being fastened, set poor examples to junior colleagues and was symptomatic of a weak safety culture.

2.8 CREW TRAINING AND CUSTOM AND PRACTICE

All crew members on the ferries were trained to comply with DSMC requirements. Not only did they hold BMLs, but also most (including Benjamin) held additional qualifications exceeding the minimum requirements of the Code. However, despite this high level of training, a number of the working practices used on board clearly demonstrated an erosion of the best practices the crew members had been taught. Examples of these included:

- Reeving mooring rope tails out through fairleads and leaving them lying on deck in preparation for mooring up again 14 hours later.
- The use of informal hand signals despite the availability of better communications systems.
- The master tolerating a lack of guidance/feedback from, and supervision of, the mooring deck during the unmooring operation.
- The ineffective use of lifejackets.
- Insufficient attention to the risk of standing in bights of rope.

The probable cause of this erosion of standards is likely to be task familiarity and the repetitive nature of the work. However, it is the company's responsibility to provide and maintain systems of work that are, so far as is reasonably practicable, safe and without risk to health.

While Benjamin was relatively fresh to the practices taught to him at college, it would have been very difficult for him to adopt working practices that were at variance to those followed by his more experienced and senior colleagues. Hence he is likely to have complied with the custom and practice on board.

2.9 RESCUE

The two men on the workboat had great difficulty in recovering Benjamin from the water. Fortunately, the port authority vessel *Kew* was nearby, and within a short time transferred a man aboard to assist.

The workboat's freeboard was just under 1m and inside from the deck to top rail was almost the same height **(Figure 6a** and **b)**. This height, while good for keeping people inside the boat, made recovery of a person from the water extremely difficult. Once alongside the unconscious Benjamin, the only equipment available for his recovery was a life-ring and boat hook. The boat hook was used to initially get hold of Benjamin; thereafter he was held in place with great difficulty by SDH2 until the crewman from *Kew* assisted. This was an exhausting task, and SDH2 was concerned that if the lifejacket rose further, it would slip off Benjamin and he would be lost.

All workboats on the river could be expected to assist in water rescue at any time, and therefore should carry suitable equipment for recovering unconscious persons.

2.10 RISK ASSESSMENT

The unmooring process allowed the slip rope to enter the water in an uncontrolled manner and, while that tail was in the water, it was vulnerable to being sucked into the up-tide Voith Schneider propeller, or being carried towards it by the tidal stream. Although crew members were aware of the need for speedy rope recovery, there was no risk assessment or formal procedure covering this operation as it was simply considered the reverse of mooring up and, if anything, less complex. However, the task of mooring to the buoys was carried out under controlled circumstances that prevented the ropes from entering the water throughout the operation. The Serco operating procedure "Mooring to the buoys" **(Figure 14)** makes no mention of the potential dangers of allowing ropes to lie in the water.

When SLMS took over operation of the Woolwich Free Ferry it implemented a review of the risk assessments and operational procedures. Since the recently appointed Senior Services Manager and Marine Services Assurance Co-ordinator had no previous marine experience, these reviews were carried out by the incumbent and longstanding Marine Manager and his deputy. The review examined procedures that in some cases had been in place since 1963, with no significant accidents having occurred. It is possible that the Marine Manager and his deputy were too close to the operations, as they too had been deck crew and masters on the ferries in the past, which might have hampered their ability to carry out an impartial evaluation of work systems.

After the accident, SLMS appointed an in-house marine expert (but external to Woolwich Free Ferry) to analyse the unmooring process. He immediately recognised the danger of taking ropes over the bulwarks, leaving tails rove through fairleads and leaving ropes on the mooring decks. Had such an independent marine expert been brought in to assist with the review of vessel's risk assessments and procedures in parallel with the shore-side health and safety review that took place when SLMS took over the operation, it is probable that the review would have been more objective and less blind to the risks of prevailing shipboard custom and work practices.

2.11 COCAINE METABOLITES

The metabolites of cocaine found during routine postmortem toxicology tests, indicated that Benjamin had taken cocaine some time before the accident. The presence of cocaethylene indicated that the cocaine had been taken in conjunction with alcohol, although no residual alcohol was found.

The MAIB has taken advice from a medical expert in the field of recreational drugs and their likely effects on behaviour. The advice given was that it is not possible to link drug action with the blood concentration of these metabolites and that, although the average elimination time of some of the metabolites found in Benjamin's body is 2 to 3 days, psychopharmacological activity terminates well before the drug residue is completely eliminated from the body.

Witness evidence indicated that Benjamin's behaviour on the day of the accident was normal and there was no indication that he was in any way impaired. Therefore, in the opinion of the MAIB, Benjamin's use of cocaine some time before the accident was not causal to the accident. Nevertheless, had Benjamin been suffering from the effects of alcohol or drugs, a suitably placed supervisor should have been able to spot his hazardous position on the deck and advised accordingly.

SLMS had an Alcohol and Substance Abuse Policy in place which allowed them to enlist the help of police should there be suspicion that any member of staff was considered unfit to carry out their duties due to impairment by drugs or alcohol. To fully implement the policy required a staff member to be displaying obvious effects of impairment. The company had no random alcohol and drug screening in place.

At the time of the accident, SLMS's alcohol and drug screening policy would not have been applied on the day of Benjamin's accident due to his apparent normal behaviour. However, a policy of random drug and alcohol screening would be a positive deterrent, especially where the metabolites of a drug could be detected in the body several days after being taken.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE BEEN ADDRESSED OR HAVE NOT RESULTED IN RECOMMENDATIONS

1. The five ferry crews each developed their own systems for unmooring, and the deckhands had their own techniques for rope retrieval as there were no guidelines on whether ropes should be recovered by leading them over the bulwark or through fairleads. [2.3]

2. There was a lack of recognition by the master and the deck crew of the dangers associated with unmooring without supervision. In this instance, a vigilant supervisor monitoring the situation and giving appropriate guidance to the master and deckhands could have prevented the rope from becoming jammed between *Ernest Bevin* and the buoy. [2.4, 2.6]

3. Without adequate supervision, the unmooring process was inherently unsafe and should have been recognised as such through SLMS's risk assessment process. [2.4]

4. Communications would have been improved by the use of hand-held radios and the master handing a radio to a nominated acting mate would remove ambiguity as to their role. [2.4]

5. A number of unseamanlike working practices were evident on board. These included:

    - Taking the rope over the bulwark creating bights in the rope that, following any subsequent outboard snagging, had the potential to pull unsuspecting persons over the bulwark and into the river. [2.3, 2.5]

    - Leaving ropes on the mooring deck with their tails rove through the fairleads in preparation for mooring up again at night. [2.5]

6. The incorrect wearing of lifejackets by senior crew, which included lifejackets being worn with the crotch straps removed and, in some instances, without the waist belt being fastened, set poor examples to junior colleagues and was symptomatic of a weak safety culture. [2.7]

7. It would have been very difficult for Benjamin to adopt working practices that were at variance to those followed by his more experienced and mature colleagues. [2.8]

8. The hazard of ropes entering the water near the Voith Schneider propellers had not been identified in the vessel's risk assessments, nor was it included in the procedures for mooring. [2.6, 2.10]

9. Had an independent marine expert been brought in to assist with the review of vessels risk assessment and procedures when SLMS took over the operation, it is probable that this review would have identified the risks of prevailing shipboard custom and work practices. [2.10]

10. The application of random alcohol and drug screening would be a positive deterrent, especially where the metabolites of a drug could be detected in the body several days after being taken. [2.11]

3.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION LEADING TO RECOMMENDATIONS

1. The workboat was not suitably equipped for recovering unconscious persons from the water. All workboats on the river could be called upon to assist in water rescue and therefore should carry suitable equipment for this task. [2.9]

SECTION 4 - ACTION TAKEN

4.1 ACTIONS TAKEN BY SERCO LIMITED MARINE SERVICES

As a consequence of this accident, SLMS has:

1. Formalised audit procedures to increase audits by technical and operational staff external to the Woolwich Free Ferry.

2. Enhanced its managerial safety checking procedures to include routine discreet shore-side observations of vessels unmooring from the buoys.

3. Revised and increased risk assessments and operational procedures from a previous 15 up to 29 enhanced and combined task focused documents. In particular, the inclusion of detailed procedures for unmooring from the buoys, emphasising the requirement for monitoring at all times.

4. Decided that when a replacement slip rope is required, a lighter gauge will be ordered.

5. Initiated changes to implement the Serco Limited Marine Integrated Management System into the Woolwich Free Ferry contract, while simultaneously retaining the DSMC mandate upon ship operations.

6. Implemented behavioural safety initiatives and training within the workforce.

7. Applied warning signage on mooring decks.

8. Reinforced its crew lifejacket mandate, emphasising the need for them to be donned correctly.

9. Implemented a policy of random alcohol and drug screening.

10. Implemented the use of hand-held radios for communications during mooring and unmooring operations.

11. Enhanced its means of incorporating formal notices from the marine superintendent into the management system.

4.2 TRANSPORT FOR LONDON

Has committed its Health and Safety auditors to conduct discreet spot-checks on the ferry operation.

4.3 MARINE ACCIDENT INVESTIGATION BRANCH

The Chief Inspector of Marine Accidents has written to the UK Major Ports Group and the British Ports Association drawing the findings of this investigation to their attention and, in particular, the need for workboats and other small commercial craft operating in ports and harbours to have an effective method of recovering a person from the water.

SECTION 5 - RECOMMENDATIONS

Serco Limited Marine Services is recommended to:

2012/143 Evaluate the suitability of its workboats for retrieving unconscious persons from the water and ensure they are appropriately equipped for such eventualities.

Marine Accident Investigation Branch
August 2012

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

Annex A

Boatmasters' licence syllabus

Boatmasters' Licence

Generic Syllabus

Categories A to D, and to Limited Coastal Sea Waters

Syllabus requirements for the issue of Boatmasters' Licence – Tier 1 Level 2

Maritime & Coastguard Agency

Contents

Introduction

Section 1

1. Bridge watchkeeping
2. Meteorology
3. Ship manoeuvring
4. Vessel handling in extreme weather
5. Mooring and unmooring a vessel
6. Ropework, access and lifting gear
7. Ship knowledge and publications
8. Basic engineering knowledge and machinery
9. Health and safety
10. Emergency action
11. Pollution prevention and handling and waste management

Section 2

1. Generic chartwork, navigation and position fixing
2. Locks and bridges

Section 3

1. Tides and currents
2. Compass work
3. Anchor work

Introduction

The mandatory requirements for the issue of Boatmasters' Licence and the standards of competence to be achieved are set out in relevant Statutory Instrument. The Maritime and Coastguard Agency (MCA) has agreed with the relevant sectors that the specifications described in this document will satisfy those requirements for Boatmasters' training and certification undertaken in the United Kingdom.

Health and Safety: Conduct of training

Training relevant to the certification and if undertaken must adhere to applicable regulations made under the Health and Safety at Work etc Act 1974 and take proper account of the advice given in associated guidance documents and 'Approved Codes of Practice'.

Organisations or Centres providing related training are required to make assessments of any potential risks to the health and safety of staff and trainees that may be associated with their activities. They are also required to identify, implement, monitor and review effective measures for minimising and controlling them. In addition, centres will be required to make effective arrangements for dealing with any emergency, incident or accident that may occur during the course of training. In the UK, the foregoing is required in accordance with the Management of Health and Safety at Work Regulations 1999.

Training Guidance

It is expected that participants would spend at least 180 hours of full time study to complete the syllabus.

GENERIC SYLLABUS – Tier 1 Level 2

1. Bridge watchkeeping

a) Describes the process of pre-sailing checks including the methods of securing openings such as weather deck hatches, tank lids, ventilators, air and sounding pipes prior to departure

b) Describes the process of pre-arrival checks and preparations

c) Demonstrates a knowledge of securing a vessel for departure

d) Describes the procedures for relief, maintenance, takeover and handover of a watch

e) Explains and describes the responsibilities of a lookout

f) Recognises sound and light signals

g) Describes the reporting procedures

h) Demonstrates a knowledge of good navigational practice while underway

i) Describes routine communication procedures with other members of the watch/crew on matters relating to watchkeeping

j) Demonstrates a working knowledge of the English language in marine terminology

2. Meteorology

a) Explains meteorological terms in sufficient depth to interpret weather conditions

b) Explains use of non-instrumental observations

c) Describes wind force, Beaufort scale, direction, true and apparent wind

d) Describes types of cloud, cloud cover and precipitation

e) Identifies on surface charts the main synoptic patterns and describes the associated weather (UK only)

f) Defines visibility including horizontal visibility

g) Describes waves, sea and swell state

h) Demonstrates a knowledge of the weather services available to shipping

3. Ship Manoeuvring

Steering by compass

a) Demonstrates a knowledge of steering a vessel including helm orders and altering course by helm orders

b) Demonstrates a knowledge of course keeping, altering course by compass and the procedure for making large alterations including maintaining of course by shore marks

c) Explains the effect of weather, ship's speed and condition of loading on steering

Steering Systems and their function

a) Demonstrates a knowledge of the components of steering systems and their function including selection of information from instruction manual

b) Describes the steering wheel or lever, helm indicators, steering motor, rudder, rudder indicators and rate of turn indicators including functioning of the rudder and propeller

c) Describes emergency steering systems including the change over procedures

Manoeuvring

a) Explains the effects on manoeuvring, turning circles and stopping distances of deadweight, draught, trim, speed, rudder angle and propeller/transverse thrust

b) Explains the effects on vessel manoeuvring of single, twin, controllable pitch and fixed propellers

c) Describes the effects of wind, current and tidal stream on vessel manoeuvring/handling

d) Describes the effects of underkeel clearance, squat and shallow water on vessel manoeuvring

e) Demonstrates the knowledge of manual depth finding

f) Describes the effects of vessel to vessel and vessel / bank interaction

g) States the precautions to be taken when grounding and; during and after a collision including minimising of collision damage

h) Demonstrates a knowledge of the manoeuvres for turning short round, emergency stop and man overboard

Regulations and systems for the safe movement of vessels

a) Demonstrates a knowledge of the content and application of the International and National Regulations for Preventing Collisions at Sea as appropriate for vessels in inland waterways, harbours and coastal sea waters.

b) Describes IALA Buoyage System A

c) Demonstrates a knowledge of the direction of buoyage, recognition of marks from shape, colour, top mark and light

d) Describes the procedure for taking the correct action on meeting marks

Visual Signalling

a) Recognises and demonstrates a knowledge of the use and meaning of single letter code flags listed in the `international Code of Signals' (Code flags that are considered essential for the tests are :- A, B, C, D, E, F, J, K, L, M, N, O, U, V, Y and Z)

b) Identifies `Distress Signals'

c) Describes the use of phonetic alphabets

Communications and alarm systems

a) Describes routine and emergency communication procedures

b) Demonstrates knowledge of the use of telephones, hand held radios, other signalling devices and emergency signals

4. Vessel Handling in Extreme Weather

a) Describes the precautions and procedures required to be carried out when heavy weather is expected including the rigging of safety lines, restriction of access to the weather deck

b) Describes how and when to make report on the conditions of seaworthiness

c) Demonstrates a knowledge of pitching, pounding, rolling, racing and broaching to (turning sideways or having stern sea in surf)

d) Demonstrates a knowledge of turning a vessel in rough sea

5. Mooring and Unmooring a Vessel

a) Demonstrates a knowledge of the safety precautions and safe working practices to be observed in securing the vessel when mooring/unmooring including mooring terminology

b) Demonstrates a knowledge of relevant sections of Merchant Shipping and HSE regulations, M notices, Company regulations and requirements, manufacturers recommendations

c) Explains the need for personal safety equipment during mooring and safe positions when towing and mooring ropes under strain

d) Explains the dangers of rope bights during towing, securing and mooring operations

e) Explains the characteristics, safe handling and use of ropes including heaving lines in mooring operations

f) Explains preparation and safe operation of winches, windlass, drum ends and similar machineries in all weather situation

g) Identifies head and stern ropes, breast ropes, towing springs, back springs, shore moorings, mooring bitts, fairleads and Panama roller leads

h) Describes routine and emergency communication procedures

i) Explains the need to keep moorings clear of thrusters and propellers

j) Explains the procedures for making fast to fixed terminals and jetties, mooring to buoys, single point moorings and exposed location buoys

k) Demonstrates a knowledge of adjusting moorings when alongside, warping along a quay, use of fenders, overboard discharge covers

6. Rope work, Access and Lifting Gear

a) Demonstrates a knowledge of safe use of man-made fibre, wire and combination ropes

b) Demonstrates a knowledge of correct use of basic knots, splices, stoppers, friction turns in stopping and mooring a vessel

c) Demonstrates a knowledge of the safety requirements to rig, recover and maintain gangways and other safe means of access to a vessel

d) Describes the methods available to ensure safe movement onboard ship

e) Describes the effects of tide, wind, waves, swell, changes of draught, trim and passing vessels while alongside

f) Outlines the care and maintenance of lifting gears including derricks, cranes and other gears

g) States the precaution to take when using lifting gears

h) States the precautions to be taken when fork-lift trucks or similar devices are used

i) States that all cargo gear should be inspected before the start of operations each day

j) Identifies lubrication schedules for deck machinery and equipment including correct lubrication of moving parts

7. Ship Knowledge and Publications

Ship Knowledge

a) Demonstrates a knowledge of terms and definitions used in connection with vessel operations and vessel construction

b) Demonstrates a knowledge of use of various types of paints and correct lubrication of moving parts including scheduling of lubrication for deck machinery and equipment

c) Prepares surfaces for coating i.e. steel, aluminium and wood

d) Explains the maintenance of fire fighting and life saving equipment

e) Demonstrates a knowledge of the need for preparation of work area and resources for maintenance

f) Identifies work area, tools and materials including safe stowage and use of materials

g) Explains `Permit to Work' procedures

h) Identifies plans, specifications, materials and equipment and the need to ensure availability

Stability and structure

a) Describes the basic principles of ship stability including the principles of floatation

b) Defines mass, volume, density and relative density

c) Defines volume, displacement, deadweight, buoyancy, waterline length, breadth, draught, Length overall, Length between perpendicular, freeboard (freeboard deck/deck line to water line) and identifies hydrostatic data

d) Defines Centre of buoyancy, Centre of Gravity, free surface, transverse metacentre, up-righting lever, up-righting moment at small angle of heel

e) Explains stable, neutral and unstable equilibrium, stiff and tender vessels

f) Explains the effect on Centre of Gravity (G) on loading, discharging, moving weights, ballasts or bunkers and changes (if any) in stability during voyage

g) Explains the dangers and effect of free surface at small angle of heel

h) Explains the causes of stress in a ship's structure including loads that create stress and strain in still water and a seaway

i) Describes water and weather tightness, watertight integrity and reserve buoyancy, watertight doors, ports, windows, deadlights and doors

j) Demonstrates a knowledge of ship construction features for various ship types sufficient to assist with ensuring watertightness and sea worthiness including the function and structure of tanks

k) Identifies structures to resist pounding, panting including the parts of structure liable to sustain damage due to heavy weather, vibration, shifting cargo, grounding or collision

l) Describes the siting and securing of air and sounding pipes, bilge and ballast piping systems from tanks/holds to engine rooms including non return valves, sea chests and mud boxes

m) Explains the methods of ensuring watertightness/ seaworthiness when closing openings in deck, bulkheads, deck machinery and lifting devices, ventilators, air and sounding pipes including features to aid the shedding of water

Publication and General

a) Explains the relationship between law, codes and other forms of guidance

b) Demonstrates a knowledge of legislation, Codes of Practice and M Notices

c) Demonstrates an awareness of the law, codes, principles and procedures and other forms of guidance relating to:

- maintaining a safe working environment on board ship
- safe movement to, from and around the vessel
- reporting of accidents and dangerous occurrences
- safety management systems
- risk assessment
- using chemicals or other hazardous materials, COSHH (Control of Substances Hazardous to Health) Regulations
- personal protective clothing and equipment

d) Appreciates the requirements of records for commercial and legislative process

e) Describes the recording methods available – written records

f) Explains the requirement for accuracy, brevity and clarity in record keeping

8. Basic Engineering Knowledge and Machinery

a) Plans engineering practices and procedures for small vessel propulsion machinery, auxiliaries and services in compliance with safety regulations including the use of machinery schedules and instructions (to include manufacturer's instructions).

b) Explains system operation and principles involved including the appropriate sequence and timing of activities for machinery and auxiliary operations

c) Describes how to locate common faults including the causes of machinery malfunctions and actions required to be taken

d) Describes measures to avoid pollution of the marine environment

e) Describes how to operate the control systems, possible problems and how to identify and correct minor deviations

f) Describes emergency shut down sequence, timing and hazards

g) Describes how to make adjustments to achieve and safe operation including the use of instruments to monitor conditions

Pumping and associated Control Systems

a) Describes routine pumping operations, bilge, ballast and operational pumping systems, equipment and machinery operations and possible problems that could occur

b) Demonstrates a knowledge of precautions to prevent pollution of the marine environment, anti-pollution procedures and associated equipment

c) Demonstrates a knowledge of relevant safety regulations, conditions, manufacturer's instructions and maintenance schedules with respect to pumping and associated control systems

Electrical Equipment

a) Describes the basic principles and operation of electrical machines (to include alternators or generators and control systems)

b) Describes electrical systems, protection arrangements, circuits and circuit breakers, instruments to monitor conditions

c) Describes the maintenance of electrical supply within given conditions, possible problems and irregularities that could occur

d) Explains fault detection system operation and isolating procedures including simple fault diagnosis, location of common faults on plant and control systems and actions to prevent damage

9. Health and Safety

a) Demonstrates a knowledge of the safety precautions, regulations, codes of practice and guidelines relating to :

- use of powered cleaning devices, hand and powered tools
- working at a height or over side
- operating lifting plant and the slinging of heavy equipment
- use and storage of chemical or other hazardous materials
- entry into and working in enclosed spaces
- protective equipment and clothing
- cargo access equipment
- the section of MARPOL relating to the disposal of waste
- maintenance of batteries

10. Emergency Action

a) Identifies the nature of emergency and takes initial action to conform to the vessel's emergency procedure

b) Takes appropriate action on recognising an alarm signal in accordance with emergency procedure including the raising of alarm promptly by the most appropriate method available

c) Communicates information to the relevant personnel promptly and accurately

d) Explains the operation of distress signalling devices including pyrotechnics including precautions to take when using signalling devices.

e) Describes how to avoid sending false distress signals and the remedial action to take if false signal is sent

f) Demonstrates a knowledge of basic Search and Rescue as would be applicable to inland waterways, harbours and coastal sea waters.

g) Describes the assistance which may be given by authorities around the coast of the United kingdom, and on inland waterways in addition to assisting other vessels

h) States the contingency plans and action to take in the event of emergencies at sea or in port as applicable, including imminent collision, collision, stranding, grounding, beaching, shoring, flooding, man overboard and abandon ship

11. Pollution Prevention and handling and Waste management

a) Describes how current guidance and legislation provides knowledge of the precautions and procedures to be taken to prevent pollution of the marine environment

b) Demonstrates a knowledge of pro-active and re-active policies, vessel operations, bunkering, hazardous substances on board, garbage and tank residual disposal, noise and clean air

Section 2

1. Generic Chartwork and Navigation

a) Demonstrates a knowledge of Navigation and routeing charts, sailing directions, chart catalogue, notices to mariners, nautical almanac, tide tables and tidal atlases carried aboard the vessel including distance tables

b) Describes the procedures for and makes necessary corrections to update charts and publications including ECDIS.

c) Demonstrates a knowledge of the use of Navigation drawing instruments, parallel rulers, dividers and compasses

d) Describes natural scale, distance measurement and chart co-ordinates

e) Plots the position of the vessel on a chart using latitude and longitude, or position lines derived from charted objects including the use of bearing, range, cross bearings, transits, running fixes, vertical sextant angles, procedures and limitations of navigation by GPS

f) Demonstrates a knowledge of the meaning of chart symbols and abbreviations

g) Explains the effects of set, drift and leeway (drift due to wind) and how to counteract

h) Explains navigational terms, international nautical mile, position line and position circle

i) Identifies charted objects/shore marks suitable for position fixing

j) Calculates dead reckoning (DR) and estimated position (EP)

k) Demonstrates a knowledge and use of regulations and systems for the safe movement of vessels

l) Explains and describes the procedures for appraisal, planning, execution and monitoring of a passage plan

m) Describes the basic operational features and controls of marine Radar and ARPA

n) Demonstrates a knowledge of the use of radar and ARPA to maintain safety of navigation

o) Demonstrates a knowledge of the use of satellite positioning systems such as GPS

p) Demonstrates a knowledge of the proper use of Echo sounder and Electronic Log

q) Describes reliability, common errors and limitations of Radar, ARPA, Satellite positioning systems, Echo sounder and electronic log

2. Locks and Bridges

a) Demonstrates knowledge of entering and leaving a dock or a lock in all stream conditions

b) Demonstrates a knowledge of passing through (under) bridges and navigating in close proximity within a canal

Section 3

1. Tides and Currents

a) Demonstrates a knowledge of tide tables and tidal stream atlases

b) States the causes of spring and neap tides

c) Defines height of tide, Mean High Water Spring, Mean Low Water Spring, range of tide, chart datum, height of charted objects, drying heights, spring and neap ranges

d) Describes the use of tidal diamonds when using charts

e) Finds the height and time of high water and low water using tide tables

f) Calculates the height of tide at a given time using tide tables and tidal curves

g) Calculates the time the tide will reach a given height using tide tables and tidal curves

h) Calculates the correction of soundings to chart datum

2. Compass Work

a) Demonstrates a knowledge of Magnetic Compass:

- card graduation in degrees
- compass bowl and binnacle
- dangers of magnetic material in the vicinity of the compass
- standard compass/steering compass

b) Calculates compass error and deviation by means of transits

c) Demonstrates a knowledge of Gyro compass and repeaters

- compass alarm and off course alarm

d) Converts compass or gyro courses to true courses

e) Determines variation and deviation using charts, curves and tables

f) Demonstrates the use of azimuth mirror, pelorus etc. for taking bearings

3. Anchor Work

a) Describes the types of anchor in common use on vessels operating in inland waterways, harbours and coastal sea areas.

b) Describes various parts of anchors, spurling and hawse pipes, connection and marking of anchor cables, chain lockers and connections, bow stoppers and other securing devices.

c) Demonstrates a knowledge of connections and markings of anchor cables, chain lockers and connections

d) Explains the securing of anchors and cables for passage and the importance of ensuring watertight integrity

e) Explains anchoring terminology and describes lights, shapes and sound signals for vessels at anchor

f) Demonstrates a knowledge of preparations and procedures for anchoring operations including in an emergency

g) Demonstrates a knowledge of maintaining an anchor watch including checks made for anchor dragging

h) Describes the safety precautions when anchoring, securing anchors including the safe use of machinery

Marine Accident Report