Report on the investigation of

a fatal accident on

Wellservicer

3 miles SE of Aberdeen, Scotland

1 April 2009

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS AND TERMS

BMS	-	Business Management System
Capex	-	Technip's terminology for financially significant projects with dedicated budgets in excess of £25,000
Class	-	Classification Society
DfT	-	Department for Transport
DNV	-	Det Norske Veritas (Classification Society)
DP	-	Dynamic Positioning
DSV	-	Diving Support Vessel
GRP	-	Glass Reinforced Plastic
HIRA	-	Hazard Identification and Risk Assessment
HS&E	-	Health Safety and Environment
ICS	-	International Chamber of Shipping
IMCA	-	The International Marine Contractors Association
ISM	-	International Management Code for the Safe Operation of vessels and for Pollution Prevention
JRA	-	Job Risk Assessment
KPI	-	Key Performance Indicators
kts	-	knots
kW	-	kilowatt
LTI	-	Lost Time Injury
m	-	metre
Manriding winches	-	Winches capable and approved for lifting personnel
Medivac	-	Medical evacuation
MEH	-	Micron Eagle Hydraulics Ltd
MOC	-	Management of Change
NEBOSH	-	National Examination Board in Occupational Safety and Health
NORSOK	-	Standards developed by the Norwegian petroleum industry to ensure adequate safety for petroleum industry developments and operations in Norwegian waters

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NORSOK U-100	-	The Norwegian petroleum industry standard for manned underwater operations
OCM	-	Offshore Construction Manager
OMT	-	Offshore Management Team
OOS	-	Offshore Operational Services of Technip UK
ORCA	-	Observe, Recognise, Communicate, Agree
PA	-	Public Address
PTW	-	Permit to Work
RBU	-	Regional Business Unit
ROV	-	Remotely Operated Vehicle
SAR	-	Search and Rescue
SMC	-	Safety Management Certificate
SMS	-	Safety Management System
TBT	-	Tool Box Talk
TOFS	-	Time Out For Safety
TUP	-	Transfer Under Pressure
UK	-	United Kingdom
UKBU	-	United Kingdom Business Unit
UTC	-	Universal Co-ordinated Time

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

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Figure 1a

Wellservicer

SYNOPSIS

On 1 April 2009, a rigger was working on top of a diving bell in the forward bell hanger on the diving support vessel (DSV) *Wellservicer,* when the winch for the diving bell's cursor[1] suddenly rendered, allowing the cursor to fall on top of him. The rigger suffered severe crush injuries, from which he later died.

Work on the vessel's diving bell emergency recovery system began during an earlier dry docking period in Vlissingen, Holland. On completion of the dry dock, *Wellservicer* proceeded to Aberdeen Bay to undertake trials of her dynamic positioning system.

The work on the forward diving bell emergency recovery system included the installation of a new winch and alterations to the diving bell's docking cursor and trolley arrangement. It became necessary to remove buoyancy blocks from the top of the forward diving bell, and while this work progressed the docking cursor, which weighed approximately 4 tonnes, was suspended from the newly installed winch, as riggers worked on the bell below. Suddenly, and without warning, the winch rendered and the cursor dropped onto the bell, trapping one of the riggers.

The MAIB investigation concluded that project management of the cursor modifications lacked direction, focus and effective monitoring at various management levels.

As a result of its internal investigation, the vessel's owner has implemented a major revision of its systems and processes to reduce the potential for future accidents, and has promulgated the lessons learned from this accident to its offshore and onshore personnel, contractors and clients.

An external contracting company involved in the new winch installation has also implemented major changes to its safety procedures and processes for external client projects, in response to the accident.

As a consequence of the actions already taken by stakeholders, no recommendations have been made in this report. However, the MAIB has published a Safety Flyer for circulation to the offshore shipping industry, which details the lessons learned from this accident.

[1] Cursor: An arrangement in the shape of an inverted bowl, which guides the diving bell into the ship from below, enabling the diving bell to become integral with the ship and her movements.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *WELLSERVICER* AND ACCIDENT

Vessel details		*Wellservicer*
Registered owner	:	Technip UK Ltd
Manager(s)	:	Offshore Operational Services, Technip UK
Port of registry	:	Aberdeen
Flag	:	UK
Type	:	Diving Support Vessel
Built	:	Sunderland Shipbuilders Ltd 1989
Classification society	:	Det Norske Veritas (DNV)
Construction	:	Steel
Length overall	:	111.4 m
Gross tonnage	:	9158
Engine power and/or type	:	6 x Wartsila 200V12, delivering 2,100 kW each. 12,600 kW total
Service speed	:	12.5 knots
Other relevant info	:	3 azimuth thrusters aft; 3 bow thrusters

Accident details		
Time and date	:	1750, 1 April 2009
Location of incident	:	3 miles SE of Aberdeen, Scotland
Persons on board	:	64
Injuries/fatalities	:	One death
Damage	:	None

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1.2 BACKGROUND

Wellservicer **(Figures 1a and 1b)** was a purpose built diving support vessel (DSV) with capability to operate with up to 18 saturation[2] divers using 2 diving bells and 2 moonpools[3] in a dedicated bell hanger on her main deck. Additionally, heavy lift facilities of up to 130 tonnes (t) were provided by 2 cranes sited on the aft deck. She had the ability to remain on station and work in quite extreme weather conditions by means of dynamic positioning (DP) facilities provided by her three bow thrusters and three azimuth propulsion units aft.

The vessel was effectively a floating work and fabrication platform whose primary function was to provide clients, frequently from the offshore petrochemical industry, with bespoke diving and heavy lift facilities to install and service subsea equipment. *Wellservicer*'s specialist equipment also enabled her to be used for salvage and wreck recovery work.

During client projects, *Wellservicer* could carry as many as 130 personnel at any one time. The nature of the vessel's work was such that external specialists could sometimes be on board for short periods. To enable personnel changes at sea, the vessel was fitted with a helipad forward.

The vessel was managed by the Offshore Operational Services (OOS) branch of Technip UK Ltd. *Wellservicer* was one of five DSVs which formed part of a specialist fleet of 10 vessels managed by Technip. The managers held a valid ISM Code Document of Compliance issued by Det Norske Veritas (DNV) on behalf of the Commonwealth of the Bahamas, for the operation of "other cargo vessels".

In February 2007 *Wellservicer* was issued with a notice of "non-compliance" by her client, StatoilHydro. This was because the vessel's design was at variance with the NORSOK U-100 standards for manned underwater operations in the Norwegian sector of the North Sea relating to the provision of emergency recovery facilities for her forward diving bell. A dispensation was issued which allowed the vessel to continue in service with StatoilHydro until such time as modifications could be carried out. These modifications were taking place at the time of the accident.

[2] Saturation divers live in an onboard accommodation chamber which is pressurised to several times atmospheric pressure for up to a month at a time, travelling to and from their work place at the sea bed in a similarly pressurised diving bell. At the end of their time on board they decompress slowly, allowing the absorbed gasses saturated within their tissues by the pressure, to gradually dissipate before exiting the chamber to normal atmosphere. Existing under pressure for extended periods negates the need for prolonged decompression at the end of each dive.

[3] Moonpool: A central, sheltered launch and recovery area for diving bells, providing access to subsea through the vessel's hull. Normally positioned strategically within the vessel to minimise the effects of sea surface induced pitch and roll.

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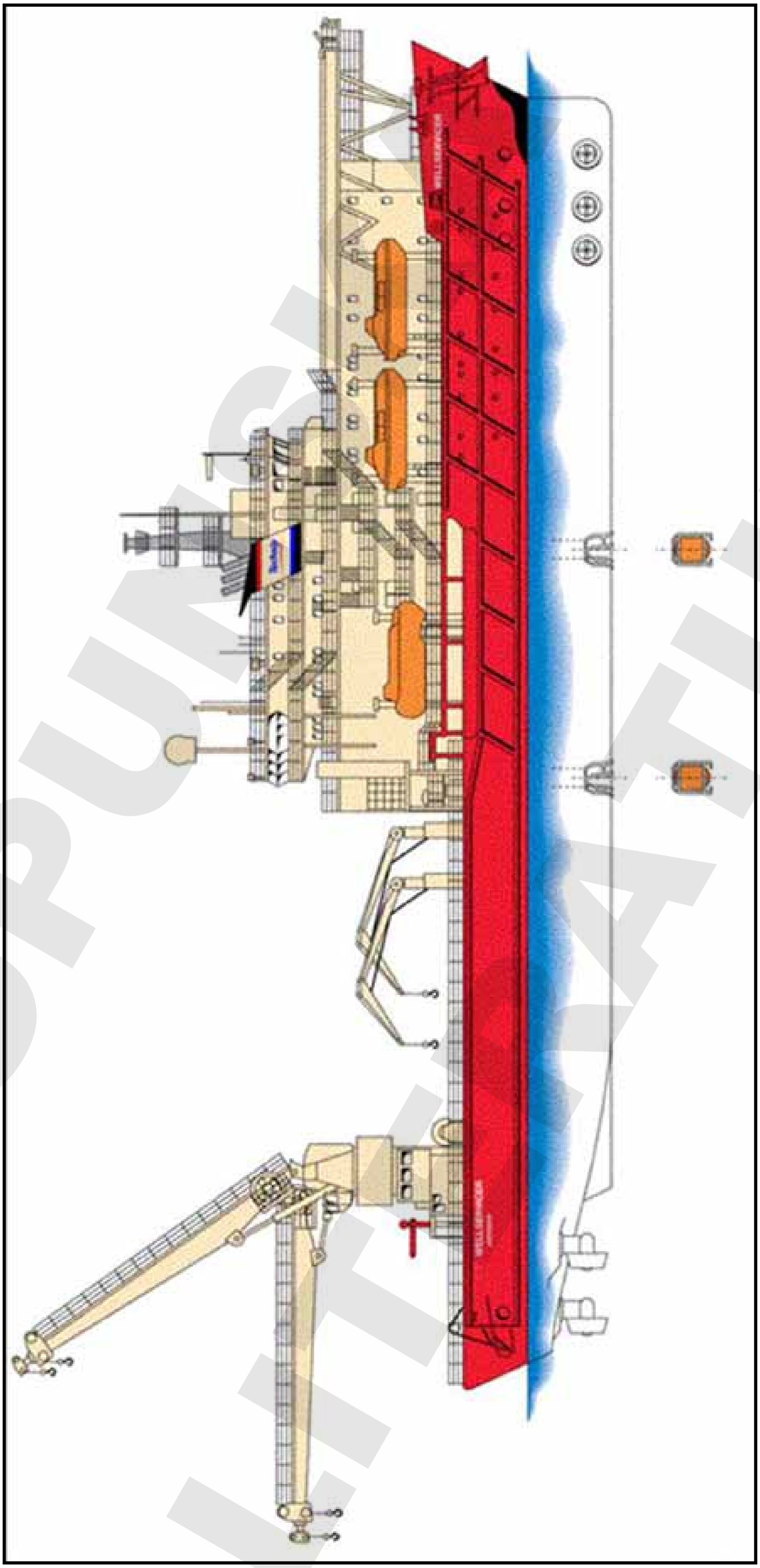
Figure 1b



Profile of *Wellservicer* showing position of moonpools

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The forward bell contingency recovery system modification (the Modification) had undergone several variations and postponement since the non-compliance issued by StatoilHydro. The Modification was considered by Technip to be a standalone internal marine project which was to be carried out when a suitable opportunity allowed, ideally when the vessel was alongside a berth. This opportunity presented itself in March 2009 when the vessel was due to go into dry dock for maintenance.

The project required the bell's recovery system to be converted from a passive to an active cursor system **(Figures 2a and 2b)**. In the existing passive system, the dive bell was recovered to the moonpool by means of two overhead wires, which allowed it to mate with its cursor at the ship's keel; the cursor and bell then ran on two vertical rails up to the bell trolley from the bottom of the moonpool. The passive cursor was simply a securing arrangement with no lifting capability. Once mated with the cursor, the bell effectively became integral with the vessel, rolling and pitching with her movements. It was essential that this operation was carried out smoothly and efficiently to prevent damage to the dive bell, or injury to occupants. The bell and cursor were both carried aloft to the trolley **(Figure 3)** by the same wires that hoisted the bell from deep sea level, and they were then secured by bell locking pins **(Figure 4)** before being "trolleyed" to the saturation chamber. Cursor supports **(Figure 5)** were then inserted into the legs of the trolley to take the weight of the cursor as the bell was lowered onto the chamber's "transfer under pressure" (TUP) trunking, where divers transferred from the bell to the chamber below. Taking the weight of the cursor on these supports prevented the 4t cursor resting on, and possibly damaging, the TUP trunking.

Active cursors have their own dedicated winch for use in an emergency. In such a situation, the cursor can attach to the bell by means of latch hooks, and carry it aloft in the event of failure of the bell's winch system. To achieve this, the bell has first to be recovered to the moonpool by separate clump wires **(Figure 6)**. *Wellservicer* already had such a system in place for her aft diving bell.

1.3 NARRATIVE

1.3.1 Dry docking

Wellservicer arrived alongside at Vlissingen, Holland on 17 March 2009 in preparation for a dry docking to effect repairs to a thruster. The dry docking, originally planned for 23 March 2009, was brought forward as part of the ongoing fleet scheduling activities, ultimately to keep the schedule for forthcoming subsea work in Canada. Bringing the dry docking forward also necessitated the bell modification project to be advanced. This was accommodated, and most of the equipment required for the Modification was delivered by 17 March.

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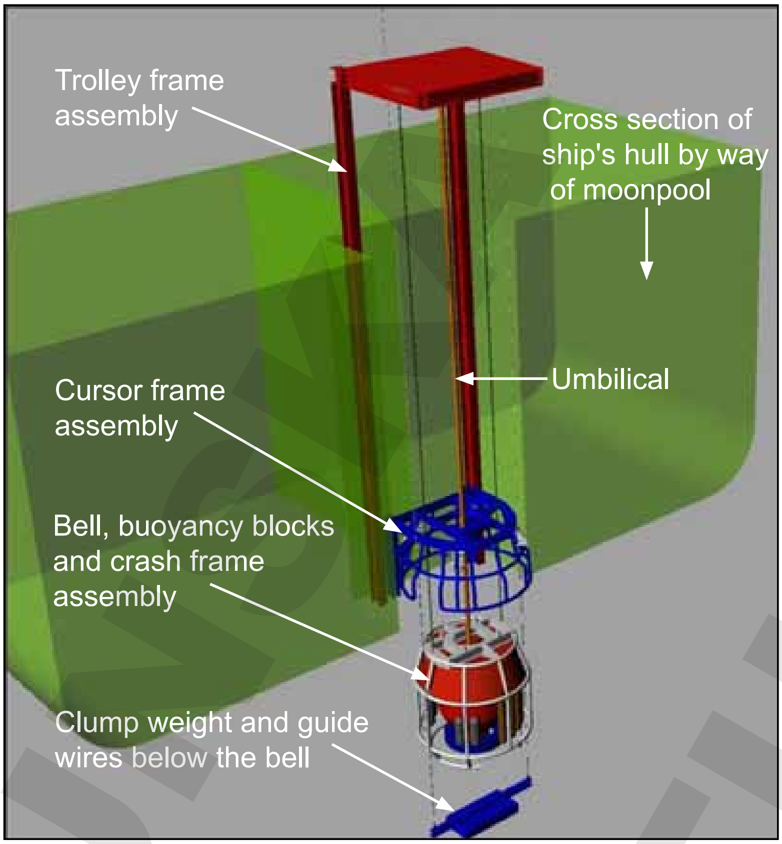
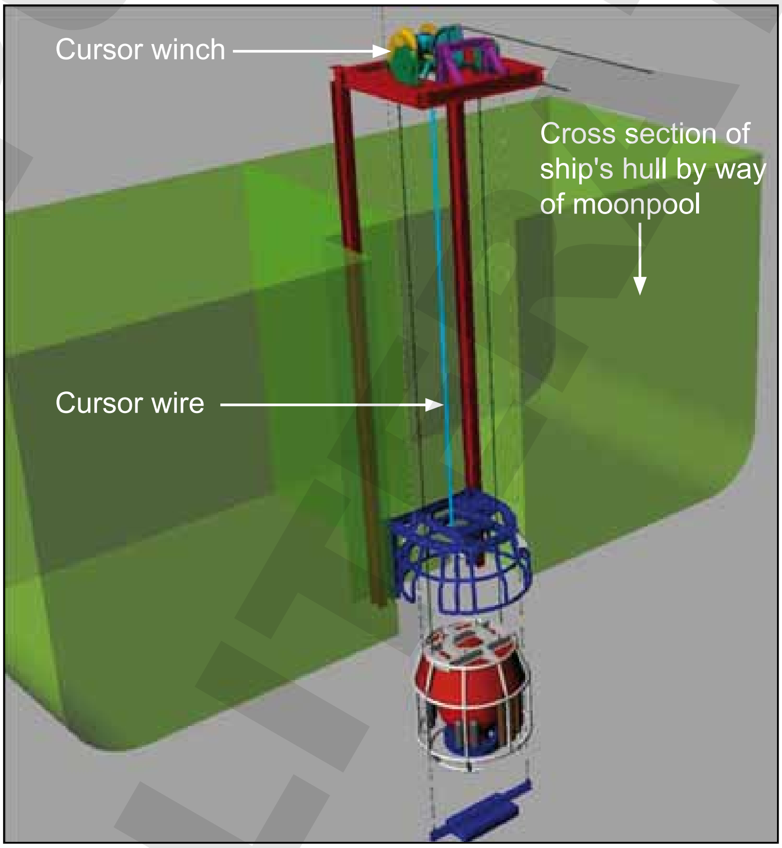
Figure 2a



Diagrammatic representation of a passive cursor system

Figure 2b



Diagrammatic representation of an active cursor assembly (umbilical removed for clarity)

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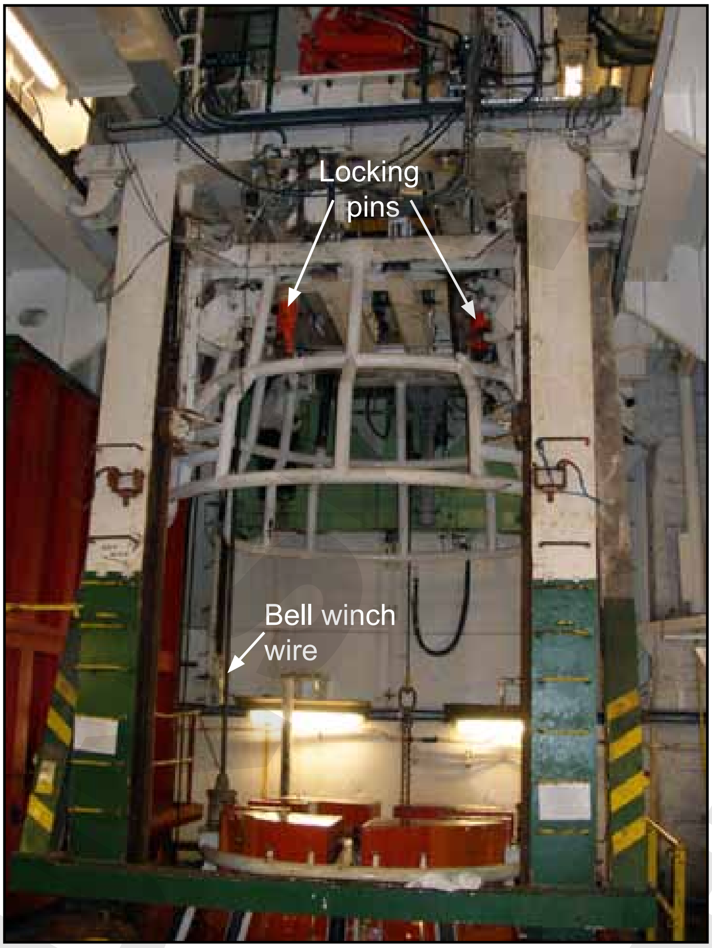
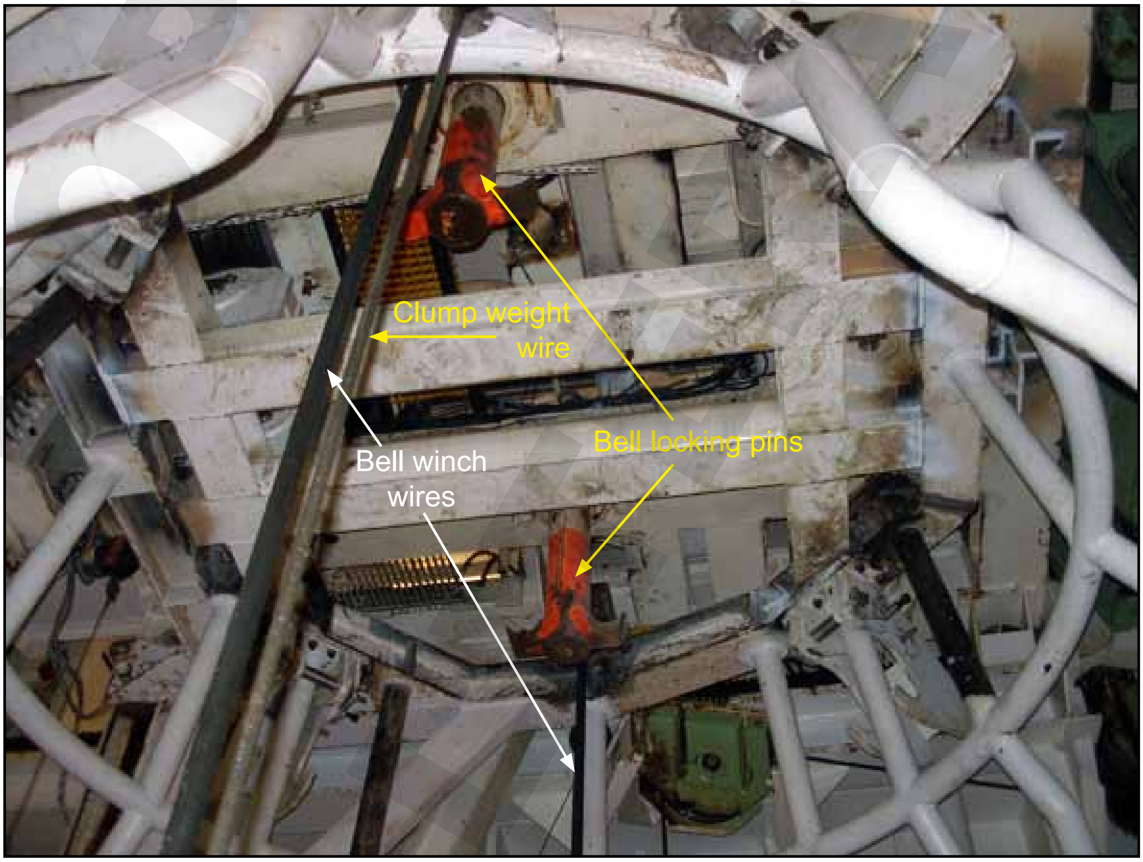
Figure 3



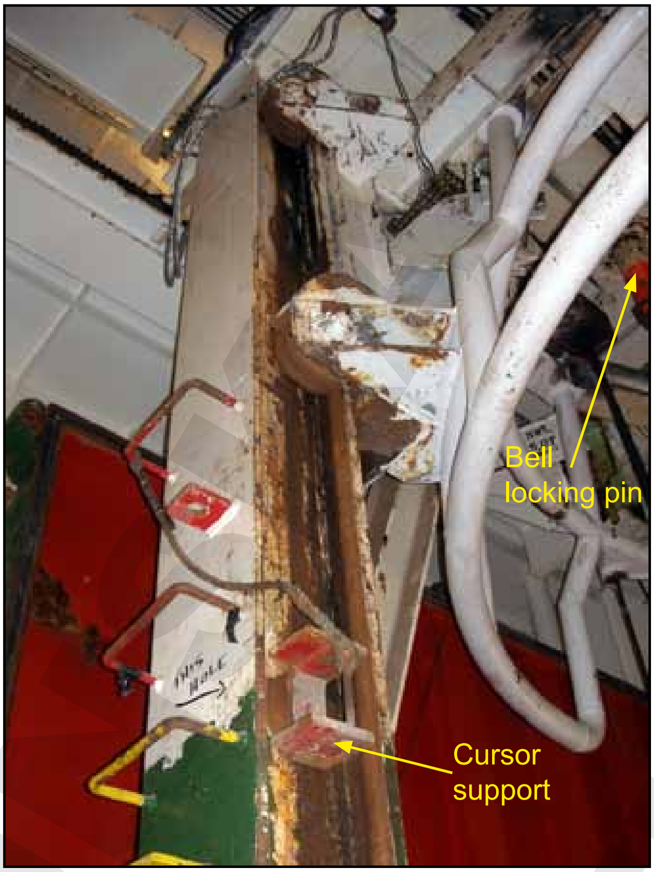
Bell trolley

Figure 4



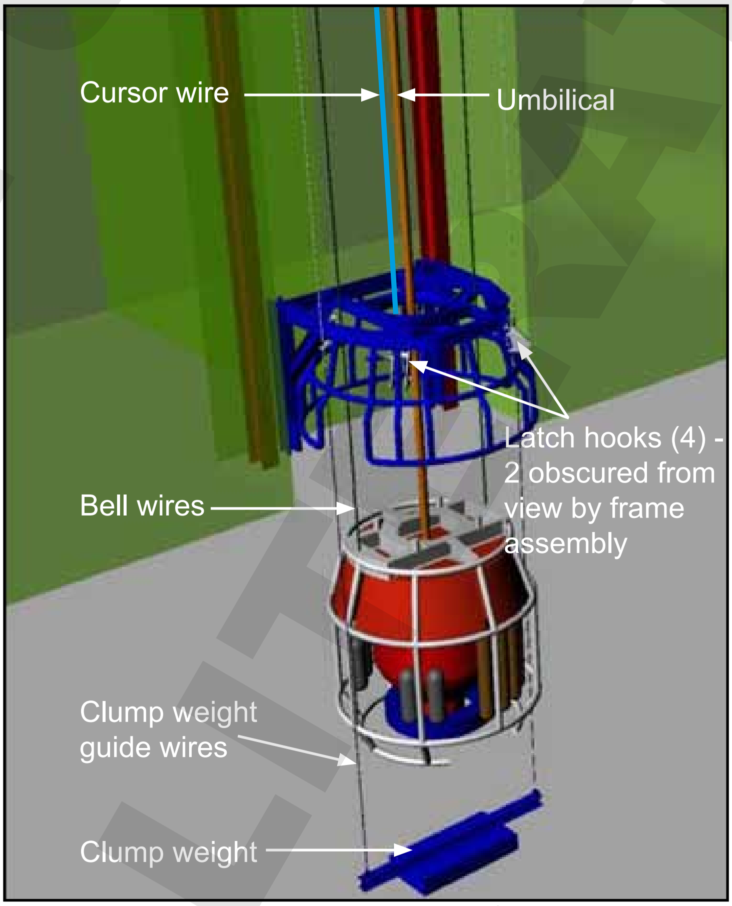
Cursor and bell trolley ‘ceiling’ from below

Figure 5



Bell trolley frame port leg, showing cursor support

Figure 6



Diagrammatic representation of various wire attachments

The vessel was met in Vlissingen by the OOS project and technical manager, the vessel's marine engineering superintendent (who was also the dry docking project manager), and a dive systems superintendent who, for the benefit of this report, is referred to as the Modification project co-ordinator.

Heavy items of equipment needed for the modifications were positioned in the dry dock floor so that they could be taken up into the vessel through the moonpool, once she docked. This removed the need to cut apertures in the vessel's bell hanger[4] bulkheads. The modifications were to be carried out by an installation team, who were a combination of the vessel's crew and external specialist contractors, sometimes working 12 hour shifts around the clock.

On 18 March divers, who had been decompressing from their recently completed offshore contract, were released from the saturation chamber, and the vessel went into dry dock. This allowed work to commence on the repairs to the thrusters and the forward bell recovery system. The Modification was scheduled for completion, including load testing, by 4 April.

Over the next 10 days the primary dry docking project was completed and alterations to the forward recovery system progressed well, despite one lost day when the vessel's fire main was unavailable and hot work could not proceed. While in the dockyard, the installation team carried out significant modifications to the bell cursor, positioned a new cursor winch on top of the bell trolley, and made modifications to the hydraulic and electrical circuitry. The new winch was powered up for the first time on 27 March and various tests and adjustments were made to the hydraulic operating controls.

The following day, *Wellservicer* sailed from Vlissingen for Aberdeen, Scotland, where DP tests were to be carried out and the bell modifications completed. Before sailing, the vessel's superintendent and the Modification project co-ordinator flew back to Aberdeen, the OOS project and technical manager having returned to the UK several days earlier.

1.3.2 Continuation of Modification

Work was expected to continue on the Modification as *Wellservicer* crossed the North Sea. However, poor weather and the effects of seasickness suffered by the shore-based contractors meant little progress was made. The vessel arrived in Aberdeen bay on 30 March, where she was met by the Modification project co-ordinator. To recover lost time incurred during the crossing, the co-ordinator brought additional contractors on board to assist with the Modification.

After various shore-based staff had boarded *Wellservicer* in Aberdeen bay, she began DP evaluation and dive system sea trials several miles offshore. Throughout the following 2 days work progressed well on the Modification,

[4] Bell hanger: a central area within the vessel housing moonpools, diving control and associated equipment.

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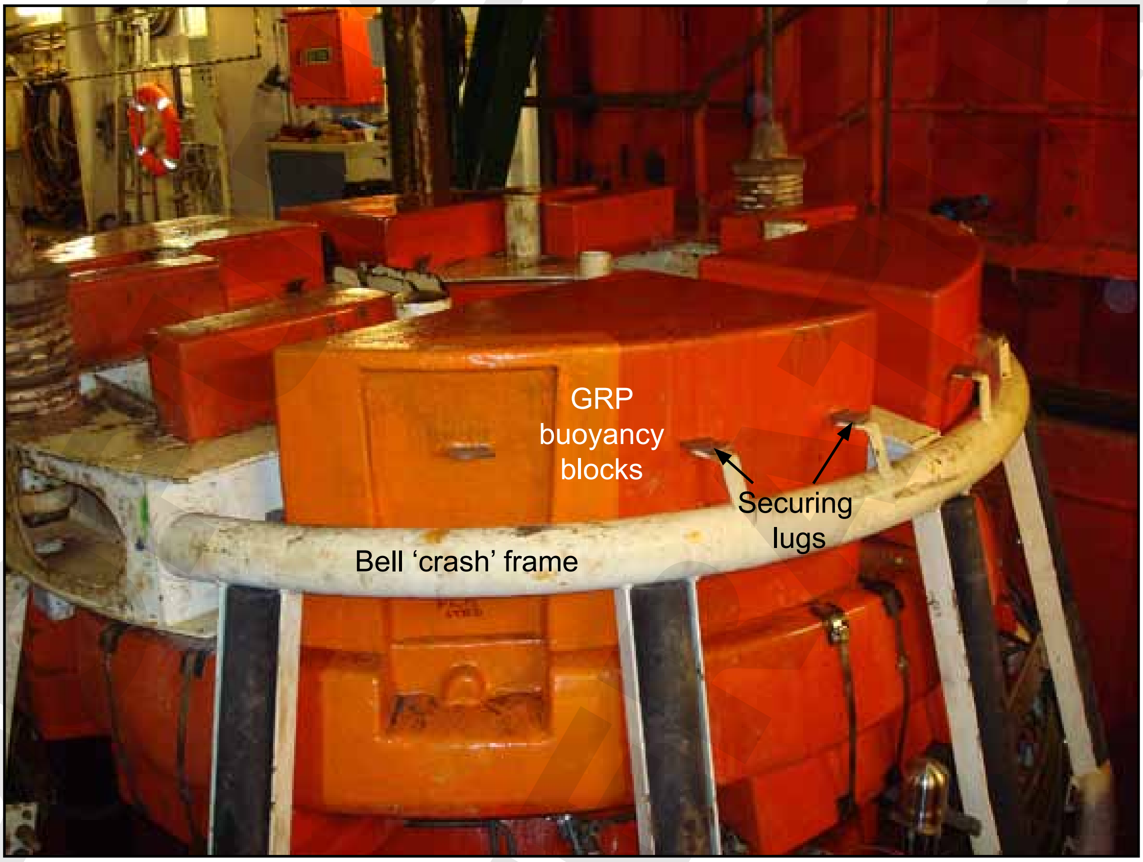
which included alterations to the dive bell buoyancy blocks and work on the cursor latch hook assembly. During this time up to 20 workers from various disciplines were working on and around the site at any one time.

Glass reinforced plastic (GRP) buoyancy blocks attached to the bell **(Figure 7)** needed to be removed for alterations. This was a difficult task due to the close proximity of the cursor and the cumbersome shape of the blocks. It was decided to move the bell and cursor from the TUP trunking to the moonpool, to hang the cursor off from the trolley by means of strops, and to lower the bell to a satisfactory height in the moonpool, thus allowing the blocks to be removed more easily. The bell top also created a convenient working platform to allow work to progress on the cursor suspended several feet above it.

Figure 7

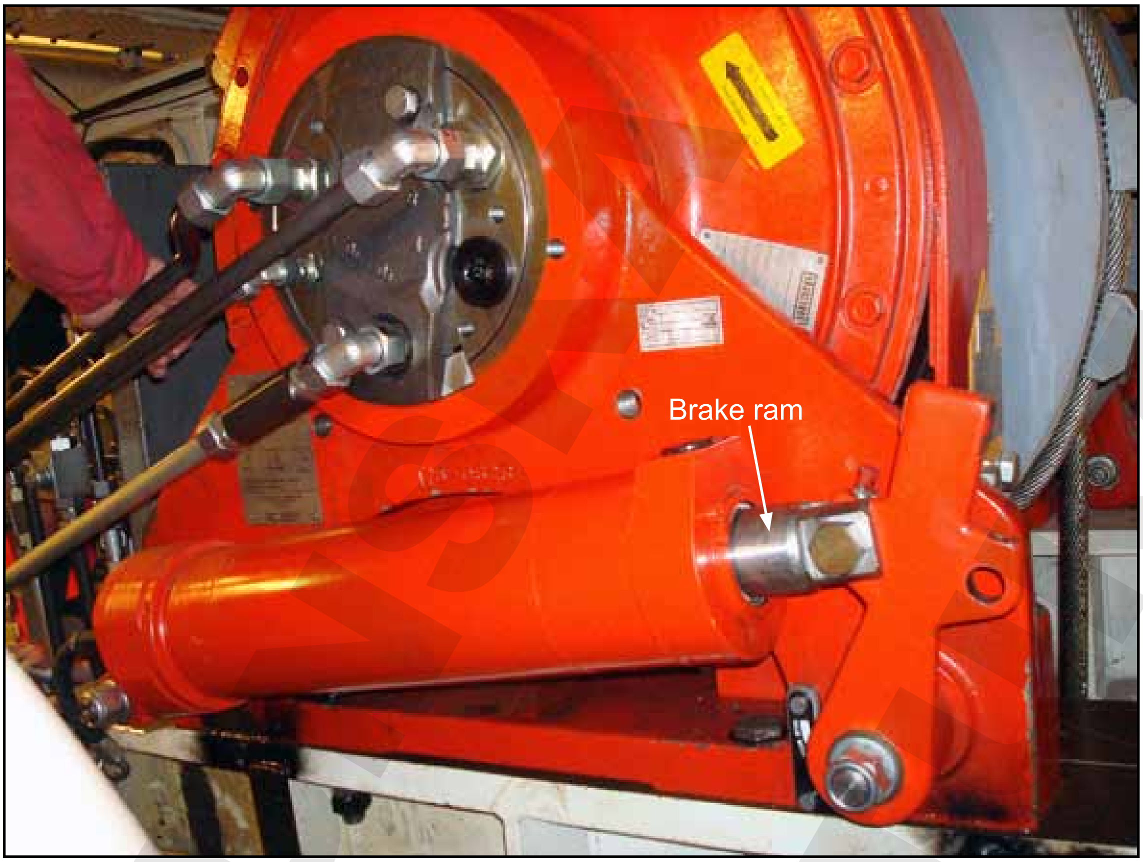


Bell top showing GRP buoyancy blocks

On 31 March, with the bell in the moonpool suspended from its normal winch wires and the cursor suspended by strops from the trolley, modification work continued, including the spooling of wire onto the new cursor winch sited on top of the bell trolley. The wire was then attached to the 4t cursor, enabling it to be independently supported by its own dedicated winch and wire. During the spooling of the winch wire, one of the Modification installation team noticed that, on one occasion, the winch brake ram **(Figure 8)** did not properly apply when

DRAFT REPORT

Figure 8



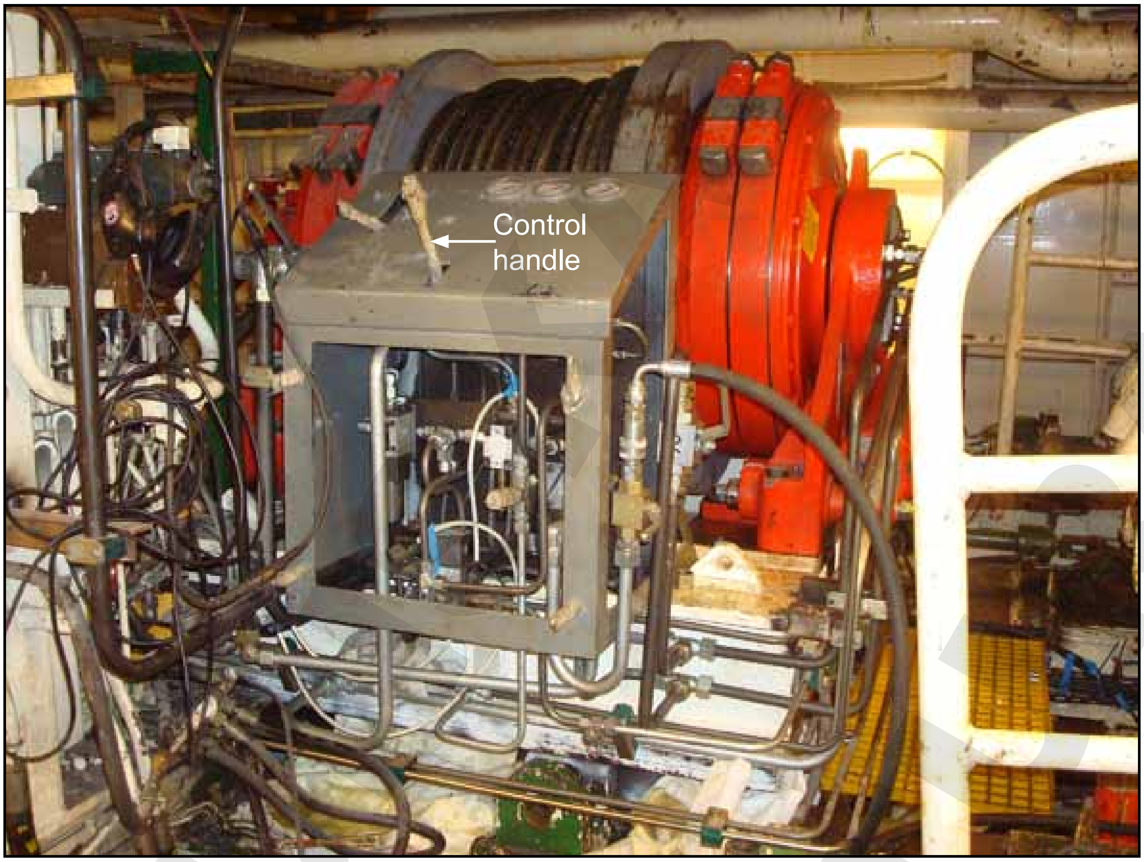
Cursor winch forward brake ram

the local winch control handle was released **(Figure 9)**. This was remedied by the winch operator wiggling the control lever, and highlighted to him that the brakes would need some adjustment as part of the system's commissioning.

The strops were removed after the wire was connected to the cursor, and the winch used to raise and lower the suspended cursor several times. This done, and appearing to be satisfactory, the strops were not re-applied.

On the morning of 1 April, the modified buoyancy blocks had been replaced on the bell, and with the cursor still suspended overhead by its wire, work progressed on the latch hooks **(Figure 10)**. This was carried out by riggers standing on top of the bell under the cursor **(Figure 11)**. The rigging of the cursor involved offering it against the bell, whereupon it was seen that the newly fitted latch hooks were catching on the buoyancy blocks. The cursor was lifted clear of the bell by the new winch and the Modification project co-ordinator got on top of the bell, below the suspended cursor, and applied guide marks to the buoyancy blocks for the GRP specialists to work to **(Figure 12)**. It was decided that the buoyancy block alterations would be carried out once synchronisation of the winches had been carried out later that afternoon, to allow the new GRP longer to cure.

Figure 9



Cursor winch local control panel

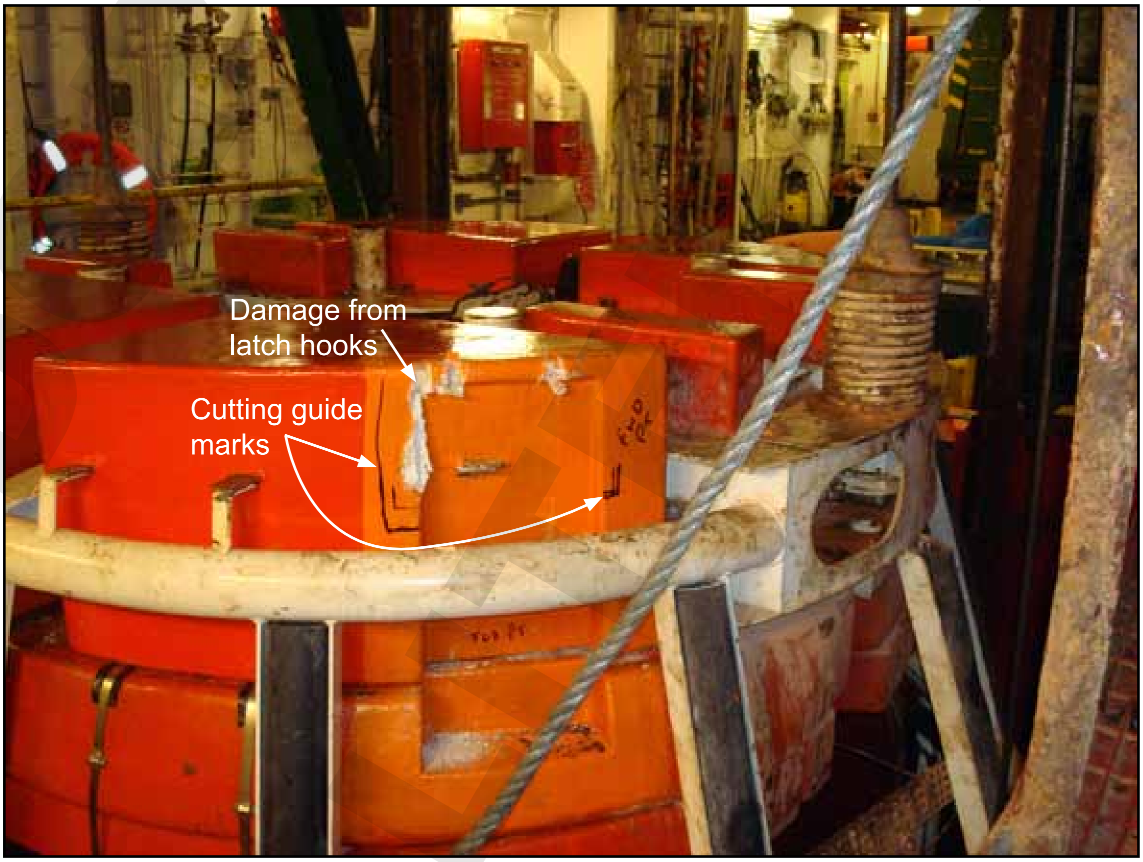
Figure 10

Rigger working on cursor latch hooks under suspended cursor

Figure 11

Riggers on top of the bell, under suspended cursor

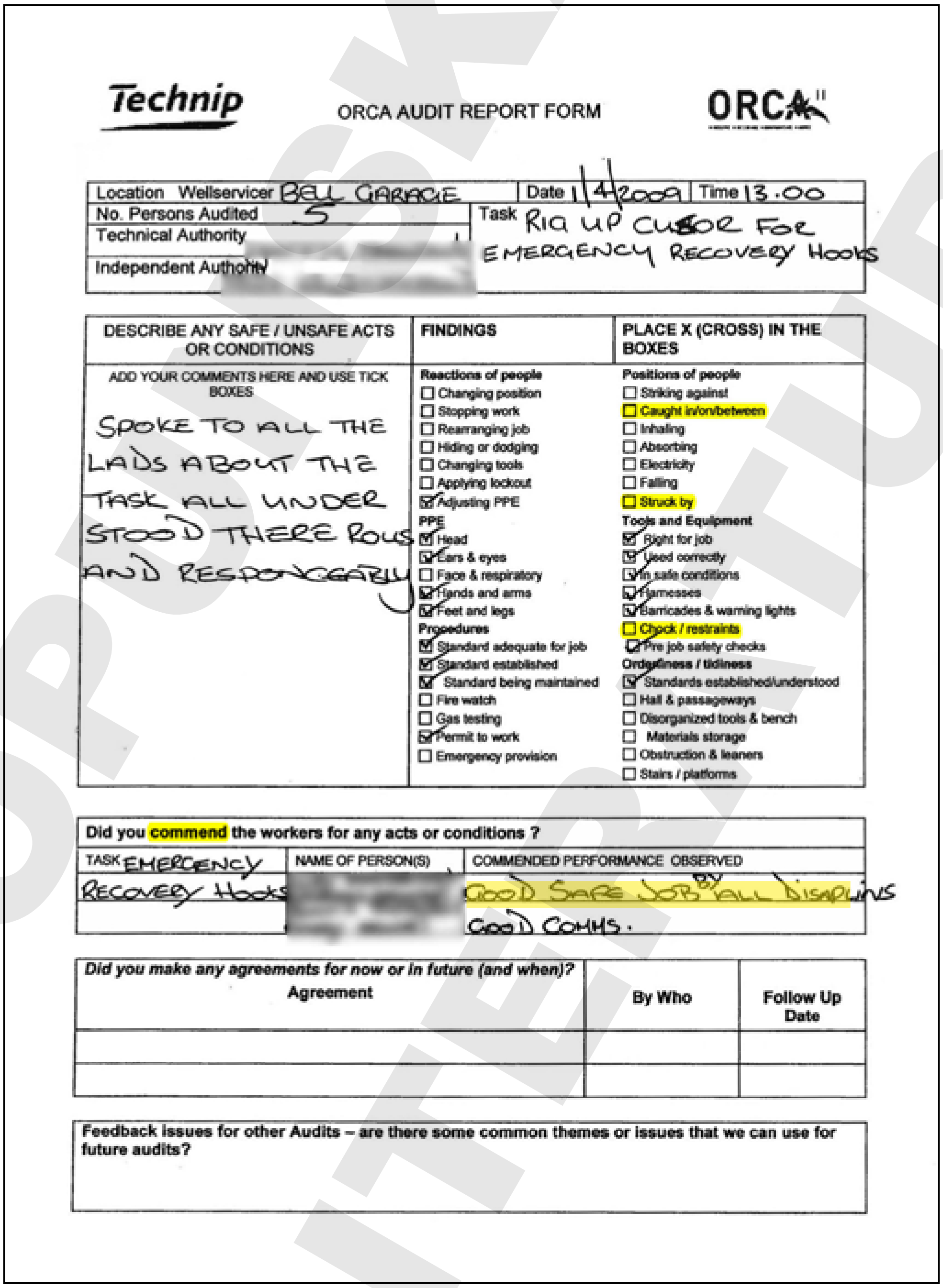
Figure 12



Damaged buoyancy blocks

Early that afternoon the Health Safety & Environment Co-ordinator (HSE-C) visited the bell hanger on various occasions to carry out routine personnel fall arrester checks. This involved him working by the bell trolley with its suspended bell and cursor. During this period of time, an ORCA[5] safety audit was also carried out by the installation team on the work operation of *"Rig up Cursor for Emergency Recovery Hooks"* [sic] **(Figure 13)**.

Figure 13



Technip ORCA AUDIT REPORT FORM ORCA

Location Wellservicer BELL GARAGE		Date 1/4/2009	Time 13.00
No. Persons Audited 5	Task RIG UP CUSOR FOR EMERGENCY RECOVERY HOOKS		
Technical Authority [redacted]			
Independent Authority [redacted]			

DESCRIBE ANY SAFE / UNSAFE ACTS OR CONDITIONS	FINDINGS	PLACE X (CROSS) IN THE BOXES
ADD YOUR COMMENTS HERE AND USE TICK BOXES SPOKE TO ALL THE LADS ABOUT THE TASK ALL UNDER STOOD THERE ROLS AND RESPONCEABILITY	**Reactions of people** ☐ Changing position ☐ Stopping work ☐ Rearranging job ☐ Hiding or dodging ☐ Changing tools ☐ Applying lockout ☑ Adjusting PPE **PPE** ☑ Head ☑ Ears & eyes ☐ Face & respiratory ☑ Hands and arms ☑ Feet and legs **Procedures** ☑ Standard adequate for job ☑ Standard established ☑ Standard being maintained ☐ Fire watch ☐ Gas testing ☑ Permit to work ☐ Emergency provision	**Positions of people** ☐ Striking against ☐ Caught in/on/between ☐ Inhaling ☐ Absorbing ☐ Electricity ☐ Falling ☐ Struck by **Tools and Equipment** ☑ Right for job ☑ Used correctly ☑ In safe conditions ☑ Harnesses ☑ Barricades & warning lights ☐ Chock / restraints ☑ Pre job safety checks **Orderliness / tidiness** ☑ Standards established/understood ☐ Hall & passageways ☐ Disorganized tools & bench ☐ Materials storage ☐ Obstruction & leaners ☐ Stairs / platforms

Did you commend the workers for any acts or conditions ?		
TASK EMERGENCY RECOVERY HOOKS	NAME OF PERSON(S) [redacted]	COMMENDED PERFORMANCE OBSERVED GOOD SAFE JOB BY ALL DISIPLINS GOOD COMMS.

Did you make any agreements for now or in future (and when)? Agreement	By Who	Follow Up Date

Feedback issues for other Audits – are there some common themes or issues that we can use for future audits?

ORCA audit form

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5 ORCA: Abbreviation for the maxim observe, recognise, communicate, agree; a behavioural based safety tool. See also 1.3.17.8.

1.3.3 Winch synchronisation

The installation team's next objective was to synchronise the speed of the cursor winch's constant tension motor with that of the bell winches. If the cursor winch payed out too fast, slack wire could have caused a riding turn to develop; if retrieving too slowly, again slack wire would have caused problems. Trials commenced on raising and lowering the bell and cursor simultaneously to the bottom of the moonpool to enable speed and tension adjustments to be carried out. The dive technician supervisor performed this operation from the dive control room, where he had control of all three winches operated by a common joystick **(Figure 14)**. Soon after 1700, winch synchronisation had reached a point where no more could be done until hydraulic pump adjustments had been made to the bell winches. It was decided that this would now be an opportune time to start the required buoyancy block modifications.

Figure 14

Dive control room

1.3.4 The accident

At about 1720 the bell was lowered to working height in the moonpool and the cursor was raised a few feet from the bell to allow access to the buoyancy blocks. Because hydraulic power to the winches was not expected to be needed for several hours, it was switched off from the control room and, as it was approaching the end of the shift, the hydraulic engineers were instructed to finish for the day.

The GRP specialists were asked to go to the bell hanger and make the alterations to the bell buoyancy blocks. Having assessed the work required, they requested the blocks again be removed from the bell to the deck to enable them to carry out their work. Riggers went onto the bell, under the suspended cursor, and unbolted the blocks for removal and, while the buoyancy blocks were being unbolted, the Modification project co-ordinator left the bell hanger to get his evening meal. It was then recognised that to physically remove the blocks and pass them onto the deck, the cursor would need to be raised higher. The dive technician supervisor went to the dive control room and called the hydraulic engineer, who was in his cabin, and asked him to return to the bell hanger and raise the cursor clear of the bell. The hydraulic engineer arrived soon afterwards and entered the bell hanger through the starboard upper level door, approximately 6m above the hanger deck. He did not observe anyone under the cursor from this position.

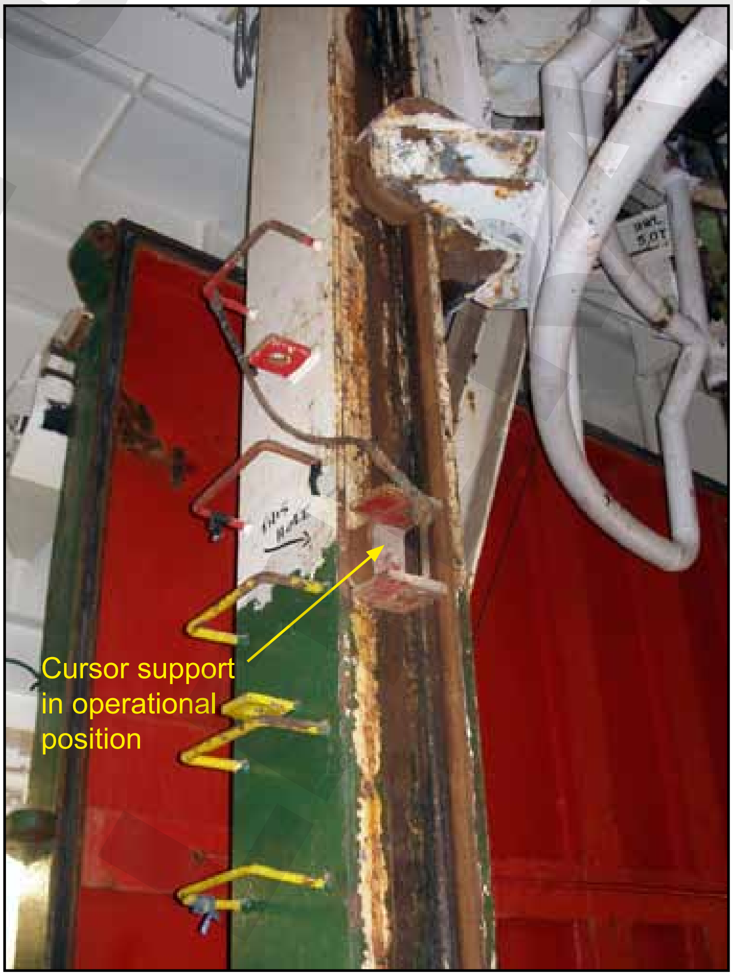
On reaching the cursor winch local controls, the hydraulic engineer indicated to the dive technician supervisor that he was ready for power to be applied to the winch. From his position directly on top of the bell trolley the hydraulic engineer had no clear sight of the cursor or bell directly below his feet, and he did not put on an available two way communications headset, as it had been malfunctioning earlier in the day. However, he did have good visual communications with the rigging foreman on the hanger deck below. The rigging foreman had full audio communications with the dive technician supervisor in the control room through headsets worn by both. Hydraulic power was applied to the new winch from the dive control room and, under guidance from the rigging foreman, the hydraulic engineer proceeded to lift the cursor. When at the required height, the foreman indicated to the hydraulic engineer to stop raising the cursor. The team confirmed that the height was suitable for the buoyancy block removal and hydraulic power was shut down at the dive control room. Neither cursor supports **(Figure 15a and 15b)**, nor securing devices, were applied between the cursor and the trolley.

The dive technician supervisor left the control room to go down to the hanger deck after shutting down hydraulic power, and the hydraulic engineer left the local winch control to return to his cabin. A rigger, David Stephenson, better known as “Luey”, was already on top of the bell, with his inertia reel fall arrester attached to his safety harness preparing for buoyancy block removal as the cursor was raised. A few seconds later the winch rendered and the cursor fell uncontrollably. This was seen and heard by colleagues, who shouted to Luey to get off the bell. He attempted to get clear of the falling cursor but, as he did so, his inertia reel fall arrester locked in place, preventing any chance of escape. The cursor continued to fall, trapping Luey between it and the diving bell.

Figure 15a

Cursor support position at the time of accident

Figure 15b



Cursor support shown in operational position

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1.3.5 Post-accident

On hearing the winch render, the dive technician supervisor ran to the bell hanger. There he saw Luey trapped under the cursor. The supervisor immediately ran back to the control room to activate the winch, and then hurried on to the mess room, knowing most of the crew would be assembled there for their evening meal. He shouted to his colleagues that an accident had occurred in the bell hanger and that a medic was needed urgently, before running back to the bell hanger to assist. The master, who was in the mess room at the time, rushed towards the bridge and, as he did so, heard a request for a medic being made over the vessel's public address (PA) system.

The hydraulic engineer had also heard the winch render and the shouts of his colleagues. He ran back to the local winch control station, reaching it before power came back on. As soon as power for the winch was resumed, he lifted the cursor, and as he did so a seal on the forward winch motor ruptured, causing oil to spray from the forward end of the winch. However, this did not prevent the winch from operating. On lifting the cursor, he released the control lever, and the winch started to veer again. The hydraulic engineer immediately recognised that the winch brakes were not applying on release of the control handle, as designed, so he raised the cursor again and held it in place by feathering the power. When the cursor was lifted clear of Luey, his colleagues rushed to his assistance and dragged him from the bell top while the cursor was surging up and down above them. Luey was carried to the hanger deck, where first-aid was administered by his colleagues and medics, who had quickly arrived on scene. The hydraulic engineer had neither sight of the crisis below his feet, nor communications from anyone at hanger deck level. He kept feathering the winch until he saw someone being carried away on a stretcher. At this point he attempted to bend down under the winch control console to remove a solenoid coil, which he hoped would cause the brakes to be applied. However, as he did so, *Wellservicer* rolled, causing him to stumble and accidently release the winch control lever. When this happened, the brakes applied to the winch and held the cursor in place.

An immediate medivac by helicopter was requested of the coastguard, and within 30 minutes of the accident, Luey was airlifted to Aberdeen Royal Infirmary, where, soon after 1845, he was pronounced dead.

1.3.6 History of the forward bell contingency recovery project

The forward bell contingency recovery project was implemented as a result of StatoilHydro raising a non-compliance with NORSOK U-100 standards for manned underwater operations in February 2007; these are trade standards of "best practice". A deadline for completion of the work was not set by StatoilHydro, but instead left open-ended for Technip to select a suitable date for the work to be carried out. As an interim measure, a temporary hydraulically-operated chain hoist was installed to provide the forward dive bell with a temporary emergency recovery system.

Co-ordination and oversight of the project was allocated by Technip to one of its dive systems' superintendents. The superintendent had been in post for about 2 years. This was the first time he had managed a project of this size and complexity.

It was originally envisaged that the modification of the bell recovery system would be a fairly straightforward, low cost (< £25,000) project, and so was incorporated as part of the vessel's general budget. Initially a previously used winch was obtained and sent to the hydraulic contractor, Micron Eagle Hydraulics Ltd (MEH), for evaluation on 14 May 2007. MEH advised Technip that the winch was unsuitable due to lack of torque capability. Consequently a second previously used winch, with manriding capability, was found and modified for the task. This arrived at MEH's premises on 24 January 2008, and was given DNV classification society (Class) approval on 14 April 2008.

A re-organisation of the Offshore Operation Service (OOS) process was initiated in October 2007 and completed in June 2008. The re-organisation was intended to bring more focus on the effective delivery of assets, primarily vessels, into the business. This resulted in the creation of two Asset Delivery teams within OOS, one having responsibility for the operation of third party vessels and DSVs while the other had responsibility for Construction and Pipe Laying vessels. Five other departments within OOS provided resources and services in support of these assets.

Around mid July 2008, a newly appointed Asset Technical manager reviewed the forward bell contingency recovery project. He became concerned about the direction the project was taking, and decreed that previously used lifting equipment should not be used for a job such as this. He approved the procurement of a new winch and an appropriate dedicated budget was sought specifically for the project. As the project progressed a budget of £200,000 was retrospectively approved for the Modification project in January 2009.

Subsequently, full design drawings for the cursor modification and new winch installation accompanied Technip's approval package to the Classification Society. Copies of the drawings were also sent to the vessel for onboard comment and feedback, but none was received.

In February 2008, while *Wellservicer* was undergoing refit, and before the Asset Technical manager's intervention, an attempt had been made to start the modification project. This included a GRP contractor deploying staff to the vessel to commence alterations to the buoyancy blocks. However, commercial precedent required that the vessel go back on a new contract before the modification work could commence.

1.3.7 Approvals

When work on the Modification was commenced, Classification Society approvals were in place for the new winch, modified cursor and attachments. Some of these applications for approval had been made by the cursor design engineer, while others were made by the Modification project co-ordinator. The hydraulic schematics, however, were only submitted for approval on 2 March 2009, 2 weeks before the Modification began, and at the time of the accident these had not been approved by the Classification Society. However, managers at Technip were unaware that approval for the schematics had not been granted, neither were they aware that the hydraulic design had not been reviewed nor approved by in-house specialists, as was required by company procedures.

1.3.8 Commissioning

At the time of the accident, work to modify the forward bell arrangement was still ongoing and the system had not been commissioned.

Neither MEH nor Technip had produced a method to formally commission the new installation.

Those directly involved in the project perceived that "commissioning" was to be part of the onboard load testing process and signing off by Class.

1.3.9 Projects

1.3.9.1 Client projects

*Wellservicer'*s main function was to provide facilities and technical expertise to external clients. Client Projects were meticulously planned by Technip's UK Business Unit (UKBU), with the vessel leased from the Asset Delivery Department of OOS.

When Client Projects were being carried out, they were generally monitored at sea by onboard client representatives, protecting the client's interests, and managed on board by an Offshore Construction Manager (OCM), a member of the vessel's offshore management team (OMT). Typically, the OCM was a subsea expert who liaised directly with the vessel's master, chief officer and the Asset Delivery Vice President onshore, to facilitate clients' requirements as required by the Project plan.

Client Projects frequently required alterations to be made to the vessel's deck structure to accommodate specialist equipment or other requirements. Such alterations would be agreed, and overseen by the OMT.

1.3.9.2 Marine projects

"Marine Project" or "Internal Project" was the term used by Technip when "in-house" work such as dry docking and refits were carried out on *Wellservicer*. These projects were normally managed by OOS marine superintendents, with additional support from the OMT. Generally, shore-based superintendents controlled these modification and maintenance projects, giving the OMT updates during progress meetings, while reporting directly to the project and technical manager ashore.

The forward bell contingency recovery system was a “Marine Project”. As it was taking place during a dry docking it was considered to be a secondary project, with the dry docking being the primary or “umbrella” project. However, this secondary project did not need to be carried out in dry dock. Carrying out the work alongside a berth, if the opportunity presented itself, had at times been considered.

Marine projects costing over £25,000 with approved standalone budgets were termed “Capex”[6] projects. At the time of the accident OOS had about 220 Marine Projects of differing scale and cost underway simultaneously. These varied from fairly straightforward low cost projects, such as installing items of vessel bridge equipment, to complex major vessel alterations and repairs.

The Modification project became a “Capex” project in January 2009 when its own budget of £200,000 was approved.

The Modification project required the interface and co-operation between steel fabricators, hydraulic engineers, GRP technicians, electricians and the vessel’s crew. Although some heavy engineering was required, the extent was relatively minor compared to some of the heavy engineering work that was typically carried out on *Wellservicer* during Client Projects.

1.3.10 Process auditing

Technip operated process auditing for projects that were deemed high risk. The Modification project was not subject to this process.

1.3.11 Communication meetings

During the dry docking, daily progress meetings took place involving the yard manager, OMT, dry docking project manager, Modification project co-ordinator, HSE-C and main contractors. These meetings included progress reviews of the Modification project. Following each progress meeting an update was sent to the project and technical manager at Technip’s offices.

The dry docking manager and the Modification project co-ordinator flew back to Aberdeen on 28 March before *Wellservicer* sailed from Vlissingen. After the vessel left dry dock and sailed for Aberdeen, daily progress meetings on the unfinished Modification project ceased. Furthermore, no formal update or progress meeting was held when *Wellservicer* arrived off Aberdeen and the

[6] “Capex”: This was Technip’s terminology used for all significant maintenance and new installation projects regardless of whether they were capital expenditure or repair and maintenance, and not necessarily “Capex” in the strict accountancy meaning of the term.

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other installation team members rejoined the vessel. However, twice daily update meetings were held enabling parties to plan work for the following 12 hours. These meetings were not minuted.

1.3.12 Manning

There were 64 persons on board *Wellservicer* at the time of the accident, 48 were vessel's crew, with the remainder being supernumeraries such as contractors.

1.3.13 Offshore Management Team (OMT)

The OMT comprised the master, chief engineer and the OCM.

In normal service, *Wellservicer*'s overarching safety and navigational responsibility fell to the master, while engineering responsibilities fell to the chief engineer. The OCM (who was not on board at the time of the accident) was responsible for ensuring the smooth running and facilitation of Client Projects. When on site during dive operations, the OCM was responsible for the subsea operations (divers and associated equipment), and had similar status to the master and chief engineer.

1.3.14 Key personnel

Master: The master of *Wellservicer* was on his second week of his second trip in command of the vessel. Prior to his promotion, he had served on Technip vessels as chief officer for 5 years, with a further 14 years on other vessels including tankers, ro-ro ferries and other DP vessels.

The master participated regularly in the dry docking progress meetings and was fully aware of the modifications being carried out in the vessel's bell hanger. It was his understanding that all necessary precautions and procedures were in place covering the work as the company had dedicated shore-based staff co-ordinating the installation process.

Chief Engineer: The chief engineer had served in that capacity, predominantly on pipe-laying vessels within the Technip fleet, since 1999. He had been serving as chief engineer on *Wellservicer* for 2 years.

The chief engineer had never been on a ship fitted with diving systems before joining *Wellservicer* and, as a result, felt somewhat uncomfortable with the diving equipment, delegating much of the work in that area to the Dive Technician Supervisors. It was also his belief that, as a dedicated marine superintendent and co-ordinator were overseeing the Modification, it had little to do with him during the actual installation phase but, rather, when commissioned, it would be handed to him as a further piece of equipment to be maintained by his staff.

There were various references within Technip's procedures to indicate that oversight and compliance with procedures during such projects required the chief engineer's authoritative input. However, this did not happen in the case of the Modification project. Procedures which required input from the chief engineer included those relating to risk assessment, tool box talks (TBT) and issuing permits to work (PTW).

The chief engineer's lack of involvement in the Modification project was not identified by his peers or line managers.

Dry docking Project Manager: The dry docking project manager was a marine superintendent with 2 years in post. As the dry docking was the primary or "umbrella" project he was deemed responsible for not only overseeing the essential dry docking based repairs, but also all secondary marine projects taking place under the "umbrella" of the main dry docking. This included the forward bell contingency recovery system.

The dry docking manager left the vessel on 28 March after completion of the physical dry docking related work. However, the Modification project was not complete when the vessel sailed for Aberdeen later that day. The dry docking manager did not re-join the vessel when she arrived in Aberdeen bay, and therefore was not on board at the time of the accident.

Modification Project Co-ordinator: The Modification project co-ordinator (the co-ordinator) was a shore-based dive systems superintendent who had been in post for around 2 years. He left the sea in 2002 after 23 years' offshore experience, mainly as a dive systems technician, to take up a shore-based job with Technip as a workshop supervisor.

Technip's job description for the position of "dive systems superintendent" did incorporate some elements of project management, but they were not expressed as a "Key Activity" of the role, and the co-ordinator had no experience in managing complex projects such as the forward bell contingency recovery project on *Wellservicer.* However, in November 2008, he attended a project management training course, but had been able to attend this for only 3 of the 5 days it was run. This was because, during the course, he was required to go to *Wellservicer* to help resolve an onboard dive systems problem. The results of the examination taken at the end of the course indicated the co-ordinator had difficulties with grasping the concept of project management, and this was made known to his line managers. As a consequence, some of his existing workload was redistributed so that the co-ordinator could concentrate on *Wellservicer*'s Modification project. No additional support was provided to him, and the role of the OMT, with respect to the Modification project, was not explained to him.

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There was an expectation that the co-ordinator's role in managing the Modification project included procurement of equipment and appointment of contractors. In addition to overall supervision of the modified cursor installation, it was expected that the co-ordinator would liaise closely with: the contractors employed on the project; the design draughtsmen; ship's staff; and the Classification Society.

Safety Officer: The chief officer was the vessel's designated Safety Officer. He had held the post on *Wellservicer* for 3 years, and had been a chief officer on various Technip vessels since 2000. Due to the complexity and workload of chief officers on DSVs, Technip had created the post of Health Safety & Environment Co-ordinator (HSE-C) to assist the chief officers with routine safety officer related work.

Health Safety & Environment Co-ordinator: The HSE-C had sailed on various Technip vessels for about 6 years as safety officer and HSE-C. He joined *Wellservicer* as HSE-C about 6 months before the accident. He held a National Examination Board in Occupational Safety and Health (NEBOSH) general certificate, and various vocational training qualifications pertaining to his safety-related role.

During dry docking projects as much as 50% of the HSE-C's day was spent carrying out safety inductions for the many visitors and contractors joining the vessel. Another 25% of this time was taken up making database entries, leaving 25% of his time to carry out site visits etc.

It was part of the HSE-C's job to occasionally "walk the vessel" and observe work processes taking place, with a specific view to safety-related elements of the work, and to assist with risk assessment and TBTs. He advised the Modification team that if they needed assistance in completing risk assessments they should ask for his help, but this was not taken up. It was his belief, however, that because of their practical experience, the Modification team in the bell hanger was better placed than he was to carry out effective risk assessment of the project work.

Three hours before the accident, the HSE-C visited the bell hanger intermittently to carry out routine inspections of the fall arresters. This included the fall arrester that Luey was wearing at the time of the accident. Around the time that the HSE-C was carrying out these checks, an ORCA audit was carried out by the installation team. It was part of the HSE-C's remit to conduct ORCA audits and train onboard personnel in ORCA procedures. He was also required to record information and statistics in the Synergi[7] database relating to ORCA and other safety-related matters.

[7] Synergi: Technip's electronic database for recording Fleet Management System audits, crew competency audits, HSE audits, hazard observations, safety incidents and ORCA audits.

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Hydraulic Engineering Technician

The hydraulic engineering technician was an external contractor provided by MEH. He had 18 years experience in hydraulic systems fabrication, repair and maintenance, and had previously worked on *Wellservicer* several times before the accident.

Vessel's Riggers/Technicians: There were seven other people in the immediate vicinity at the time of the accident, including riggers and technicians. Between them they had about 120 years experience in offshore rigging and diving work, and most had sailed together for several years. Throughout the project, rigging and general labouring was carried out by the vessel's riggers, while the Modification works were conducted by external contractors.

Casualty: Mr David (Luey) Stephenson was aged 44 and had been a rigger on *Wellservicer* since 2003. He held certification as an offshore banksman, rigger and slinger. Luey was a highly respected member of the vessel's crew and, as a trained ORCA auditor, was recognised for being very safety conscious. He had carried out an ORCA audit on the day of the accident for rigging of the cursor and fitting the latch hooks to it. This audit did not highlight the hazard of the cursor being a suspended load. However, 1 week before the accident, Luey had personally raised a hazard observation when he saw someone walking under the suspended diving bell in the bottom of the dry dock.

1.3.15 Micron Eagle Hydraulics Ltd (MEH)

MEH was an approved contractor for Technip UK and had carried out repair work on *Wellservicer* on several occasions. It was contacted by Technip in April 2007 to undertake the winch installation and associated hydraulic modifications because of its previous experience of the vessel. No formal quotes were asked for or given, no tendering process took place and no formal contract was awarded.

MEH was not requested to produce commissioning procedures for the winch installation and did not do so. It did, however, provide a "Theory of Operation" document **(Annex 1)** for the new winch system and a hydraulics circuit schematic **(Annex 2)** for reference. The hydraulic circuit schematic was not reviewed by Technip's "in-house" specialists before being sent to Class for its approval, on 2 March 2009.

1.3.16 Winch

The winch assembly was supplied in component parts by Hagglunds Drives UK to Technip for assembly in April 2008. The component parts had DNV type approval for use in manriding winch applications.

The components were assembled to form the winch in MEH's workshop, from where it was taken to Technip's yard for load testing. Load testing was carried out on 10 March 2009, 1 week before the vessel was due to dry dock. Load testing also included evaluation of the winch drum braking systems. Following load testing, the winch was stripped down into its component parts again before being transported to the dry dock in Holland. The components were hoisted from the dry dock bottom into the vessel up through the forward moonpool, and then re-assembled on board the vessel **(Figure 16)** before being installed on top of the bell trolley.

Figure 16

Winch being assembled in bell hanger

1.3.17 Business Management Systems

Wellservicer operated a fully integrated safety management system (SMS) as required by the International Management Code for the Safe Operation of Vessels and for Pollution Prevention (ISM), and held a Safety Management Certificate (SMC) valid for 5 years. The SMS gave procedures for normal operational activities and referred to Technip's Business Management System (BMS) for Project activities.

An external ISM audit carried out in September 2008 revealed no non-conformances but did note four observations, which were addressed soon afterwards. Internal and external audit reports were reviewed for a 3-year period preceding the accident; these audits revealed minor non-conformities, but none in the areas relating to the accident.

There were a number of BMS procedures and safety tools relevant to the accident including: Management of Change (MOC) Procedure; the OOS Project Management Procedure; Hazard Identification & Risk Assessment (HIRA) Procedure; Job Risk Assessment (JRA) Procedure; Permit-to-Work system (PTW); Time Out For Safety (TOFS); Tool Box Talk (TBT) and Observe Recognise Communicate Agree (ORCA).

1.3.17.1 Management of Change Procedure (MOC)

Technip had a 20 page guideline document detailing the processes to be applied to all operations and projects affected by change to their original intent or changes in methods carried out during the task. The document stated that the procedures applied *"to all aspects of Technip's related offshore operations, including but not limited to Project, Marine, ROV, etc…"* Some of those involved in the accident believed that MOC was only applicable to external Client Projects and not to internal Marine projects.

Change of method and process occurred on numerous occasions during the installation of the forward bell contingency recovery system. However, MOC procedures were not applied, despite their application being raised and minuted during *Wellservicer* dry docking meetings on both 30 January and 6 February 2009, where all attending superintendents were advised that it was mandatory for MOC procedures to be applied when *"installing new systems".*

1.3.17.2 OOS Project Management Procedure

Technip's Project Management Handbook gave guidelines on how projects should be followed from start to finish. These guidelines included processes designed to ensure the basic elements of project management were adhered to. Structured progression, starting with a project workscope, was required, followed by project feasibility, kick off, planning, execution and close out. As part of this system, a project team was a prerequisite, however no project team was appointed for the forward bell contingency recovery system project.

The handbook made frequent references to such issues as risk assessment and management of change.

The planning section of the handbook required an electronic Project Folder to be compiled within the OOS computer network system, and populated with details of the project. This Project Folder held very few records or information regarding the forward bell contingency recovery system. The procedures had, however, been followed in the primary dry docking project folder. Additionally, an aide mémoire document to the Project Management Handbook, the *OOS Project Management Model* **(Annex 3)**, also gave guidance on project processes and deliverables. Neither of these documents were utilised during the life of the forward bell contingency recovery system project.

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1.3.17.3 Hazard Identification & Risk Assessment (HIRA)

HIRA was the primary tool used by Technip's shore-based management team to identify hazards associated with work that involved tasks, such as the modifications to the forward bell contingency recovery system. This would normally involve a meeting of all stakeholders, in an early attempt to: identify hazards and hazardous events; to establish reasons for them occurring; to consider the risks evolving from those hazards; and finally, specifying control measures to reduce those risks.

A shore-based meeting was held on 13 February 2009 to carry out an HIRA for the installation of the emergency winch on the forward bell trolley. The meeting attendees comprised five shore-based Technip employees; it did not include members of the vessel's OMT or external contractors.

This meeting resulted in a Risk Assessment **(Annex 4)** being produced to cover the expected work programme from initial lifting of the winch components from the dry dock bottom through to the buoyancy block modifications to the diving bell. The HIRA did not identify the suspended cursor as a hazard.

The HIRA was intended to form the basis of risk management activities at the worksite where the document should have been reviewed and discussed with the installation team, HSE-C and the OMT as one element of a dedicated job risk assessment.

1.3.17.4 Job Risk Assessment (JRA)

Following completion of an HIRA, Technip's internal procedures required that a JRA be carried out on board the vessel to identify if particular tasks had been omitted, or not adequately covered by the shore-based assessment. This review was not carried out, and no subsequent dedicated risk assessment was produced.

A risk assessment was carried out for cursor winch load testing at Technip's yard a week before the dry docking. This assessment was carried out by the project co-ordinator, an HSE superintendent and two of the hydraulic contractors involved in carrying out the Modification. It identified winch failure as a possible hazard, and controls were put in place to mitigate the risk during the load test.

Technip's Job Risk Assessment Procedure also refers to the use of Generic JRAs. Generic JRAs were allowed to be used where routine tasks were undertaken and the associated risks were deemed to be unchanging. Generic JRAs were frequently referred to during the installation of the forward bell contingency recovery system.

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1.3.17.5 Permit-to-Work system

Technip used a PTW system to define safe working procedures when carrying out work such as hot work (burning, welding etc), and other hazardous activities such as confined space entry. A primary function of the PTW system was to ensure senior supervisory personnel were kept aware of ongoing tasks and their potential influence on other work. Technip's PTW system required:

- The person in charge (the person responsible for ensuring the work was carried out in an efficient, safe and careful manner), before commencing work, to apply for a work permit from the responsible person.
- The responsible person (the authorising authority for the PTW), following a review of the application, and highlighting of safety requirements to the person in charge, to authorise a work permit to be granted by the issuing authority.
- The onboard issuing authority (the master or his representative) to record control measures in place to mitigate identified risks and, if need be, define further safety precautions additional to those already highlighted by the responsible person.

This procedure enabled the issuing authority to identify any conflicting, or interacting, activities occurring on the vessel by reference to the "live" permits issued on board, at any time.

In common with its MOC procedures, Technip's PTW system required a suspension of work if there were *"problems associated with the work that change the nature of the work originally planned".*

An internal audit conducted by Technip in April 2006 recognised that its completed work permits frequently indicated that the "person in charge", and "responsible person" (for the work), were the same individual, thus removing a potential safety barrier of "another pair of eyes". This concern was drawn to the attention of the master and chief officer of *Wellservicer*, for their increased vigilance.

Approximately 20% of work permits involving the Modification showed that the "person in charge" and "responsible person" were the same. Technip required that the "responsible person" should always be a senior supervisory individual. Also, for work affecting the vessel's structure, fixed plant, or project equipment, the company required that the "responsible person" should be the chief engineer or his nominated deputy. However, none of the work permits relating to the Modification were completed by the chief engineer.

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At the time of the accident, there were three live work permits in place. These permits were for: the GRP contractors working aloft to remove buoyancy blocks from the forward bell, hydraulic contractors working aloft on the winch hydraulics, and fabricating contractors carrying out hot work aloft. These permits all referred to a generic working at height risk assessment, while the latter also referred to a generic risk assessment covering hot work in the moonpool area. There was no live PTW for the vessel's riggers to work aloft on the bell to remove the buoyancy blocks or to work under the suspended load while installing the cursor latch hooks. In the course of the Modification project no work permits at all were issued for the 0600 to 1800 rigging team, despite their frequent working on and around the bell trolley and its associated equipment.

1.3.17.6 Time Out for Safety (TOFS)

Technip used the standard safety tool "Time out for Safety" (TOFS), whereby anyone, at any time, could call or signal for work to cease if they believed the work process was unsafe or changing from the agreed plan. During the dry docking project five TOFS were initiated, but none related to the Modification. However, on 30 March an ORCA Synergi entry commended the Modification team for taking a TOFS when the task changed from that discussed in an earlier TBT; the paper copy of the computer entry made no mention of this in the dedicated commendation section. The TBT referred to in the Synergi entry was also not evidenced in hard copy.

1.3.17.7 Tool Box Talk

Technip's BMS structure included a documented guide for Tool Box Talks. TBTs were to be used as a tool to communicate risk assessments to working teams and as part of pre-commencement procedures to ensure personnel carrying out the task understood the work, and were aware of the hazards and precautions to be taken. When a TBT was carried out in relation to a Project, it was required to be documented and recorded in the Project Folder.

Eleven TBTs were documented between 17 March and 1 April for various strands of the Modification project. No TBT was documented relative to the Modification project on the day of the accident, and none of the TBTs carried out were recorded in the Project Folder.

The TBT pro forma **(Figure 17)** included, as an aide mémoire, potential Hazards Categories to be considered and, if relevant, discussed with the work team. Many project related TBTs recorded indicated all the Hazards Categories listed on the form as being relevant and discussed with the team, including radiation and biological hazards, with the greatest risk to people identified as slips, trips and falls **(Figure 17)**.

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TOOL BOX TALK FORM

Vessel / Site: WELL SERVICER.

Talk Location: WORKSHOP

Work Location: DIVE SYSTEM Date: 19/03/09.

Tool Box Talk Leader: [redacted]

Signature: [redacted]

Work Activity / Task:

MAINTENANCE ON DIVE SYSTEM.

Talk Leader Prompts:

These questions should be directed at relevant personnel to confirm understanding of the task and hazard.

1. What Hazards can be foreseen?
2. What must you do to make the task safe?
3. What are you responsibilities for implementing the control measures?
4. What might go wrong with this job?
5. At which step will we stop and re-assess the job?
6. How will you be communicating with the team?
7. What do we do if we see changes to work arising?
8. Is everyone familiar with and know how to use all tools and equipment safely?
9. Are there any additional hazards and control measure required that are not covered in the JRA?
10. Are we ready to start the job?

Simultaneous Operations:

What other work activities are taking place at the same time?
(Think about location, environment, timing, etc)
List the Hazards:

VESSEL OPERATIONS

Stop the Job Triggers:

Some of the key triggers identified for stopping the job are;

ANY ABNORMAL OCCURANCE.

Roles & Responsibilities:

These have been defined, agreed and clearly communicated to all work parties. Key roles and responsibilities are:

DIVE TECH SYSTEM MAINTENANCE.

Hazard Categories: (Think about Location, Equipment & Task). Tick all that apply and discuss with team.

Dropped Objects ☑ Moving Objects ☑ Pressure ☑ Unfamiliar Personnel ☑ Heat ☑

Lighting/Visibility ☑ Lifting Equipment ☑ Manual Handling ☑ Work at Height ☑ Cold ☑

Access / Egress ☑ Dangerous Equip ☑ Biological ☑ SimOps ☑ Spills ☑

Weather ☑ Hazardous Subs ☑ Electrical ☑ Vibration ☑

Radiation ☑ Other..

Biggest Risks to People: SLIPS TRIPS & FALLS

Work Party Declaration:

Names and signatures of persons involved in this job.

- I have participated in the Tool Box Talk
- I know the hazards involved and the controls required to make the job safe
- I have read and will follow the relevant procedures
- I will stop the job if the job changes, I feel it is unsafe or if I observe any of our agreed Stop-the-Job Triggers.

1. Signature [redacted] Name [redacted]
2. Signature ______ Name [redacted]
3. Signature ______ Name ______
4. Signature ______ Name ______
5. Signature ______ Name ______
6. Signature ______ Name ______
7. Signature ______ Name ______

Tool box talk form

1.3.17.8 Observe Recognise Communicate Agree (ORCA)

Technip operated a behavioural safety tool known as "ORCA". These were practical safety audits carried out using the maxims of *Observe*, *Recognise*, *Communicate* and *Agree*, as a means of identifying unsafe acts within the workforce to positively influence its behaviour and reduce the potential for accidents. These audits were also used as part of the company's key performance indicators (KPIs), which were used to measure the vessel's safe working performance.

The concept of ORCA was to encourage workers to take ownership of their working practices to ensure they were conducted safely.

In practice, a trained auditor with knowledge of the task would be accompanied by an independent auditor and observe the actions of workers to enable recognition of both good and bad safety behaviour.

Where an unsafe act was observed, the auditor would communicate this to the perpetrator by asking them to review their actions so that they could identify possible hazards in their recent work procedure and, by feedback and agreement, implement a more appropriate method of work. Unsafe acts were required to be recorded in the Synergi database, with corrective actions confirmed within a given time period and observed and communicated by a follow up ORCA Audit. If the follow up audit confirmed corrective action was in place, the hazard would be closed out on the database. If it did not, a further entry to the effect would be made and the status would remain open for further follow up.

ORCA audits would be documented on an audit report form **(Figure 13)** at the time, and then recorded in the Synergi database. However, the names of those not conforming were not to be recorded on the audit form.

If, during an ORCA audit, the workers were seen to be carrying out the task appropriately and in complete safety, they were to be commended, not only verbally, but also named as commended for safe practice on the audit form. These positive audits were also logged on Synergi, but as they were not unsafe acts they became self-closing because no follow up was required.

There were 36 ORCA audits carried out on the entire vessel between 17 March and the time of the accident. Of these, 29 were carried out by the 0600-1800 rigging team; all 29 praised the people involved for safe behaviour. No audits were carried out on contractors involved in the Modification project.

Less than 3 hours before the accident, an ORCA audit was carried out for *"Rig up cursor for emergency recovery hooks"* [sic] **(Figure 13)**. This audit commended the installation team for *"Good safe job by all disaplins Good*

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comms" [sic]. However, the audit did not identify the potential for workers to be "caught between" or "struck" by objects. It also did not identify the risks posed by suspended equipment not being secured by "chocks" or "restraints".

1.3.18 Safety Awards Scheme

The crews on vessels operated by Technip participated in a safety incentive scheme known as "Passport to Safety". This was a scheme whereby crew members were materially rewarded for avoiding lost time injuries (LTI). *Wellservicer* had an enviable record of 7 years without LTI, and was held up, by some, as an exemplar of safe working practice.

Key Performance Indicators (KPIs), taken from the vessel's safety performance statistics were entered in safety league tables and used to measure safety performance across the Technip fleet. As part of this scheme, Technip donated gifts to registered charities through the vessel's welfare fund.

Technip's senior management were concerned that the existing rewards scheme was not totally efficient due to its emphasis on injuries rather than proactive safety behaviour, and were progressing a new scheme to reflect this at the time of the accident.

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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 MODIFICATION PROJECT

2.2.1 Progression

When *Wellservicer*'s non-compliance with NORSOK U-100 standard was identified, Technip initiated what were perceived to be relatively low cost modifications to the vessel's forward bell launch and recovery system. The expected costs were incorporated within a general vessel budget. The Modification was not identified as a *Project* within its own right and, even after obtaining a dedicated "Capex" budget, the company's Project Management Procedures were not applied. Technip's project management handbook stated: *"Project management principles will be applied to any activity within OOS that has the potential to impact upon the operation of vessels, plant or equipment. The principles will be applied regardless of the financial value of the project…"* The Modification project undoubtedly fell under this remit and should have been subject to all project management procedures.

Failure to apply Technip's project management procedures from the outset allowed the project to meander from that point forward. There was no initial project workscope briefing report or feasibility report carried out to identify the magnitude of the task and resultant direction it should take. The failure to apply these control procedures at an early stage meant that all subsequent gate reviews and interventions failed to take place.

The project grew through a series of three winches, and at least one false start. Initially, second-hand winches were modified for use in the active cursor system and the project subsequently escalated after rejection of the second modified winch. MOC procedures should have been strenuously applied at this point, if not previously.

The further escalation of the Modification to a "Capex" project required creation and completion of a Project Folder within the company's internal computer network. Although it was created, population of the Folder was sparse. Technip's management failed to identify this through simply monitoring the Folder, but chose instead to accept verbal and email updates on the Modification's progress.

The Modification involved a number of engineering disciplines, including: structural, hydraulic, electrical and GRP specialists. Throughout the modification process these diverse disciplines influenced each other, requiring frequent amendments to schedules. MOC was not applied during these amendments;

instead, the work progressed in a somewhat ad-hoc manner. This was most evident when a proposal was made to lower the bell into the moonpool to facilitate buoyancy block removal from its earlier work position on top of the TUP trunking. This was a sound proposal, simplifying work greatly, but was progressed without applying any risk assessment or basic safety measures.

The co-ordinator went on top of the diving bell under the suspended cursor on at least two occasions, prior to the accident, to mark the buoyancy blocks for cutting. This might have given the rest of the team a signal that it was safe to do so, when actually they should have been calling TOFS to review the work programme.

2.2.2 Communication meetings

Daily progress meetings involving the OMT and various stakeholders were held during the dry docking project. These included a daily overview of the Modification project, and were also an opportunity for raising concerns. Progress meeting reports were emailed daily to shore-based management.

When the vessel sailed from Vlissingen for Aberdeen, the dry dock project manager and Modification project co-ordinator left the vessel. The Modification team remaining on board were under the supervision of a Dive Technician Supervisor, until the vessel arrived off Aberdeen.

No formal Modification project progress meetings were held after the vessel left Holland and, although update meetings were held when the vessel arrived off Aberdeen, these were un-minuted. The reduced formality of these meetings might have caused contractors and ship's staff to construe work progression differently, possibly resulting in each group working somewhat independently of others. No formal update or progress meeting was held upon the vessel's arrival off Aberdeen for returning or new team members, thus encouraging the ad hoc system to continue.

The change to a more informal way of monitoring the project and absence of the earlier email reports should have been an indication to both the OMT and shore-based management that the project was changing direction, and thus prompted them to intervene and satisfy themselves that the correct procedures were being followed. The fact that no intervention took place was indicative of either an acceptance of change or, in the case of the OMT, uncertainty about its supervisory role during what was perceived to be a shore managed project.

2.2.3 Contractor appointment

The hydraulic element of the Modification was awarded to MEH on the basis of previous competent repair and maintenance work. No tendering process took place despite a requirement for this within Technip's procedures for purchases over £25,000. However, no initial feasibility report had been carried out to indicate the potential costs. MEH was not awarded a formal contract, nor was it asked to produce comprehensive design, construction or commissioning documents. It did, however, supply its “Theory of Operation” document and hydraulics schedule **(Annex 1 & 2)** a few weeks before mobilisation. The contract between Technip and MEH was very much a “gentlemen’s agreement”, with no clear mandate of what was expected of either party.

MEH was a general repair and maintenance hydraulics company, rather than a designer of new systems. When initially contacted, it was asked to carry out a modification that was perceived to be within its competence. The project grew, however, and MEH was carried along with the momentum of that growth. When the final scope of the project was realised, the whole undertaking should have been revisited to include a structured contractor selection and tendering processes.

2.2.4 Contingency Recovery System’s Design

About 20 months before the work started it was recognised that precise engineering drawings would be required for the cursor modification. As a result, Asset Delivery of OOS produced comprehensive design and work scope packages for the cursor and trolley alterations. These were processed in accordance with Technip’s procedures for revision and acceptance before being sent for subsequent Class approval.

Technip had in-house expertise within its Technical Solutions Department of OOS who could have evaluated MEH’s hydraulic proposals. However, they were not asked to do so before the plans were submitted for Class approval. Had the Technical Solutions Department been involved, it would probably have highlighted the lack of commissioning processes and potential weaknesses in the hydraulic design. If this work had been part of a Client Project, then the Technical Solutions Department would have been a member of the evaluation team. However, because the Modification was considered to be an internal Marine project this was not considered necessary.

2.2.5 Classification Society approvals

Class approvals had been obtained for the new winch, modified cursor and attachments. The hydraulic schematics were submitted by Technip for approval on 2 March 2009, 2 weeks before the Modification began, allowing little time for review and revision, had this been required.

The process adopted by the Classification Society, Det Norske Veritas (DNV), when issuing approvals, is as follows:

1. The client is required to advise DNV of the proposed work and provide full details, including specification, drawings and full supporting documentation. All should be provided in good time to allow for detailed review and approval.

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2. Purchasing, fabrication, assembly, installation and commissioning commences after Class confirms approval of the design specification.

3. During fabrication and assembly, Class surveyors monitor the installation to ensure that it complies with Class Rules and is in accordance with the approved documentation and drawings. On completion, the surveyor witnesses final commissioning of the system, including any load testing necessary.

In the case of *Wellservicer,* the late submission by Technip of the hydraulic design for approval meant that it had not been fully reviewed by the Class Society prior to the commencement of the installation. Such a review should have identified any potential weaknesses in the design. The subsequently identified single point of failure within the hydraulic circuit emphasised the need to follow not only the correct approval process, but also to apply stringent commissioning procedures. Had the Project followed the designated Class approval route, the potential failings within the circuit design might well have been identified, and remedial actions implemented. However, this can not be verified as the project was aborted following the accident.

2.2.6 Commissioning

There was no agreed commissioning process for the new installation. The winch had been load tested onshore and had been in operation on board the ship for several days before the accident. The system had been accepted by the installation team, informally, as fully functional. It was their belief that “commissioning” was to be part of the onboard load testing and Class approval.

After the cursor winch had been load tested onshore it had been stripped down and then re-built on board the ship, effectively becoming a new structure. Therefore the results of any previous testing should have been disregarded. The load testing onshore tested the winch on a hydraulic test bed. The test therefore did not verify the operational suitability of the system’s other component parts, such as the hydraulic lines, power units, valves and the control console.

Load testing is not commissioning; commissioning should be a precursor to a worksite load test and should include all the necessary checks to ensure the system is fully functional and that all components are appropriately adjusted before the system is put into service. The commissioning process should include methodically working through the hydraulic system under all potential operational permutations. Load testing, on the other hand, is a process whereby the winch, brakes, associated hydraulic components and fabricated structures are all tested under critical pressures to ensure the system can handle the calculated maximum operational load, plus a prescribed safety margin.

At one point during installation, a member of the installation team observed that the brakes did not fully apply. This was corrected by wiggling the control handle, and a mental note was made at the time to adjust the brakes later on. This was, in all probability, an early indication that the pilot valve was faulty and the "wiggle" was simply enough to release pressure from the system allowing the brakes to apply.

2.2.7 Winch/hydraulics investigation

The MAIB appointed an independent hydraulics specialist, Aberdeen Hydraulics Ltd, to carry out a preliminary, non-intrusive investigation into the cause of the winch failure. This investigation focused on the hydraulic circuit schematics and winch design. The preliminary investigation revealed areas of concern within the "as built" compared to the circuit schematic, and it proposed several potential areas for further, intrusive investigation **(Annex 5)**.

Similarly, Technip commissioned an independent external expert, Thomson Engineering Consultants, to carry out an intrusive investigation into the hydraulic circuit. This investigation, observed by Aberdeen Hydraulics on behalf of the MAIB, identified a malfunction within the local control panel for the winch.

The control panel circuit and components were then sent to SMS Consultants, Department of Mechanical Engineering of the University of Bath, for further independent controlled investigation and evaluation. These investigations were attended also by representatives from Technip, MEH and Burgoynes consulting engineers. Representatives of the MAIB and the pilot valve manufacturer, Wandfluh AG of Switzerland, were also in attendance. The investigations identified a defective pilot valve within the control panel which, under certain circumstances, prevented the release of hydraulic pressure in the brake circuits, thereby preventing operation of the brakes (see **Annex 6,** SMS Consultants report summary). Subsequent examination by Wandfluh AG of its records revealed the valve in question to be about 9 years old. However, the company has confirmed it is confident that its quality control processes are effective, having received no other reports of faults in valves of this type.

2.2.8 Winch failure

The winch rendered as a result of a faulty pilot valve in the hydraulic feed line to the winch brakes.

In view of the function required to be carried out by the winch, i.e. emergency lifting or constant tension of the cursor wire in normal operations, the hydraulic lock, often found in winches to prevent them from veering, was not incorporated in the Hagglunds winch. This would have been acceptable provided the brakes were independently controlled. However, the design of the hydraulic circuit was such that the brakes were controlled through a single source (the defective pilot valve) and the independence of the brake operation was compromised. Consequently, on this occasion, when the control lever was released and the power to the winch switched off, neither brake applied as hydraulic pressure was retained in circuits to both the brakes by the defective valve. The weight of the suspended cursor then caused the winch drum to creep back and go into freefall.

2.2.9 Client projects v marine projects

Technip projects operated on two different levels. Client projects were systematically planned and designed by a dedicated Projects Department of Technip's UKBU, and were aimed to deliver client satisfaction. These projects were managed on board *Wellservicer* by the OCM liaising directly with master and chief engineer on board, and the OOS Asset Delivery Vice President onshore. Marine projects, on the other hand, were given to the OOS Asset Technical Department to develop and manage under a system of marine superintendency, operating alongside ship's staff, which sometimes created a nebulous chain of command.

Although client projects were very much larger than most marine projects, similar structured processes could have been applied. Technip had the staff and expertise to do this and could have taken advantage of in-house experience by enlisting assistance from its UKBU and Technical Solutions Department.

2.2.10 Superintendency

Internal Marine projects such as modifications and dry docking were normally overseen by OOS shore-based superintendents. This arrangement led the master and chief engineer to become detached from the usual chain of responsibility when such projects were being undertaken because they believed that the superintendents were totally responsible for the satisfactory completion of the work. As a consequence, lines for reporting with respect to such projects were sometimes blurred when superintendents were on board. However, the master and chief engineer had ultimate responsibility for what took place on their ship; this can only be done through close liaison and good communications between superintendents and the master and chief engineer.

2.2.11 Modification Project supervision

Effective monitoring of the project was not carried out by Technip's management ashore despite the requirements for staged reviews within the BMS, and their required involvement in these. This might have been caused by a failure to recognise the project's escalation from its original low budget status to a major "Capex" project. Nevertheless, its evolution was transparent and, regardless of cost, should have been afforded appropriate recognition and monitoring.

The project co-ordinator's line managers expected him to co-ordinate and actively supervise the shipboard alterations and winch installation, despite such responsibilities being largely outside the parameters of his job description and his background discipline, and despite his known lack of experience and aptitude for project management.

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Combined supervision of the shipboard alterations and winch installation was not given by the appropriate members of the OMT due to a lack of understanding of responsibilities.

2.2.12 Process auditing

Process auditing (as opposed to financial auditing) is commonly used by many organisations to ensure that agreed managerial and safety procedures are being correctly applied.

Technip's projects were selected for audit on a risk basis, following desk top assessment of their risk profile. This did not happen for the Modification project, resulting in a valuable safety net being removed. Had audit processes been applied they would have revealed, initially, inadequate Project Folder population and a subsequent physical audit of the project's progress should then have highlighted many of the safety barriers required under Technip's procedures were not being utilised, or were being applied inappropriately.

2.2.13 BMS procedures

Technip had numerous procedures in place to prevent accidents, two examples being: The Management of Change Procedure and the OOS Project Management Procedures.

Management of Change: MOC procedures were not applied during the Modification project despite a requirement for them when *"installing new systems."* Additionally, in the hours leading up to the accident, the work activities changed and evolved frequently, again with insufficient structured safety procedures applied. Basic MOC processes would have required, as a minimum, re-evaluation of the work in hand, and further risk assessment. The non-application of MOC procedures, in this instance, may be attributed to one or more of the following:

- Perceptions that these processes were not applicable to internal Marine projects.
- Misunderstanding of what "change" meant with respect to work operations.
- Lack of recognition that a MOC situation had developed.
- Ignoring the requirement because the MOC procedure was perceived to be of little value.
- Reluctance to apply the procedures due to perceived time constraints.
- Complacency.

Project Management Procedures: Senior managers' failure to follow defined procedures set an example that was emulated further down the chain. In particular, no project team was appointed, despite being emphasised in Technip's procedures, and one person was expected to "manage" the project and carry out work which would normally be spread over a team of people. Also, because there was no project team, the benefits of exchanging ideas (formally or informally) through discussion and interaction were not available; lack of a project team meant there were no benefits of self policing, thus removing further opportunities to keep the project on course.

Assumptions were made at various management levels that project management procedures were being followed, but checks were not carried out to confirm the veracity of verbal reports.

Failure to apply the above procedures meant that the main safety tools intended to ensure the safe completion of the project were also not utilised effectively.

2.2.14 Safety tools

The abundance of safety tools employed by Technip failed to identify the clearly hazardous situation that was allowed to develop on *Wellservicer,* and ultimately led to the death of Luey Stephenson.

Risk Assessment

The **HIRA** carried out on 13 March for installing the winch and cursor failed to recognise two major hazards in the installation process, namely "winch failure" and "suspended loads". No ship's staff attended this meeting, thus weakening the process. Intriguingly, a risk assessment for the winch load testing in Technip's yard a few weeks before the accident did highlight the potential for winch failure, but this was not carried through to the meeting of 13 March. This HIRA should have been followed up with a dedicated risk assessment carried out on board. However, this was not done, and no review of the HIRA was undertaken by the project and technical manager, dry docking project manager or co-ordinator when they joined the vessel in Holland for the dry docking.

Furthermore, none of the senior OMT queried this, despite a requirement for stakeholders of senior rank to be involved in the compilation of the risk assessment. Instead, generic risk assessments were utilised when easily recognisable routine tasks were to be performed.

Most of the project stakeholders believed others were carrying out risk assessments. However, if that was indeed the case then they, too, should have participated in those risk assessments, since Technip procedures required all those performing a task to be involved. This assumption indicates either a low regard for the effectiveness of risk assessment, or a general lack of understanding of the process.

The closest approximation to carrying out a dedicated risk assessment of the Modification project arose when the HSE-C suggested to the installation team that he could help with Job Risk Assessment if they so required. However, he did not push the matter as he felt their experience of the work process was much superior to his. The HSE-C's involvement in such matters, however, should be compulsory, to gain the benefit of a fresh pair of eyes.

Permit to Work

Work permits were used regularly during the Modification project; none, however, were issued at any time for working under suspended loads as required by the BMS. Permits were issued mostly to contract workers predominantly working at heights and carrying out hot work. None of the work permits were signed by the chief officer or second engineer as the responsible person, despite this being a Technip requirement for work affecting the vessel's structure, fixed plant or project equipment. This was not picked up by the PTW issuing authority (master or his deputy).

There were three live work permits at the time of the accident, none of which were for the riggers on shift at the time of the accident (0600-1800 shift). None of the work permits that were issued, from the beginning of the dry dock until the accident, which were related to the Modification project, were issued for work undertaken by the 0600-1800 shift of riggers. This is hard to reconcile given the nature of the riggers' work, and suggests that, in respect of the riggers, the PTW system had broken down. The PTW system was a prerequisite on board all Technip vessels and was emphasised at the induction of all persons joining the ship. If safety systems such as PTW are to work effectively, interaction is needed between at least two working levels: supervisory and person(s) carrying out the task. Both should know when a permit is required, and where one does not recognise that a permit is necessary, the other should communicate this requirement. For the 0600-1800 rigging team to escape this system for 16 days would indicate a high level of complacency, or a reluctance to question authority. Tellingly, at least ten ORCA audits carried out by the rigging team involved working at heights, which should have required an associated work permit.

Time Out for Safety

There was little evidence of TOFS being called during the Modification project, despite frequent changes to the operation. A Synergi ORCA entry praised the 0600-1800 rigging team for taking a TOFS when the task changed from that discussed in an earlier TBT. However, the equivalent paper copy of the ORCA audit made no mention of this in the dedicated commendation section, and the TBT referred to in the Synergi entry could not be found in hard copy.

The scope of the Modification project was such that one could expect a number of TOFS being called during the work. That none were properly recorded suggests that this safety tool, at best, requires reinforcement and, at worst, was not working.

Tool Box Talk

The TBT regime should also have alerted personnel to the lack of dedicated risk assessments if it functioned correctly, as one of its purposes was to communicate risk assessment findings and control measures to those physically involved. This did not happen. Again, this should be driven by two way communications, whereby workers should bring such things to the attention of line management.

Of the TBTs recorded during the Modification project, many showed all hazards, including those of radiation and biological hazards, as relevant to the project and worthy of discussion with the team concerned **(Figure 17)**. Furthermore, even after discussing the 20 hazard categories, slips trips and falls were sometimes deemed the greatest risk to the work team. Although there is no doubt that some TBTs took place, the attention paid to the detail poses the question of the quality of these TBTs, and whether they could be improved by simple random observation/auditing procedures. The blanket ticking of the boxes would appear to display complacency towards the system. TBTs were not recorded in the Project Folder as required.

Observe Recognise Communicate Agree

The ORCA behavioural safety tool, if used appropriately, was an excellent vehicle for encouraging all involved to take ownership of their own actions and safety. However, for the 0600-1800 rigging team it seemed to have developed into something different. Between 17 March and 1 April, 29 of the 36 ORCAs carried out on the entire ship were carried out by the 0600-1800 rigging team – an abnormal amount for any one team. All of these audits commended the team for safe working, and were entered in Synergi accordingly by the HSE-C. As these were self-closing, with no corrective action needed, they automatically helped boost the vessel's KPIs.

The HSE-C should have been alerted by the relatively high number of ORCAs produced by that group over a short period compared to other teams. Furthermore this should have prompted him to question their quality as they were all commendations for safe working, and could have encouraged him to expressly visit the bell hanger and carry out a random audit himself.

2.2.15 Safety awards

The crew of *Wellservicer* were proud of the vessel's record of 7 years with no LTIs. There is anecdotal evidence of personnel on vessels operating similar schemes not reporting minor injuries, especially towards the end of a trip

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when they could go home and recuperate for several weeks, to preserve the ship's LTI record. Although there was no evidence to suggest this occurred on *Wellservicer*, the apparent cavalier attitude to safety and safety management systems displayed by some of the crew in the lead up to this accident makes this possibility more likely.

Technip's senior managers had concerns about the potential for such a situation before the accident, and were already reviewing the "Passport to Safety" rewards scheme.

2.3 HUMAN FACTORS

The failure of the installation team to appreciate the risks of working under the suspended cursor may be difficult to explain, as evidence for the causes of this type of human failure is difficult to obtain. Any explanation must be somewhat speculative. However, the following factors might have played a part:

- **Misplaced confidence:** The absence of a project plan requiring full checks and commissioning before relying on the hydraulic system was crucial. The installation team was oblivious to the deficiencies in the new hydraulic system. However, they had seen the winch operational for several days and, although they knew it had not been formally commissioned, they had seen it lift heavy loads satisfactorily. Their confidence in its capacity is, therefore, understandable.

- **Novelty:** The conversion of the cursor from a passive system to an active system allowed the bell and cursor to be separated from each other and operated in a way that would seldom, if ever, have been seen before. This novelty might have had two consequences:
    - Although the danger presented by walking under a dynamic suspended load appears to have been well understood, (indeed Luey admonished someone a few days earlier for walking under the suspended bell), the static cursor sitting against the trolley legs was less familiar and, perhaps, less likely to be recognised as presenting the same sort of risk.
    - In normal diving bell launch and recovery operations, it was routine practice to put the cursor supports in place **(Figure 5)**. In the rather different context of the modification process, the need for this routine might not have been evident to riggers focused on the technical challenges of the task[8].

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[8] Whether the cursor supports would have withstood shock loading from the falling cursor is debatable without further analysis of the equipment. However, had the cursor wheels been placed gently on the supports, as in normal dive operations, the task of removing the buoyancy blocks would most probably have been carried out without incident.

- **Social factors:** Many of the personnel involved had worked together for several years, which probably fostered easy communication and trust within the team. However, the longstanding relationships might also have been instrumental in local practices being developed that were convenient rather than rigorous (e.g. ticking the boxes and signing off Tool Box Talk Forms, PTW forms, ORCAs, etc. without engaging in real discussion or examination of the risks). Additionally, individuals within the group might have been averse to challenging such practices or the example set by their seniors.

- Although the external contractors were probably well-versed in their own companies' safety procedures, it would be natural for them to conform to the operating environment they found on board *Wellservicer*. This tendency might, conceivably, have been strengthened by commercial considerations and, as such, also inhibited challenge.

- **Organisational factors:** Technip provided tangible rewards for good performance on some safety indicators. Although the rewards were relatively small in material terms, they could well have been associated with some kudos, which can sometimes be even more effective in influencing behaviour. Reward systems can be self-defeating, particularly in an organisation which already has a good safety record and comprehensive risk management processes. The practice may even lead to concealment of minor incidents and injuries.

- Fatigue is not considered a contributory factor in this accident despite it occurring close to the end of a 12-hour shift. Several members of the installation team worked under the suspended load on several occasions earlier on the day of the accident and on the preceding day. This strongly suggests that other factors were more significant.

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SECTION 3 - CONCLUSIONS

3.1 CONCLUSION

The Modification installation team did not exercise a reasonable duty of care by failing to apply the most basic of safety principles while working under a suspended load.

The winch rendered due to a single point of failure in an un-commissioned hydraulic system, which prevented the winch drum brakes from applying, thus allowing the winch to render under load.

The Modification project lacked direction and focus from inception, and evolved randomly without adequate supervision from management ashore or on board *Wellservicer* during the installation.

3.2 SAFETY ISSUES

Safety issues identified during the investigation, which have not resulted in recommendations but have been addressed (see Section 4):

1. The applicability of Technip's Project Management Procedures was not understood by key players. [2.2.1]

2. Technip's Project Management Procedures and Management of Change procedures were not applied to the Modification project. [2.2.1], [2.2.13]

3. Lack of formal progress meetings possibly fostered ad hoc working procedures. [2.2.2]

4. Technip's external contractor procedures were not applied. [2.2.3]

5. Technip's procedures and in-house expertise were not applied to the hydraulic design element of the Modification project. [2.2.4], [2.2.9]

6. Modifications began without receipt of the Classification Society's approval for the hydraulic system design. [2.2.5]

7. Commissioning processes were not applied to the new winch and hydraulic installation prior to use. [2.2.5], [2.2.6]

8. The design of the hydraulic circuit meant that the winch brakes did not operate independently (as required by Class rules) since a single point of failure was inherent in the un-commissioned hydraulic system. A pilot valve was flawed, causing the valve to malfunction and prevent the winch brakes from applying. [2.2.6], [2.2.7], [2.2.8]

9. There was disparity between the processes followed for Client Projects and Marine Projects. [2.2.9]

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10. The master and chief engineer believed that superintendents were responsible for completion of the project work. This led to reporting lines becoming blurred while superintendents were on board the vessel. [2.2.10]

11. The job description of the project co-ordinator was incompatible with the role expected of him. [2.2.11]

12. Line management failed to effectively monitor the project despite a requirement to do so, and knowledge of the project co-ordinator's lack of experience and aptitude for project management. [2.2.11]

13. The lack of process auditing, in this instance, removed a potential safety barrier which could have picked up not only on failings in the project's overall management structure but also on the lack of a safety process. [2.2.12]

14. BMS procedures and safety tools were either not applied or were inappropriately applied, leading to a lack of safety controls being effected. [2.2.13], [2.2.14]

15. Safety tools were used inappropriately and failed to identify hazards of suspended loads. [2.2.14]

16. Individuals failed to ensure their own welfare by working under a suspended load without applying basic safety measures to prevent the cursor falling. [2.2.1], [2.2.14]

17. Inappropriate use of the BMS procedures and safety tools resulted in a failure to identify the cursor as a suspended load. [2.2.14]

18. Dedicated risk assessments were not carried out at the work site, instead, generic risk assessments were used, without review. [2.2.14]

19. Work permits were not issued for the 0600-1800 rigging team for tasks where they were required. [2.2.14]

20. Where work permits were issued during the Modification project, they were frequently not signed by the appropriate person. [2.2.14]

21. TBTs were ineffective and of dubious quality. [2.2.14]

22. Communications between on board line management, riggers and contractors were weak in the area of proactive safety issues. [2.2.14]

23. TOFS were seldom called by ships' crew or external contractors. [2.2.14]

24. ORCA was used inappropriately by frequently commending persons rather than highlighting unsafe acts, resulting in erroneously enhanced KPIs, all of which failed to be detected during onboard database entry. [2.2.14]

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25. The installation team appeared to have had misplaced confidence in the new equipment. [2.3]

26. The novelty of the modified equipment might have caused the installation team to relax their vigilance. [2.3]

27. The reward system may have created a false representation of actual performance. [2.3]

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SECTION 4 - ACTIONS TAKEN

4.1 ACTIONS TAKEN BY TECHNIP UK

Technip UK carried out a comprehensive investigation in response to the fatal accident on *Wellservicer* on 1 April 2009. Its investigation required *Wellservicer* to be taken out of service for several weeks to allow inspection of the modified cursor system and its subsequent removal. During this time, Technip suspended all OOS Asset Technical projects, pending rigorous auditing and redefining requirements for existing and future project reporting.

As a result of its investigation, Technip UK has implemented, or is in the process of implementing, the following actions:

- A review of internal project management procedures to enhance: senior management involvement; training; BMS auditing; and personnel selection.
- A review of the Offshore Operational Services organisational structure to include the level of engineering projects to be performed “in-house” and the HS&E support required during such marine projects.
- A revision of project managers’ functions, taking into consideration their background experience and levels of responsibility.
- Active sharing of the lessons learned from this accident with Technip employees, contractors and clients.

4.2 ACTIONS TAKEN BY MICRON EAGLE HYDRAULICS LTD

Micron Eagle Hydraulics Ltd (MEH) has revised its procedures to ensure that in future:

- Clients provide full build specifications and comprehensive work scopes and agree these with MEH prior to commencement of projects.
- Build specifications are assessed and the need for additional third party review or Certification Authority approvals considered at the job quotation phase.
- The commissioning process includes meetings of all involved parties to discuss and agree clear definitions of individual responsibilities.

Following a review of its Health & Safety Policy and Procedure for Working on Clients’ Premises, MEH has mandated requirements for its personnel to:

- Ensure clients have suitable and sufficient risk assessments in place for the intended work. If no such assessments are in place, MEH will carry out risk assessments, which in turn will be reviewed and agreed with the client, prior to task recommencement.

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- Call “Time Out for Safety” if work appears to be unsafe, thus stopping further work from continuing until all issues are addressed appropriately.
- Carry out regular progress meetings with clients to include the review, appraisal and update of risk assessments.

4.3 ACTIONS TAKEN BY THE MARINE ACCIDENT INVESTIGATION BRANCH

The MAIB has issued a safety flyer highlighting lessons learned from this accident for promulgation to the offshore support industry **(Annex 7)**

4.4 ACTIONS TAKEN BY THE INTERNATIONAL MARINE CONTRACTORS ASSOCIATION

The International Marine Contractors Association (IMCA) has agreed to promulgate to its members the MAIB Safety Flyer describing this accident and the principal lessons learned from it.

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SECTION 5 - RECOMMENDATIONS

In view of the actions already taken following this accident, no further recommendations are made.

Marine Accident Investigation Branch
January 2010

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

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