Report on the investigation of

a fatality on board the workboat

Llanddwyn Island

Roscoff, France

1 March 2010

Marine Accident Investigation Branch
Mountbatten House
Grosvenor Square
Southampton
United Kingdom
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Report No 14/2010
November 2010

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 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 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, 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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CONTENTS

GLOSSARY OF ABBREVIATIONS, ACRONYMS AND TERMS

BF	-	breaking strength
BHP	-	brake horsepower
Boskalis	-	Royal Boskalis Westminster NV
Brown Code	-	Code of Practice for the Safety of Small Workboats and Pilot Boats
BTA	-	British Tugowners Association
COSWP	-	Code of Safe Working Practices for Merchant Seamen
CPR	-	cardiopulmonary resuscitation
gt	-	gross tonnage
GMDSS	-	Global Maritime Distress Safety System
Harmonised Code	-	Marine Guidance Note (MGN) 280 - Merchant Shipping - Small Vessels in commercial use for sport or pleasure, workboats and pilot boats - alternative construction standards
HMS	-	Holyhead Marine Services Ltd
HTC	-	Holyhead Towing Company Ltd
HSEQ	-	Health, Safety, Environmental and Quality
ISM	-	International Safety Management (Code)
kN	-	kilonewton
kW	-	kilowatt
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
mm	-	millimetre
NWA	-	National Workboat Association
rpm	-	revolutions per minute
RYA	-	Royal Yachting Association

Safety Factor	-	5:1 unless otherwise stated
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping
SWL	-	Safe Working Load
t	-	tonnes
TTI	-	Tension Technology International Ltd
UTC	-	Universal co-ordinated time
VHF	-	Very High Frequency

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

SYNOPSIS

On 1 March 2010, Edward Kay, the deckhand on board the UK registered workboat *Llanddwyn Island*, was struck by a towing hawser when it parted. He died at the scene.

The workboat was moving a dredger in Roscoff, France and Edward had moved into the 'snap-back' zone of the hawser while it was under tension. The failed element was a chain connected to the stern of the dredger. The chain had not been provided by the vessel's owner and its use in the hawser was not in accordance with best practice. There were no written procedures for towing and pushing operations provided on board, and the vessel's risk assessments had not been reviewed since 2006.

The MAIB investigation identified that the minimum qualification requirements for the skippers of UK workboats operating under the Brown and Harmonised Codes need review and also do not equip skippers to undertake towing activities. A voluntary towing endorsement is currently being developed which has the potential to improve the safety of towing operations in the future.

Recommendations have been made to the Maritime and Coastguard Agency, the National Workboat Association, the British Tugowners Association, and the UK Harbour Masters' Association aimed at improving the qualification and training requirements for workboat skippers, particularly workboats engaged in towing operations. A recommendation has also been made to the National Workboat Association, the British Tugowners Association, and the International Association of Dredging Companies, which is intended to encourage the exchange of information between parties arranging charter parties for vessels engaged in towing operations. A further recommendation has been made to the Holyhead Towing Company aimed at assisting the development of safe systems of work on board its vessels.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *LLANDDWYN ISLAND* AND ACCIDENT

Vessel details

Registered owner	:	Holyhead Towing Company Limited
Port of registry	:	Beaumaris
Flag	:	UK
Type	:	Coded workboat
Built	:	1994, Holyhead, Wales
Classification society	:	Bureau Veritas
Construction	:	Steel
Length overall	:	21.5 metres
Gross tonnage	:	113
Engine power and/or type	:	2 x Cummins K19M engines, total 940 BHP at 1800rpm
Service speed	:	About 9 knots
Other relevant info	:	Twin screw, bollard pull of 14 tonnes

Accident details

Time and date	:	Approximately 1010, 1 March 2010
Location of incident	:	Roscoff, France
Persons on board	:	3
Fatality	:	1 – Edward Kay

1.2 NARRATIVE

1.2.1 Background

Llanddwyn Island sailed from Falkenberg, Sweden on 18 February 2010 and arrived in Roscoff, France on 25 February 2010 to assist with a port development project. For the project, the vessel was manned by a day crew and a night crew, each comprising a skipper and a deckhand/engineer.

During the afternoon of 27 February, *Llanddwyn Island* **(Figure 1)** towed the backhoe[1] dredger, *Manu Pekka* **(Figure 2)**, within the port using four lines to connect the vessels in a 'hip to hip' configuration **(Figure 3)**. During the move, the lines were adjusted to compensate for changes in tension as the dredger's spud legs[2] were raised and lowered. Three similar moves were conducted overnight, during which two of the lines parted and were replaced.

On 28 February, the day crew decided to conduct *Manu Pekka*'s first move of the morning by pushing the dredger into position. In preparation, the deckhand, Edward Kay, made up a hawser to connect the workboat to the dredger's stern. The hawser comprised the winch wire, a doubled 72mm polypropylene rope stretcher and a length of 13mm steel chain **(Figure 4)**. The hawser was led between the dolly pins on the workboat's bow and its chain was rove through a pad eye on the stern of *Manu Pekka* and secured to a shackle on the rope stretcher **(Figure 5)**.

Figure 1

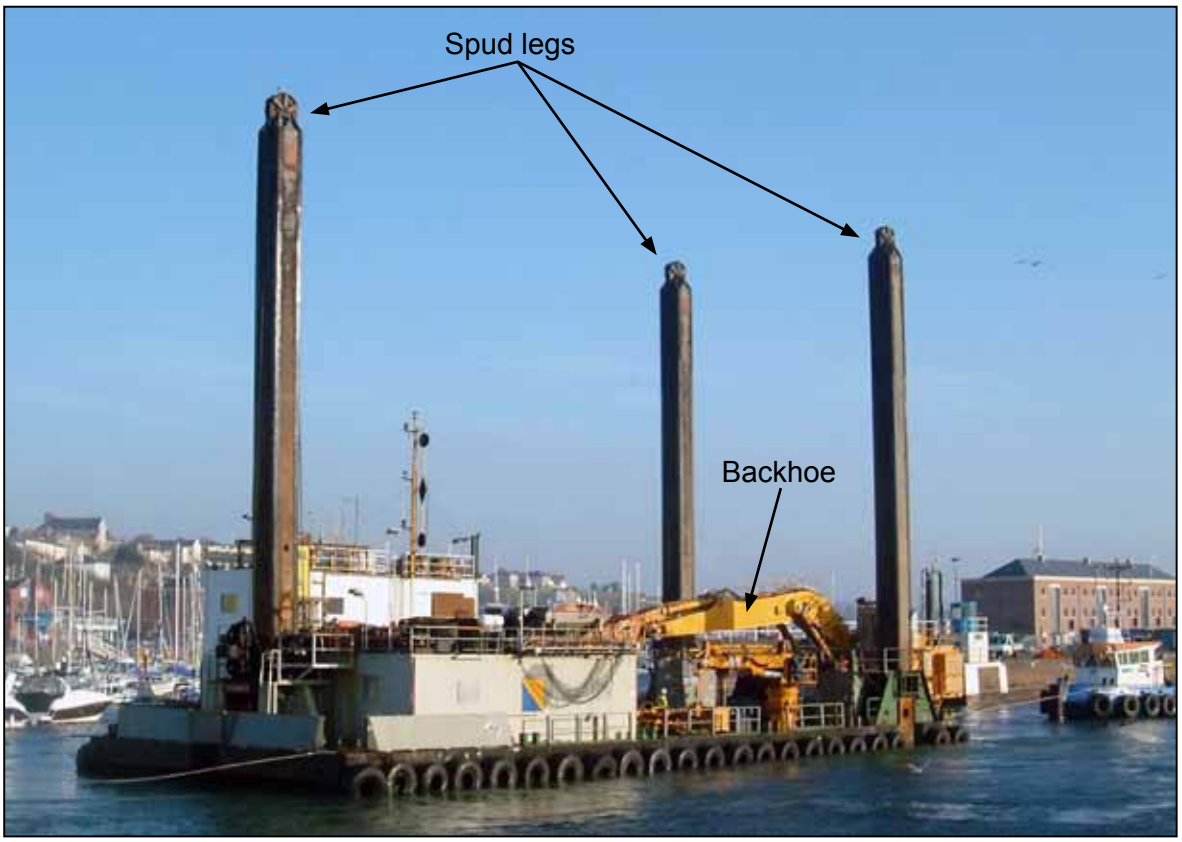
Llanddwyn Island

[1] A backhoe is an excavator whose shovel bucket is attached to a hinged boom.

[2] Spud legs are used to hold a dredger or pontoon in position and are lowered and raised mechanically.

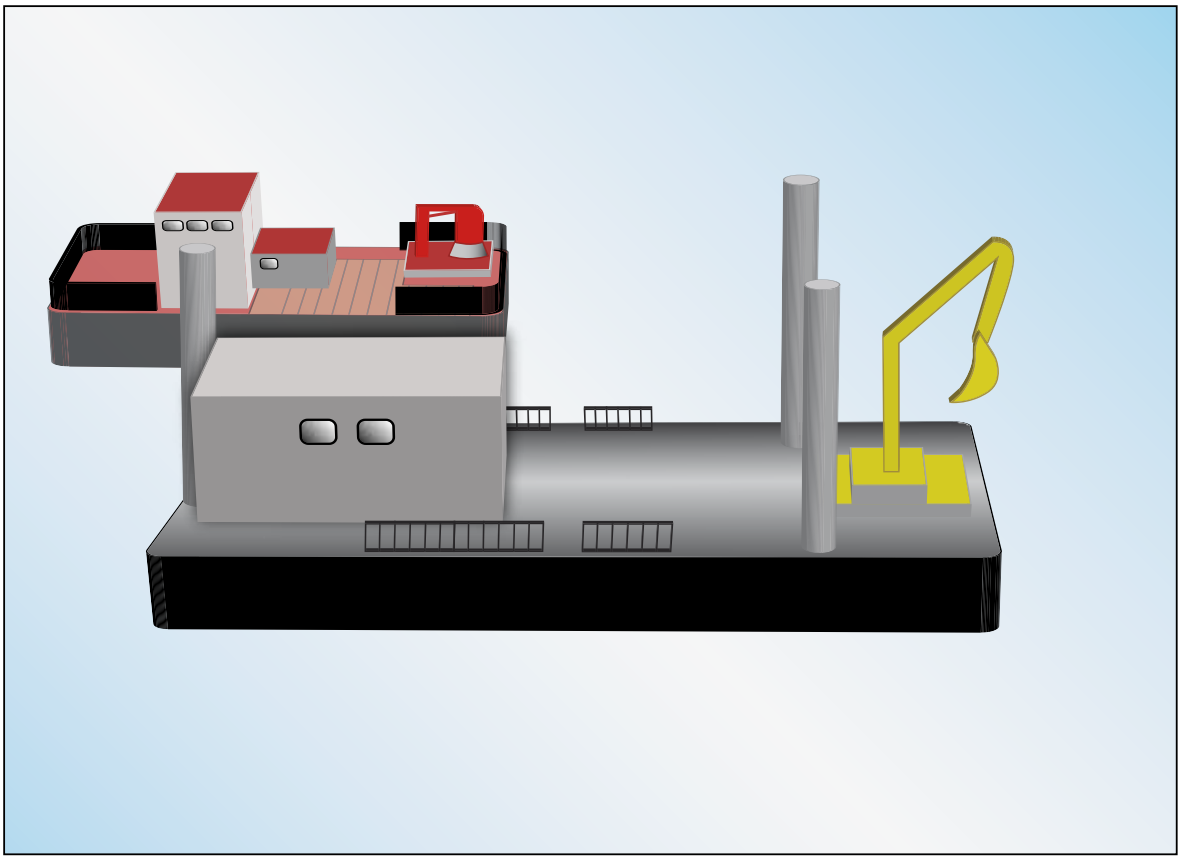
Image courtesy of Adrian Owens

Figure 2



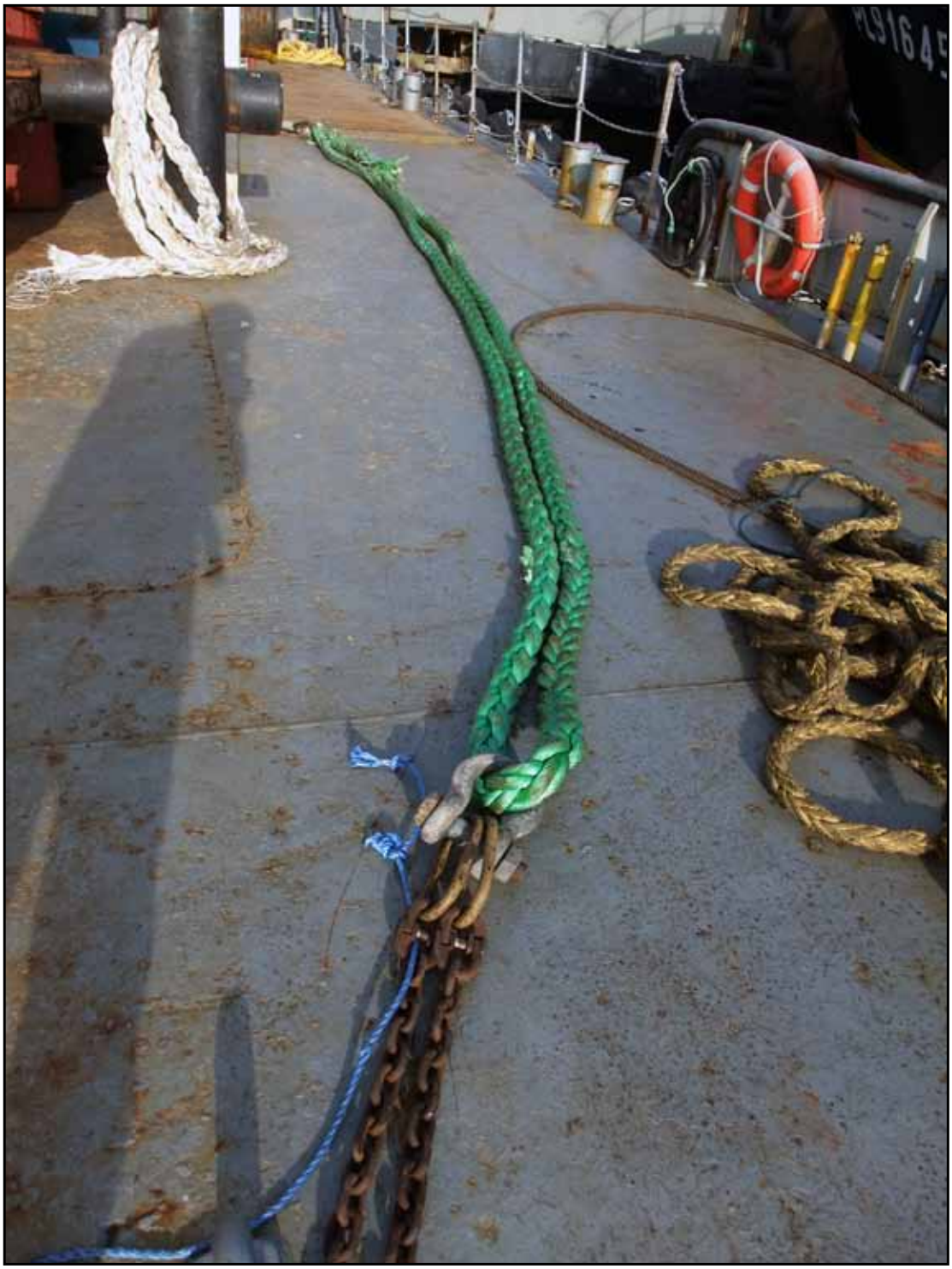
Manu Pekka

Figure 3



Hip to hip towing arrangement

Figure 4



Towing hawser

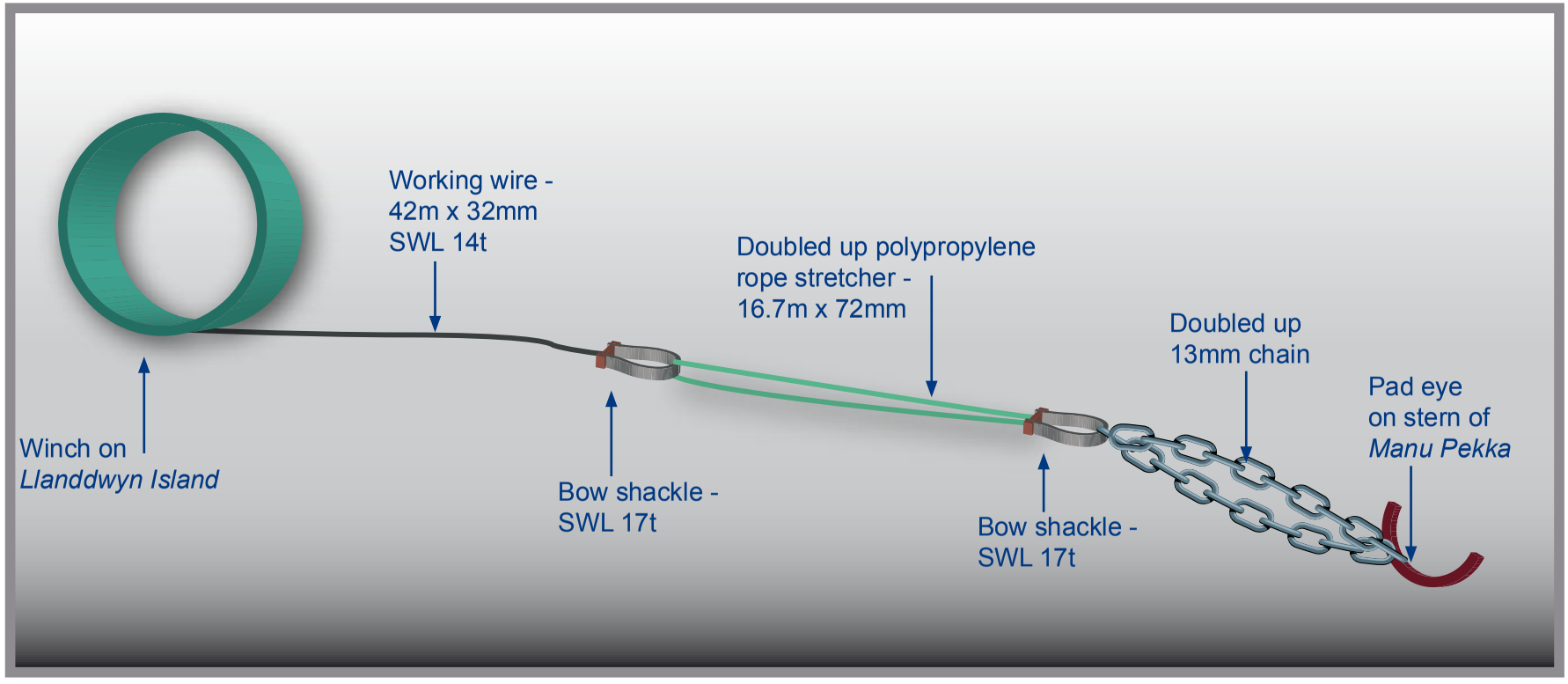


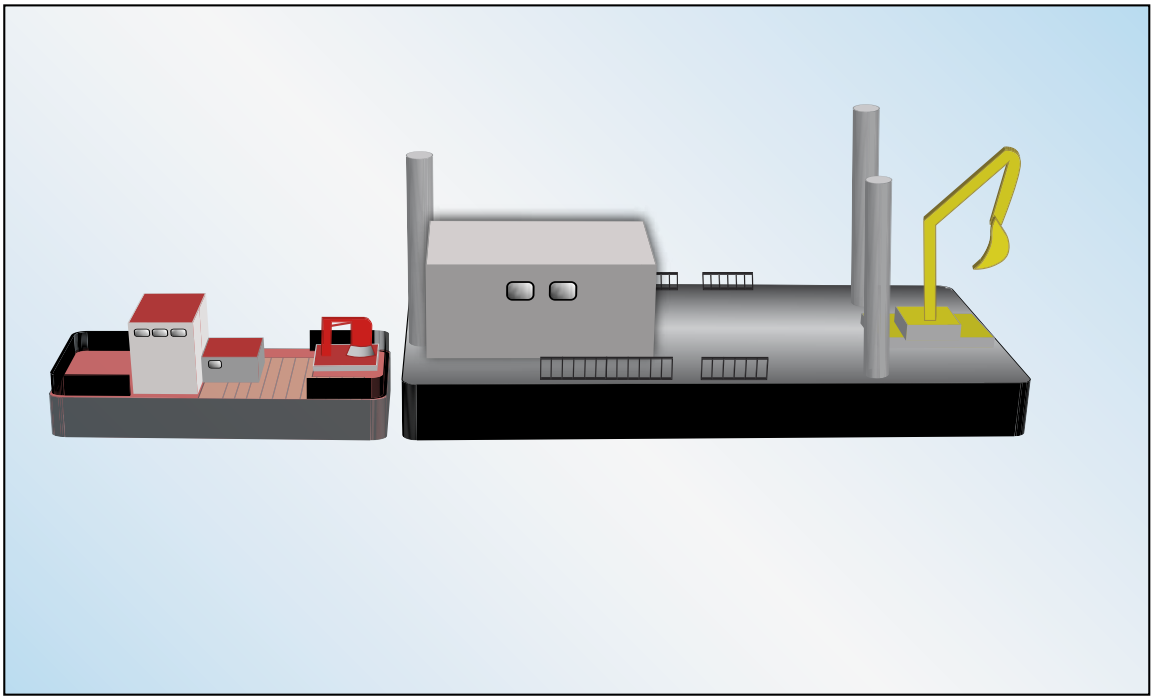
Figure 5

Hawser elements

Note: The SWL shown is one fifth of the breaking strain. However, within the towage industry, the SWL used by some operators is one third of the breaking strain

Llanddwyn Island's day skipper found it much quicker and easier to manoeuvre the barge when pushing from astern **(Figure 6)** as he did not need to rely on the direction of the tow being controlled by the backhoe operator using the excavation bucket as a pivot on the seabed. The single hawser continued to be used during several further moves conducted by the day and night crews. It was usual practice for the skippers to signal to the deckhands when the operation was complete and therefore safe to proceed forward to disconnect the chain.

Figure 6



Pushing position

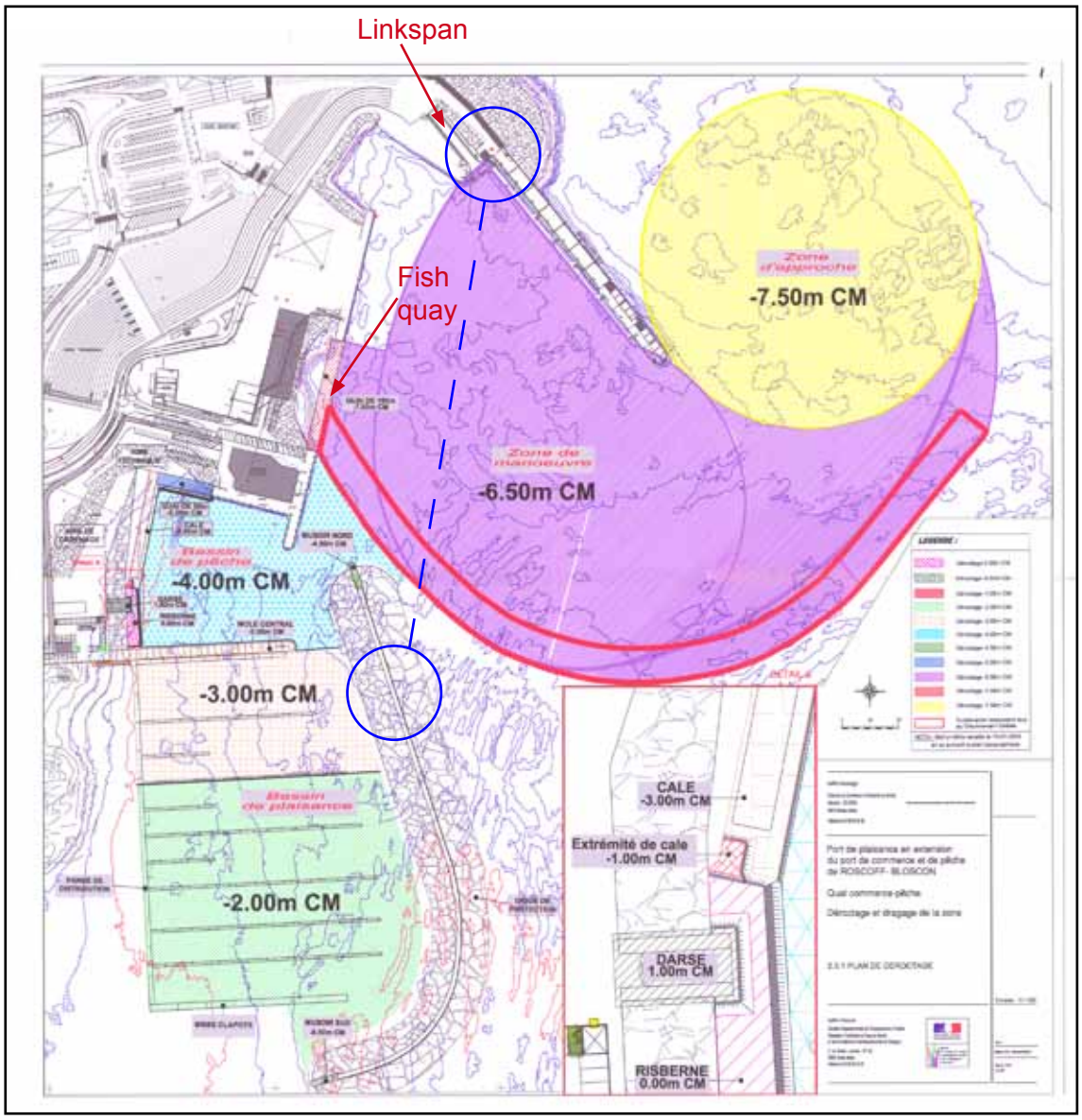
Overnight, the polypropylene stretcher was damaged when *Llanddwyn Island* manoeuvred *Manu Pekka* in high winds. The night crew replaced the stretcher with an unused 80mm polypropylene rope.

1.2.2 The accident

During the handover between the night and day crews on the morning of 1 March 2010, Edward was informed that the stretcher had been replaced with a stronger rope and he was advised to be wary of the chain, which was considered to be the weakest part of the hawser.

By that time, the weather conditions had improved and it was a bright sunny day with light winds and calm seas. At about 1000, *Llanddwyn Island* secured to *Manu Pekka*'s stern in readiness to move the dredger from a position south of the fish quay to the linkspan **(Figure 7)**. Before the move commenced, the dredging superintendent transferred from *Manu Pekka* to *Llanddwyn Island* so that he could be landed ashore on completion of the move. He had not been on board *Llanddwyn Island* during a move, and accompanied the skipper on the flying bridge to witness the operation.

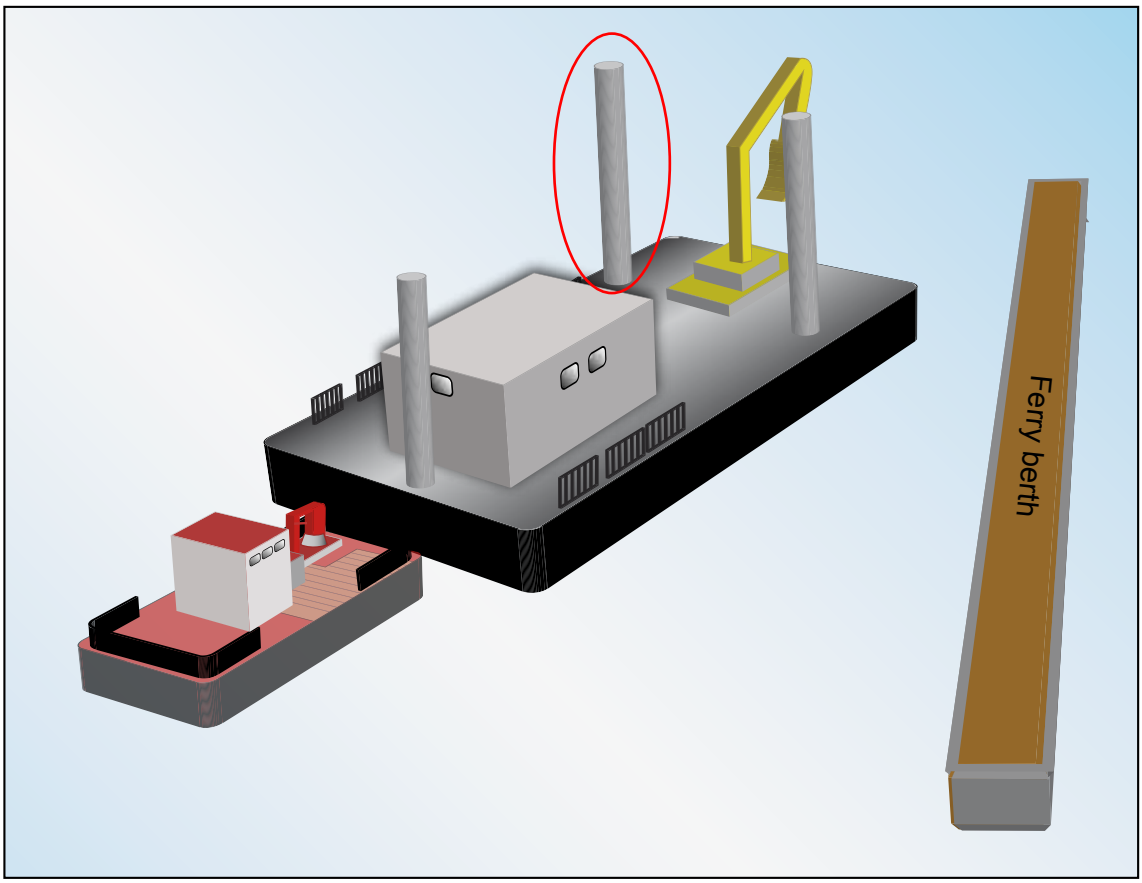
Figure 7



Project area

As *Llanddwyn Island* pushed *Manu Pekka* towards her intended position, the backhoe operator lowered the excavator bucket into the water and informed *Llanddwyn Island* on Very High Frequency (VHF) radio that he was slowing the move. *Llanddwyn Island*'s skipper reduced engine power and the dredger's port spud leg was lowered **(Figure 8)**. Both the skipper and the dredging superintendent then went below to join Edward in the wheelhouse. Shortly after, Edward went on to the deck; the skipper assumed that he would not go forward to disconnect the hawser until the manoeuvring was completed.

Figure 8



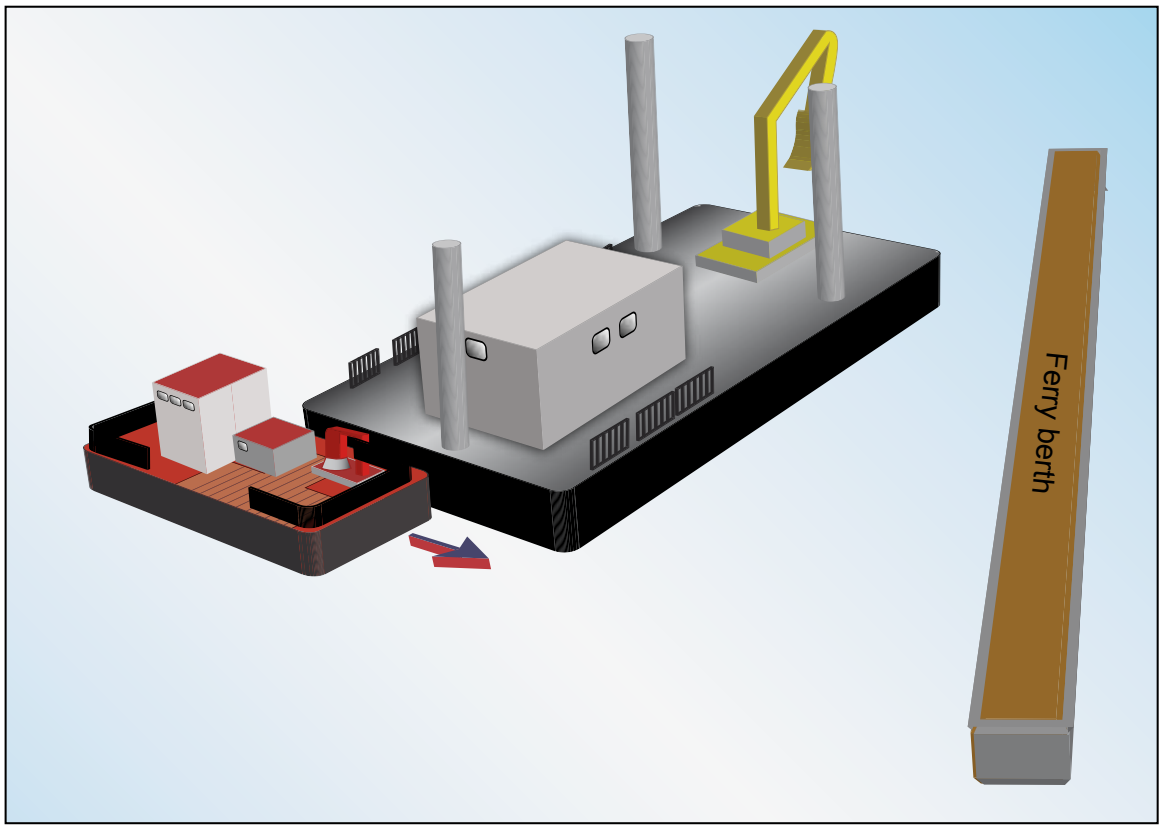
Port spud leg

The backhoe operator requested that *Llanddwyn Island* turn the dredger in an anticlockwise direction. To achieve this, *Llanddwyn Island*'s skipper veered the winch to ensure that the hawser was slack, and then manoeuvred *Llanddwyn Island*'s port side parallel to the stern of *Manu Pekka* with her bow level with the dredger's centreline **(Figure 9)**. In this position, *Llanddwyn Island's* skipper was able to assess the dredger's movement by looking down the dredger's port side. The skipper then went ahead on the port engine, applying between a quarter and half power.

When *Manu Pekka* was in position, the backhoe operator called *Llanddwyn Island* and informed the skipper that he was lowering the dredger's remaining spud legs. This call was not heard on board *Llanddwyn Island*.

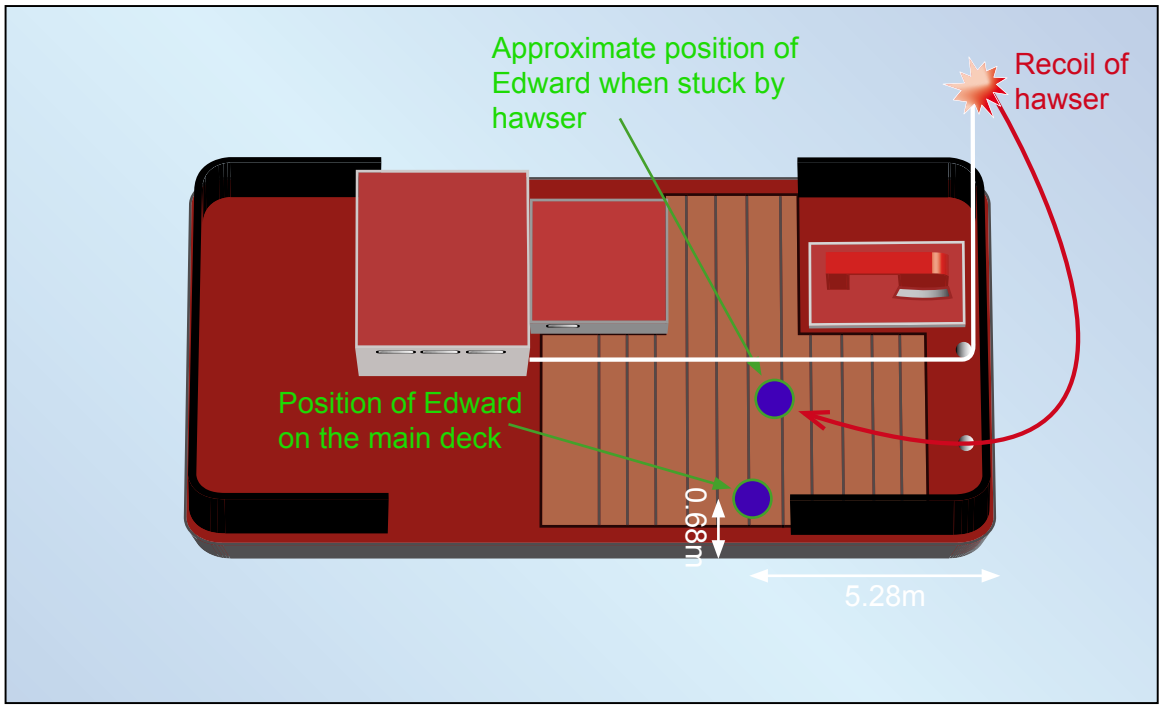
Meanwhile, Edward moved forward on the starboard side of the main deck. Suddenly, and without warning, the chain connecting the hawser to the pad eye parted. The hawser recoiled and struck Edward, who was thrown against the starboard rail before falling on to the deck **(Figure 10)**.

Figure 9



Turning *Manu Pekka* into position

Figure 10



Hawser failure

1.2.3 Emergency response and postmortem

The skipper and the dredging superintendent immediately went on deck and moved Edward further inboard. They checked for a pulse, but there was no sign of life. As *Llanddwyn Island* was still making way, the skipper returned to the wheelhouse and manoeuvred the vessel towards the vessel's nominated emergency berth. The dredging superintendent was unable to contact the shore authorities by mobile telephone so he shouted for the dredger's skipper to call the harbourmaster. On being notified of the accident at 1015, the harbourmaster immediately called the emergency services.

Once alongside, the skipper and the dredging superintendent commenced cardiopulmonary resuscitation (CPR) and were soon assisted by the skipper of another project vessel, MV *Audrey*. CPR was continued after the emergency services arrived but Edward did not regain consciousness and was declared deceased at 1115.

The results of Edward's postmortem showed that the cause of death was the neck and head injuries that were inflicted by the hawser. A toxicology report indicates that he had not consumed alcohol before the accident.

1.3 POST-ACCIDENT SURVEY AND TESTS

1.3.1 Chain

The parted steel chain **(Figure 11)** was recovered and sent to Tension Technology International Ltd (TTI) for inspection and testing. The test report **(Annex A)** summary included:

- *"Two breaking load measurements have been conducted on samples from the failed 13mm chain sling, with an average result of 224.3kN. Therefore the chain satisfied the minimum strength requirement for 13mm grade 8 short link chain for lifting purposes (in accordance with BS EN 818-2)*

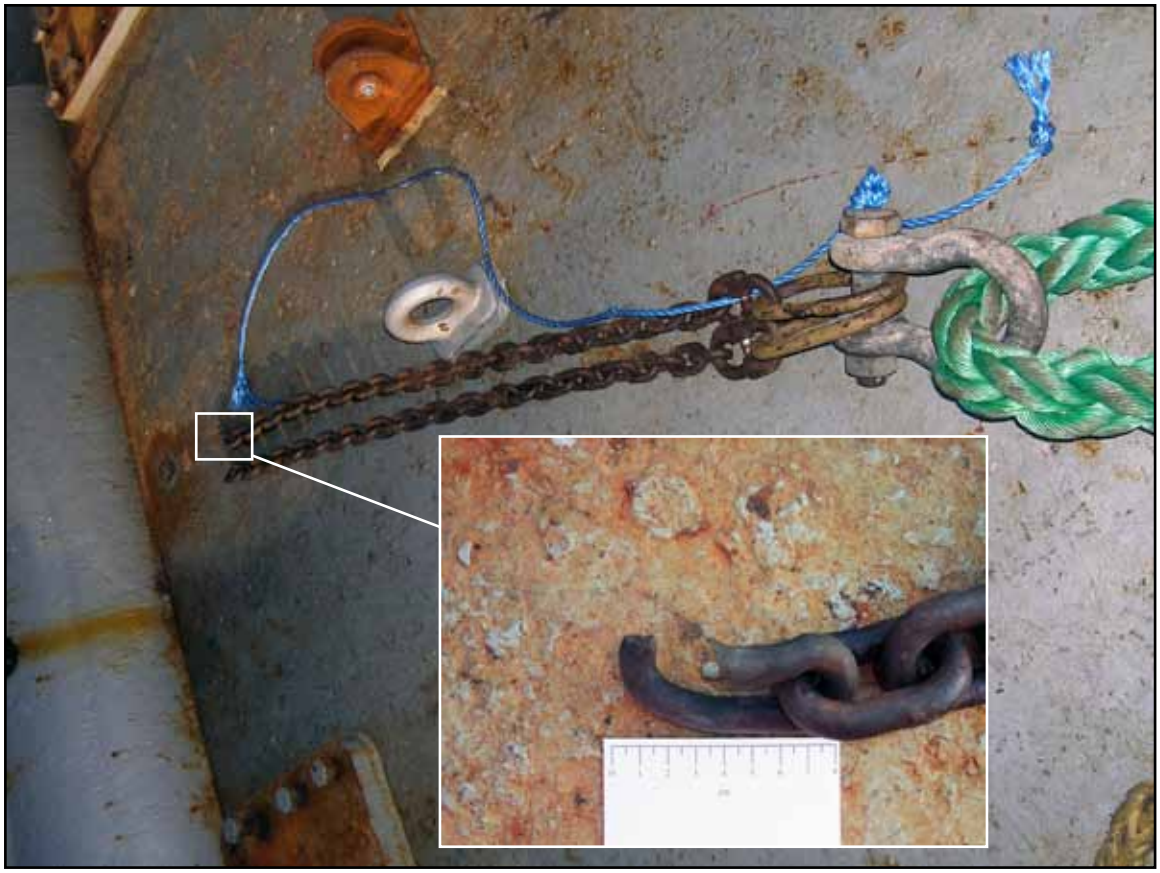
- *The fracture surfaces of the failed link were too corroded for detailed (microscopic) examination. However, the general appearance of the failure (gross plastic distortion) indicates a failure caused by high loading rather than fatigue. Subsequent testing indicated that the failure mechanism was in the form of an overload whilst the chain was doubled back on itself around a (pad-eye) pin.*

- *Two tests were conducted to break a length of 7mm chain doubled over a pin (180° wrap) scaled to match the diameter of the pad eye. The average breaking strength of the chain in this condition was found to be 48.94kN, a reduction of 25% in strength when compared to the straight chain strength.*

- *These findings would equate to a breaking load for the 13mm sling in the doubled up condition of 336.5kN.*

- *Even though the doubled back chain configuration was found to have reduced the average breaking strength (BF) of the straight chain, at 75% of BF the residual strength was still in excess of the Working Load Limit by a factor of 3.*
- *Although the strength of the doubled back chain was in excess of the same chain in the straight configuration, its ability to absorb (shock loading) energy in this configuration would be very considerably reduced. This finding is highly significant in the context of strain driven (e.g. marine) environments."*

Figure 11



Parted steel chain

1.3.2 Rope stretcher and dolly pins

Examination of the polypropylene stretcher revealed chafing damage at the point where it had been in contact with the dolly pins **(Figure 12)**. Evidence of rope chafing was also found on the port dolly pin[3] **(Figure 13)** and the deck roller.

[3] A dolly pin is an iron bar which may also be referred to as a norman pin

Figure 12

Chafing damage to rope stretcher

Figure 13

Chafing marks on port dolly pin

1.4 *LLANDDWYN ISLAND*

1.4.1 The day crew

The skipper had served on board fishing and small commercial vessels throughout his working career. He had been a skipper for over 20 years and had worked for Holyhead Towing Company (HTC) since 2002. He had also previously worked for the company on several occasions and first sailed on board *Llanddwyn Island* in 1994 when the vessel entered service. The skipper held a commercially endorsed Royal Yachting Association (RYA) Yachtmaster Offshore certificate and had completed training courses in sea survival, elementary first-aid, personal safety and social responsibility, fire-fighting, and the Global Maritime Distress Safety System (GMDSS).

Edward Kay was 58 years old and had served in the Royal Navy as a seaman before joining the Merchant Navy. Edward joined HTC in July 2007, and had completed one previous contract on board *Llanddwyn Island.* He had also been employed as a deckhand/engineer on HTC's multicat workboats and had skippered the company's small passenger vessels. Edward held a commercially endorsed RYA Yachtmaster Offshore certificate and a second engineer's Certificate of Competency which allowed him to work on board near coastal vessels up to 3000kW. During his service in the Royal Navy, Edward had completed courses in sea survival and fire-fighting. At the time of the accident, he was wearing a boilersuit, boots, a safety helmet and a lifejacket.

The day crew were employed on a cycle of 4 weeks on followed by 2 weeks off, and worked a 12 hour watch between 0630 and 1830. They were accommodated ashore when not on watch.

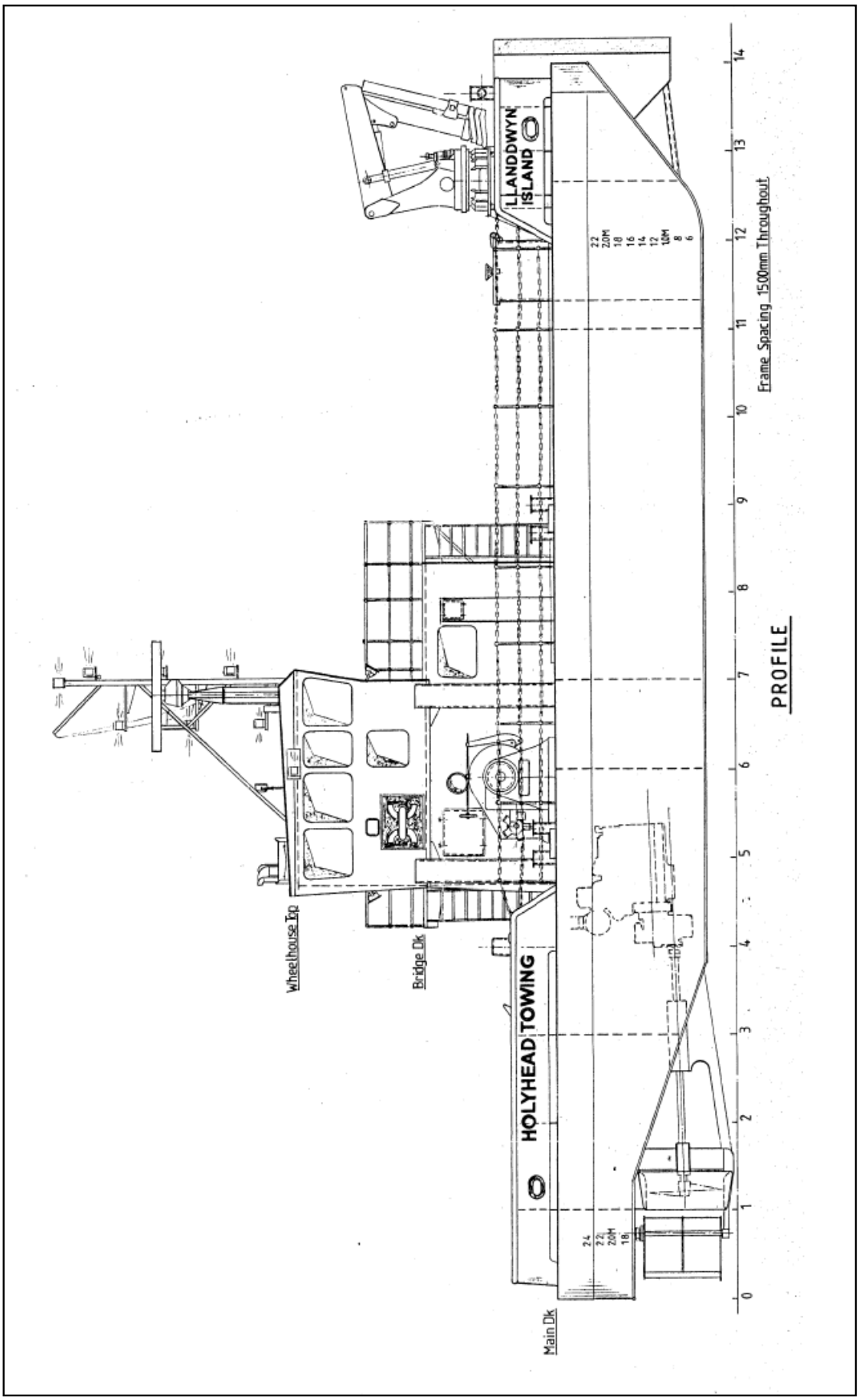
1.4.2 Construction, layout and towing equipment

Llanddwyn Island **(Figures 1 and 14)** was built by Holyhead Marine Services (HMS) in 1994 and was owned and operated by HTC. She was mainly used for anchor-handling, pushing, towing, and transporting cargo.

The wheelhouse was sited on the port side; equipment fitted included the propulsion controls, radar and VHF radio. The propulsion could also be controlled from a flying bridge above the wheelhouse, which afforded a good all-round view during towing and pushing operations.

A hydraulic crane with a safe working load (SWL) of 11.4t was sited on the main deck, forward of the accommodation. An anchor-handling winch with a pulling power of 30t was also sited on the main deck and could be controlled locally or from the wheelhouse. Other deck fittings included a towing hook, sited aft of the winch; a guard on the starboard side of the wheelhouse to protect crew when lines were under tension **(Figure 15)**; and two removable dolly pins at the bow which were used when working wires and hawsers. A horizontal deck roller was also fitted on the bow, forward of the dolly pins. The vessel had substantial tyre fendering on her sides and bow.

Figure 14



Llanddwyn Island - profile

Figure 15

Protective guard

A selection of loose towing equipment was kept in a storage area under the main deck. With the exception of the chain, the loose towing equipment used in the hawser had been supplied by HTC, but certification had only been provided for the winch wire and the 'bow' shackles. The chain had been brought on board during a previous project.

Table 1 shows the SWL of the hawser components used at the time of the accident. The SWL of the chain has been determined from testing; the SWL of the rope stretcher is estimated.

Component	Breaking Strain	SWL Safety factor 5:1	SWL Safety factor 3:1
Winch Wire	71.5 t	14.3 t	23.8 t
Rope Stretcher 72 mm	61.4 t (Estimated)	12.28 t	20.46 t
Rope Stretcher 80mm	75.5 t (Estimated)	15.1 t	25.16
Bow Shackles (Each)	85 t	17 t	28.3 t
Chain Strop 13mm – straight pull	22.4 t	4.48 t	7.46 t
Chain Strop 13mm 180° pull	33.6 t	6.72 t	11.2 t

Note: 3:1 is the safety ratio used by Holyhead Towing Company

Table 1 - Safe Working Loads of the hawser components

1.4.3 Certification

Llanddwyn Island was certificated under the Code of Practice for the Safety of Small Workboats and Pilot Boats, commonly referred to as the 'Brown Code'. Following survey, a category 1 workboat certificate was issued on 27 April 2009 by The Society of Consulting Marine Engineers and Ship Surveyors, a Maritime and Coastguard Agency (MCA) appointed certifying authority. This permitted the workboat to operate up to 150 miles from a safe haven. The vessel's towing hook and winch were checked during the survey, but checks on her loose towing equipment were not required.

Like most UK workboats that operate outside UK waters, the vessel also held a certification of class, which was issued by Bureau Veritas on 22 December 2009. The certificate classified her as a coastal vessel, and allowed her to operate within an area up to 6 hours sailing time from a port of refuge or safe sheltered area.

A Document of Compliance was issued for the vessel by the MCA on 26 February 2010 to certify that the construction and equipment of *Llanddwyn Island* complied with the applicable regulations regarding the carriage of specified dangerous goods.

1.5 HOLYHEAD TOWING COMPANY LIMITED

1.5.1 Overview

HTC is part of the Holyhead Group which also comprises HMS and the parent company, Holyhead Boatyard. The company provides purpose-built shallow draught workboats and tugs to dredging and marine civil engineering companies. It has a fleet of 30 vessels operating worldwide and is involved in joint ventures with Jifmar Offshore Services (France), Caspiisky Buksir (Kazakhstan) and Workboat Services (Falkland Islands). HTC's fleet provides a wide range of services including coastal tug work, dredging, pipe-laying, support to the construction and maintenance of offshore wind farms, and the transportation of the Airbus A380 wings by MV *Afon Dyfrdwy.*

1.5.2 Safety management

With the exception of *Afon Dyfrdwy*, HTC's vessels do not have to meet the requirements of the International Safety Management (ISM) Code. In May 2009, the company employed a health, safety, environmental and quality (HSEQ) manager to develop a framework for a health and a safety management system for its workboat fleet, including the implementation of onboard safety manuals. This work was ongoing at the time of the accident.

HTC did not provide written procedures for use on board *Llanddwyn Island*. It had provided written risk assessments in 2006 for a number of the tasks undertaken by the vessel **(Annex B)**, but these assessments had not been read by the crew or reviewed.

HTC had not provided internal training for *Llanddwyn Island*'s crew; it relied upon their experience within the workboat sector.

1.6 THE CHARTER PARTY

The development of an all weather deep water marina with 625 berths for yachts in Roscoff required the dredging and blasting of a basin within the harbour. This work was being conducted by Atlantique Dragage, which had subcontracted the provision of support workboat services to HTC. Atlantique Dragage had contracted HTC to undertake similar work on a number of previous occasions.

The charter party between Atlantique Dragage and HTC was agreed in February 2010 and was a uniform time charter party for offshore service vessels, also known as a "supplytime 89" charter. The hire period was for a minimum of 3 months with scope to extend if required. Section 39 of the charter party required a survey of *Llanddwyn Island* to be completed by a nominated surveyor prior to starting the 'on hire period'. No survey of *Llanddwyn Island* was conducted.

The use of *Llanddwyn Island* was restricted in the charter party to:

> *Any reasonable service within the legal and operational capabilities and certification of the boat and crewing arrangements*

It was intended that the vessel would be used to transport explosives and personnel between the shore and the blasting barges, and the project manager had approved the vessel to be used for this purpose. The decision to use *Llanddwyn Island* to move *Manu Pekka* was made after the vessel's arrival in Roscoff.

1.7 ATLANTIQUE DRAGAGE

Atlantique Dragage is based in France and is a branch of Royal Boskalis Westminster NV (Boskalis). Boskalis is a service provider operating in the maritime infrastructure, dredging, and maritime service sectors, and has a fleet of over 300 vessels operating in over 50 countries.

The company's HSEQ management system provided a framework for its project managers to follow. Copies of all relevant external documents such as tenders, conditions of contracts, contractors' risk assessments, and project risk assessments were required to be retained. On this occasion, there was no exchange of risk assessments between Boskalis and HTC regarding the use of *Llanddwyn Island.*

Subcontractors were also required to attend an induction lecture. The crews from *Llanddwyn Island* completed a safety induction given by the Atlantique Dragage dredging superintendent prior to the start of operations on 26 February 2010. The attendance of the two skippers and the night deckhand was recorded, but Edward's attendance was not.

1.8 *MANU PEKKA*

Manu Pekka **(Figure 2)** is one of the three largest backhoe dredgers in the world and is owned by Royal Boskalis Westminster BV. Built in 1983 by OMP Oy, Finland, she had an overall length of 47.9m, a breadth of 15.0m and a moulded draught of 3.0m. Although the dredger is registered as 680t, her tonnage on 1 March 2010 was 870t. She did not have a means of propulsion.

A Demag H 185 S backhoe capable of using buckets up to 14m^3 was sited forward, with offices and accommodation sited aft. Three spud legs were capable of being lowered to the seabed to stabilise the vessel during dredging operations. *Manu Pekka* can move around considerably on the water as her spud legs are being raised or lowered.

1.9 THE BROWN CODE

1.9.1 General

The Brown Code is given force by The Merchant Shipping (Small Workboats and Pilot Boat) Regulations 1998, and it applies to all United Kingdom (UK) Workboats of less than 24m loadline length that carry 12 or less passengers and proceed to sea, and to all UK pilot boats. The Code details the construction,

safety, and manning standards required for workboats. Its requirements concerning vessels engaged in towing are generally limited to the design and operation of towing hooks and release of towing lines, but also include:

> *Towing arrangements should be maintained to ensure that they are in an efficient working condition.*

1.9.2 Manning and qualifications

The qualification requirements for a workboat crew operating in area category 1 include that the skipper should hold at least an RYA Yachtmaster Offshore (motor) certificate. Additionally:

> *There should also be on board a second person holding at least an RYA certificate of competency or service as coastal skipper (Motor)*

and,

> *One of the persons referred to above should be familiar with the operation and maintenance of the main propulsion machinery of the vessel, and should hold a Marine Engine Operators Licence.*

For operations in daylight in area category 6 (within 3 miles of land and not more than 3 miles radius from either the point of departure to sea or from the seaward boundary of protected waters), the minimum qualification for a skipper is an RYA Powerboat Level 2 certificate.

The code requires that all RYA certificates be commercially endorsed and that the skipper or another person on board should hold a first-aid certificate. At least one person is also required to hold a suitable radio operator's certificate.

Similar requirements are detailed in Marine Guidance Note (MGN) 280 - Merchant Shipping - Small Vessels in commercial use for sport or pleasure, workboats and pilot boats - alternative construction standards, which is also known as the Harmonised Code and may be used by vessel owners as an equivalent standard to the Brown Code.

1.9.3 Application

Vessels certified under the code are permitted to operate in the territorial waters of other countries, including France. However, an increasing number of countries within Europe, and worldwide, require that vessels be 'in class'[4] and/or that their crew hold Certificates of Competency in compliance with the International Convention on Standards of Training, Certification and Watchkeeping (STCW).

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[4] 'in class' – entered with a classification society.

1.10 QUALIFICATIONS

Candidates for the RYA Yachtmaster Offshore certificate must have completed the following within 10 years prior to their examination:

- 50 days sea time
- a minimum of 2500 miles
- 5 passages, each of over 60 miles
- 5 days experience as skipper (minimum 2 days and 2 night passages).

The examination syllabus includes: the International Regulations for Preventing Collisions at Sea, safety, boat handling (including towing in open sea conditions and in confined areas), general seamanship, the responsibilities of a skipper, navigation, meteorology and signals. The section on safety covers the responsibilities of a skipper in relation to safety equipment, fire-fighting and prevention, and knowledge of rescue procedures; it does not cover risk assessment or work-related safety procedures.

The RYA Powerboat Level 2 certificate is awarded following a 2-day course aimed at providing the skills and knowledge to drive a powerboat.

RYA certificates are commercially endorsed following the successful completion of a sea survival course, an MCA recognised medical examination, and the payment of a £30 fee.

1.11 TOWING GUIDANCE

Guidance on safe operation during towing is provided by the MCA in The Code of Safe Working Practices for Merchant Seamen (COSWP) and in MGN 308 (M+F) Mooring, Towing or Hauling Equipment on all vessels - Safe Installation and Safe Operations **(Annex C)**. COSWP details core safe working practices to be followed on board all UK registered vessels. Chapter 1 of the Code states:

> *It is important that the risk assessment considers the consequences of the failure of any element of the equipment.*

Chapter 25 covers anchoring, mooring and towing operations, and states that personnel should remain in an area of safety when moorings are under load, and explains that when a tensioned rope or wire is led around a pedestal, its ‘snap-back’ zone will change and increase in area. A copy of the COSWP was available on board *Llanddwyn Island* as required by the Merchant Shipping (Code of Safe Working Practices for Merchant Seamen) Regulations 1998.

The guidance provided in MGN 308 (M+F) includes the safe use of equipment, precautions to be taken during towing operations, the risks of ‘snap-back’ zones, and the responsibility of employers and operators with regard to health and safety requirements.

1.12 SIMILAR ACCIDENT

On 19 February 2010, an engineer on board HTC's workboat, *Afon Caradog*, was seriously injured. The vessel was engaged in a pushing operation in Saudi Arabia when the casualty, who was not involved in the operation, went on to the working deck. As the vessel manoeuvred, a wire rope came under tension and slid over the top of the waist post and struck the engineer on his right arm. The engineer was thrown on to a piece of deck machinery and sustained serious injuries to his head and neck. The casualty was hospitalised for over a week before he was able to be repatriated to the UK.

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 THE FAILURE OF THE CHAIN

The results of the tests conducted on the chain following the accident **(Annex A)** indicate that the doubling up of the chain around the pad eye at the stern of *Manu Pekka* significantly reduced its breaking load and ability to absorb energy. In addition to the load induced by a straight pull, the chain link central to the pad eye was also affected by loads from adjacent links, the transverse compressive load from the pad eye, and by friction. Consequently, instead of the breaking load of the doubled-up chain being almost 45 tonnes, it was reduced to about 33 tonnes, still making it the weakest element of the hawser by far **(Table 1)** as identified by the night crew.

It is evident from the chafing on the previously unused polypropylene stretcher against the dolly pin **(Figure 13)**, and the recoiling of the stretcher, that the chain element of the hawser parted when under considerable tension. The tension primarily resulted from *Llanddwyn Island* manoeuvring ahead when parallel to *Manu Pekka*'s stern in order to turn the dredger in an anti-clockwise direction. However, in view of the inherent weakness of the doubled-up chain in relation to the rope stretcher, and its inability to absorb shock loading, it is feasible that the chain broke when the tension in the hawser was increased suddenly and without warning due to the movement of *Manu Pekka* as her spud legs were lowered, or as *Llanddwyn Island* continued to manoeuvre ahead after the legs had been lowered.

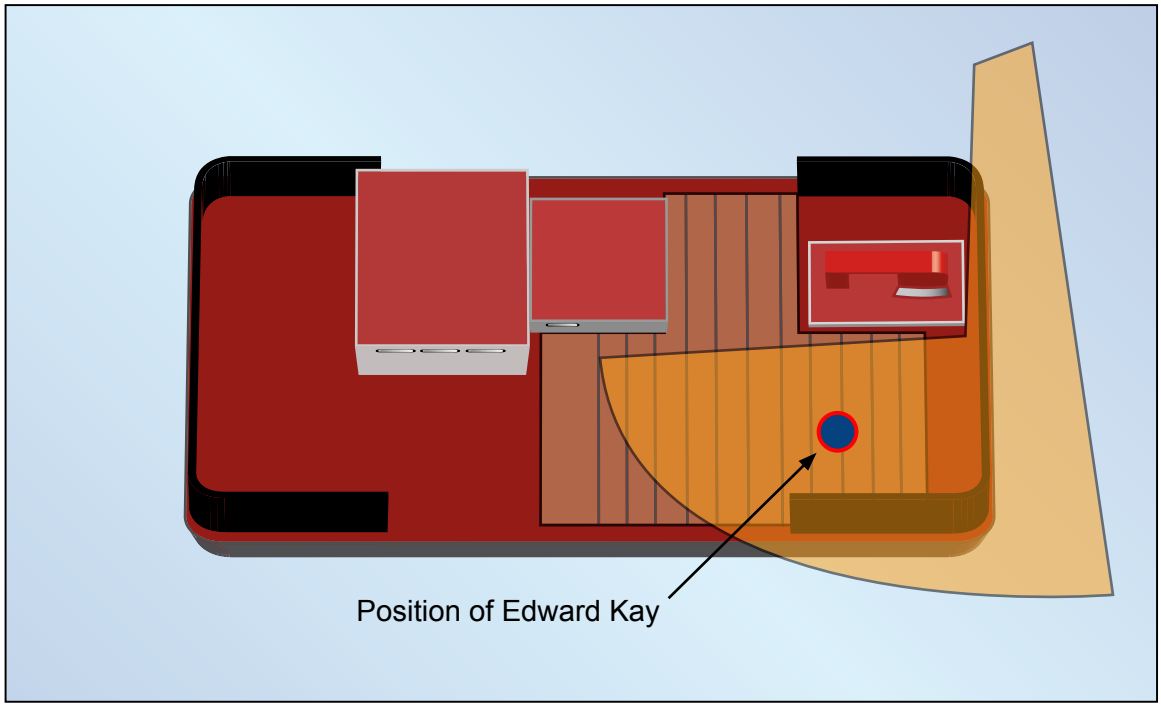
The inclusion of a doubled-up chain in the hawser was not in accordance with best towing practice and was inappropriate for the work being conducted. It would have been more usual to connect a hawser of this type with a stronger element such as a wire pennant or a single chain with a sufficient breaking strain.

Although the doubled-up chain was about 50% stronger than the use of a single chain, it remained the weakest element of the hawser. Consequently, when the hawser tensioned, it is likely that the chain parted before the rope stretcher could absorb the increased loading, particularly as the stretcher was 'nipped' around the dolly pin.

2.3 SAFETY OF PERSONNEL

The recoil or 'snap-back' area to *Llanddwyn Island*'s forward deck when working with a hawser around the port dolly pin is shown at **Figure 16**. Edward was an experienced deckhand who was undoubtedly aware of the dangers associated with a tensioned line. It is not known why he moved to the forward part of the deck while *Llanddwyn Island* was still manoeuvring ahead against the hawser, particularly as the skipper had not signalled to him that it was safe to do so. It is possible that he assumed that the move was complete when he saw the dredger's spud legs being lowered. This would usually have been the case, but because the skipper did not hear the message from the backhoe operator that he was in position and lowering the remaining spud legs, the skipper kept *Llanddwyn Island* pushing against the hawser.

Figure 16



'Snap-back' area

It was clearly dangerous for Edward to move into the 'snap-back' zone but, given the visibility of the forward deck from the wheelhouse **(Figure 17)** and the speed of events, it is possible that the skipper did not have sufficient time to challenge Edward's actions.

Figure 17

View from the wheelhouse

Unlike the mooring decks on conventional vessels, it would have been an impractical task to identify and mark the 'snap-back' areas on *Llanddwyn Island*'s deck as recommended in the COSWP and MGN 308. Indeed, because of the diverse nature of her employment, there were probably no permanently safe areas on *Llanddwyn Island*'s deck. Consequently, the need to ensure the safety of personnel, and remind crew of the hazards encountered through procedural measures such as toolbox talks, briefings, and positive communication as detailed in MGN 308 was essential.

2.4 SAFETY MANAGEMENT AND CULTURE

Although HTC had responded to a need to provide a more structured safety management of its workboat fleet by its employment in 2009 of an HSEQ manager, a number of factors indicate that the safety management of *Llanddwyn Island* was rudimentary. These include:

- Not all of the vessel's activities had been considered in the risk assessments completed in 2006 **(Annex B)** and the assessments had not been reviewed periodically.
- The risk assessments were not reviewed following the serious accident on board *Afon Caradog*.
- The crew had not read the risk assessments.

- No guidance or written procedures were provided regarding towing and pushing arrangements or operations.
- The use of the doubled-up chain in the hawser was not in accordance with best practice.
- The chain used had not been provided by HTC, and the certificates for some of the loose towing equipment were not held on board.
- HTC did not provide towage training for its more experienced crew.

However, the shore and onboard management of *Llanddwyn Island* was probably little different to other vessels operating in the workboat sector. Unlike the wider merchant marine sector, the UK workboat sector is relatively close-knit; recruitment tends to be by word of mouth, and great reliance is placed on crew experience. This is not surprising, given that workboat operations are worldwide and crews need to be virtually self-sufficient when operating in remote locations. Crews must also be able to adapt and improvise in order to complete the varied tasks that they are expected to complete. Furthermore, due to their predominantly small boat backgrounds, the close confines of a workboat results in the relationship between workboat skippers and their crew being less formal and hierarchical than on board larger ships.

The development and implementation of effective safety management and safe systems of work within the workboat environment is likely to be extremely challenging. Although HTC's planned provision of safety manuals and procedures is an important step in this respect, it is unlikely to be successful unless it is accompanied by measures to assist the development of a strong safety culture among its skippers and crews.

2.5 TRAINING AND QUALIFICATIONS

2.5.1 Commercial endorsements

Similar to many of their peers in the workboat sector, the skipper and Edward were allowed to work on board *Llanddwyn Island* because they held commercially endorsed RYA Yachtmaster Offshore certificates. However, the knowledge and experience required to obtain this qualification only equipped them to navigate a cruising yacht (sail or motor) within 150 miles from land; it did not prepare them for the variety of work tasks expected of a workboat crew. Similarly, the RYA powerboat level 2 qualification, which is accepted as a suitable qualification for workboat operators within 3 miles of the shore, only equips its holder to drive a powerboat.

In view of the potential dangers associated with a number of workboat operations, the use of commercially endorsed RYA certificates alone, as acceptable qualifications for the operation of workboats, is highly questionable. A requirement to also complete training in fire-fighting and personal safety or

safety awareness as part of the endorsement would at least equip prospective skippers to deal more effectively with onboard emergencies and to understand safe systems of work. It would also be consistent with the requirements for crew on board UK fishing vessels.

2.5.2 Voluntary endorsements

The limitations of the training and qualifications required to operate workboats has been recognised by the National Workboat Association (NWA) and the British Tugowners Association (BTA). In conjunction with the MCA, these bodies are developing three towing endorsements for tug and workboat crews: general towage, sea towage and ship assist. It is intended that the endorsements will be voluntary and will be awarded following the completion of a task record book and oral examination on all elements of towage, including risk assessment.

The introduction of towage endorsements is undoubtedly a positive step towards improving the knowledge of best practice among workboat skippers. However, for the proposed endorsements to have a positive impact on the safety of towing operations conducted by UK workboats, it is essential that vessel owners insist that their crews obtain the relevant towing endorsement(s), and that authorities commissioning workboat services such as harbourmasters, insist on boats' skippers having the relevant endorsements through contractual requirement. Failure to do so will remove the incentive for current and prospective skippers to 'buy in' to the process.

2.6 SCOPE OF WORK

HTC and Boskalis had previously worked together on various projects, but they exchanged little information prior to *Llanddwyn Island* starting work in Roscoff. This is not uncommon in the workboat sector where, through practical experience, workboat operators and project managers tend to be aware of each others' general requirements. Furthermore, additional services are usually allowed for in the charter party, and skippers are expected to fulfil the tasks given to them.

However, in this case, the lack of detail concerning the scope of the work Boskalis expected *Llanddwyn Island* to undertake prevented HTC and the workboat's skippers from fully assessing the suitability of the vessel, and her manning and equipment requirements prior to arriving in Roscoff. In particular, the details of *Manu Pekka* such as weight, windage, and towing arrangements, and details of the tow, such as distance and frequency, were not known. Therefore, the towing arrangements required on board *Llanddwyn Island* were not considered, and the difficulties encountered when moving *Manu Pekka* during the high winds experienced overnight on 28 February 2010 were not foreseen.

When *Llanddwyn Island*'s role was changed from transferring personnel and explosives to and from blasting barges, to that of moving *Manu Pekka*, this was accepted by the skippers, who then had to determine how this was to be achieved with the manpower and equipment available. While it is recognised that many of the tasks undertaken by workboats are done at short notice, and frequently require crews to 'think on their feet' and to improvise, some of the hazards in this approach could be significantly reduced if the requirements of known and possible tasks are carefully assessed prior to each charter. This is only feasible if sufficient information is exchanged between the charterer and the workboat managers.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. The doubled-up chain was the hawser's weakest element, and its inclusion was therefore not in accordance with best towing practice and was inappropriate for the work being conducted. [2.2]

2. In view of the potential hazards on the deck of *Llanddwyn Island* when engaged in towing or pushing, procedural measures such as toolbox talks, briefings, and positive communication were essential. [2.3]

3. A number of factors indicate that the safety management of *Llanddwyn Island* was rudimentary. [2.4]

3.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION ALSO LEADING TO RECOMMENDATIONS

1. HTC's planned provision of safety manuals and procedures is important to the development of a safety management system but is unlikely to be successful unless it is accompanied by measures to assist the development of a safety culture among its skippers and crews. [2.4]

2. In view of the potential dangers associated with a number of workboat operations, the use of commercially endorsed RYA certificates alone, as acceptable qualifications for the operation of workboats, is highly questionable. [2.5.1]

3. A requirement for workboat skippers to complete training in fire-fighting and personal safety or safety awareness would equip them to deal more effectively with onboard emergencies and to understand safe systems of work. [2.5.1]

4. The proposed introduction of voluntary towing endorsements will have a positive impact on the safety of towing operations if workboat owners and authorities commissioning workboat services insist that skippers hold the relevant towing endorsement(s) for the work to be undertaken. [2.5.2]

5. The lack of information exchanged between HTC and Boskalis prior to the start of *Llanddwyn Island*'s charter prevented HTC and the workboat's skippers from fully assessing the suitability of the vessel, and her manning and equipment requirements in relation to the activities she was expected to undertake. [2.6]

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

1. It is clear from the evidence available that the chain element of the hawser parted when under considerable tension, and that the doubling up of the chain around the pad eye at the stern of *Manu Pekka* significantly reduced its breaking load and ability to absorb shock loading. [2.2]

2. Edward was an experienced deckhand who was undoubtedly aware of the dangers associated with a tensioned line. It is not known why he moved to the forward part of the deck when the hawser was still under tension. [2.3]

SECTION 4 - ACTION TAKEN

4.1 HOLYHEAD TOWING COMPANY LIMITED

HTC has:

- Informed its crews of the circumstances of this fatality and the serious injury on board *Afon Caradog*.
- Commenced seminars for its skippers focusing on safety and procedures.
- Continued to develop and introduce its onboard safety manual.
- Developed a pre-charter checklist to determine the scope of work expected to be undertaken by its vessels, and the manning and equipment requirements.

4.2 MARINE ACCIDENT INVESTIGATION BRANCH

The MAIB has issued a safety flyer **(Annex D)** highlighting the circumstances and lessons learned from this accident.

SECTION 5 - RECOMMENDATIONS

The **Maritime and Coastguard Agency** is recommended to:

2010/134 Revise the requirements for the commercial endorsement of RYA certificates to include training in basic fire-fighting, safety awareness and risk assessment.

2010/135 Expedite the introduction of the MCA/NWA/BTA towing endorsement, and encourage crew intending to work on towing vessels to complete the endorsement when it becomes available.

The **National Workboat Association, British Tugowners Association** and **UK Harbour Masters' Association** are recommended to:

2010/136 Promulgate to their members the need to ensure that workboats engaged in towing operations are skippered by suitably qualified and experienced personnel who hold, as a minimum, either a boatmaster's licence or a commercially endorsed RYA Yachtmaster's offshore certificate, and have completed the appropriate MCA/NWA/BTA Towing Endorsement when they are available.

The **National Workboat Association, British Tugowners Association** and **International Association of Dredging Companies** are recommended to:

2010/137 Work together to develop and promulgate a checklist detailing the anticipated scope of works for vessels engaged in towing operations which would enable vessel owners to determine project and vessel requirements when arranging charter parties.

Holyhead Towing Company Limited is recommended to:

2010/138 Continue to develop and implement safe systems of work on board its vessels through the introduction of safety manuals and procedures, the review and revision of the risk assessments for the activities undertaken, identification of the training needs of its crews, and the engagement of its skippers in developing a safety culture.

Marine Accident Investigation Branch
November 2010