ACCIDENT REPORT

Report on the investigation of the grounding of

Transocean Winner

following the loss of tow from

ALP Forward

Isle of Lewis, Scotland

8 August 2016

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SERIOUS MARINE CASUALTY REPORT NO 19/2017 SEPTEMBER 2017

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2012 – Regulation 5:

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

NOTE

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

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

0030/ND	-	Noble Denton GL Technical Standards Committee's document 0030/ND, *Guidelines for Marine Transportations*, issued in 2015
ALP	-	ALP Maritime Services BV
Aqualis	-	Aqualis Offshore Marine services LLC
COG	-	Course over the ground
DNV GL	-	Det Norske Veritas - Germanischer Lloyd
DPA	-	Designated person ashore
ETV	-	Emergency Towing Vessel
IMO	-	International Maritime Organization
kN	-	kiloNewton
kts	-	knots
kW	-	kiloWatt
LOC	-	London Offshore Consultants
m	-	metre
MCA	-	Maritime and Coastguard Agency
MSC/Circ.884	-	International Maritime Organization's MSC/Circ.884 of 1998, Guidelines for Safe Ocean Towing
nm	-	nautical mile
SOG	-	speed over the ground
SOSREP	-	Secretary of State's Representative
SPOS	-	Ship Performance Optimisation System
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended
t	-	tonne
Transocean	-	Transocean Ltd
TTI	-	TTI Testing Ltd
Vuyk	-	Vuyk Engineering Rotterdam BV
WPT	-	Waypoint

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

SYNOPSIS

At 0652 on 8 August 2016, the Marshall Islands registered semi-submersible rig *Transocean Winner* grounded on the north coast of the Isle of Lewis, Scotland. The grounding followed the loss of tow from *ALP Forward,* a Dutch registered anchor handling tug. The rig's starboard pontoon was damaged during the grounding, leading to the loss of approximately 53m^3 of diesel oil. The diesel oil was broken up by the rough seas and there was no pollution of the shoreline. *Transocean Winner* was refloated on 22 August.

The tug and tow was on passage from Stavanger, Norway to Valletta, Malta when it encountered severe weather west of the Hebrides. The effect of the wind and waves on *Transocean Winner* overcame *ALP Forward*'s ability to control the tug and tow which were dragged backwards for over 24 hours until the tow line parted. The emergency tow line was not accessible and *Transocean Winner* ran aground on the north coast of the Isle of Lewis. Examination established that *ALP Forward*'s tow line was in a deteriorated condition before the tow commenced, and it was further weakened during the heavy weather prior to the accident.

The MAIB investigation found that, once the effect of the wind on *Transocean Winner* had taken control of the tug and tow, the grounding was very likely regardless of whether the tow line held or parted. The emergency towing vessel *Herakles* was situated in Kirkwall, Orkney some 12 hours transit time from Lewis. It was unable to arrive at the accident site before *Transocean Winner* grounded. However, had the emergency towing vessel been on scene, it is very unlikely that it would have been able to provide any practical assistance in maintaining control of *Transocean Winner* or preventing the grounding.

ALP Forward's capabilities satisfied industry requirements but the master had insufficient information to predict that the tug would be unable to hold the rig in the forecast weather. Owners and warranty surveyors ashore were not able to provide timely assistance due to ineffective monitoring of the daily reports, and the emergency towing arrangement was unsuitable for use in poor weather.

Transocean Winner's owner has started an internal investigation and taken action to ensure that all parties, both on-site and ashore, are fully engaged with the planning and monitoring of similar tows in the future.

ALP Maritime Services BV has been recommended to review its procedures with regard to the production of Towing Manuals to ensure that they provide those responsible for the safety of the tow with all the necessary information, and to provide comprehensive guidance on the maintenance, inspection and discard of tow lines.

Courtesy of www.offshorepost.com

Transocean Winner

ALP Forward

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *ALP FORWARD* AND *TRANSOCEAN WINNER* AND ACCIDENT

SHIP PARTICULARS		
Vessel's name	*ALP Forward*	*Transocean Winner*
Flag	Netherlands	Marshall Islands
Classification society	Det Norske Veritas - Germanischer Lloyd	Det Norske Veritas - Germanischer Lloyd
IMO number	9367516	8756320
Type	Tug	Semi-submersible rig
Registered owner	ALP Forward BV	Transocean Offshore International Ventures Limited
Manager(s)	ALP Maritime Services BV	Transocean Offshore International Ventures Limited
Construction	Steel	Steel
Year of build	2007	1983
Length overall	65m	92.92m
Gross tonnage	2,789	17,580
Minimum safe manning	7	Not applicable
VOYAGE PARTICULARS		
Port of departure	Stavanger, Norway	
Port of arrival	Valetta, Malta	
Type of voyage	Long international	
Cargo information	None	None
Manning	17	Unmanned
MARINE CASUALTY INFORMATION		
Date and time	8 August 2016, 0652	
Type of marine casualty or incident	Serious Marine Casualty	
Location of incident	Dalmore Bay, Isle of Lewis, Scotland	
Place on board	Vessel	Vessel
Injuries/fatalities	None	None
Damage/environmental impact	Tow stops damaged and main tow line broken	Pontoons damaged on grounding and 53m^3 diesel lost
Ship operation	Towing	Under tow
Voyage segment	Mid-water	Mid-water
External & internal environment	North-west near-gale force winds, rough to very rough seas, dark, poor visibility	
Persons on board	17	None

1.2 NARRATIVE

On 26 July 2016, the Dutch registered anchor handling tug *ALP Forward* arrived in Stavanger, Norway. The tug had been chartered to tow the semi-submersible rig *Transocean Winner* to Valletta, Malta for decommissioning or sale.

On 1 August the tow was approved by the warranty surveyors, Aqualis Offshore Marine Services LLC (Aqualis), and *ALP Forward*'s main tow line was connected to the towing bridle that had been newly installed onto *Transocean Winner* **(Figure 1)**. The rig owners, Transocean Offshore International Ventures Limited (Transocean), *ALP Forward*'s managers, ALP Maritime Services BV (ALP) and Aqualis had agreed that a clear 3-day weather window would be required before the tug and tow could depart. On the morning of 3 August, *ALP Forward*'s master and a representative of Transocean agreed that there was an appropriate weather window and that conditions were right for departure. The tug and tow departed Stavanger at 1300 with an anticipated voyage speed over the ground (SOG) of 6.5 knots (kts). The tow line was set to a length of 760m. The estimated date of arrival in Malta was 21 August.

On the afternoon of 4 August, the ALP operations assistant telephoned *ALP Forward*'s master to discuss the weather. There was a low pressure system deepening over the North Atlantic that appeared to be worse than originally forecast. The master assured him that the tug and tow would not be affected by this as he expected to be in a position clear to the south before the weather conditions in the area worsened. The operations assistant then advised the master to proceed to the west to gain more sea-room; the master confirmed that he would consider that option but, for the moment, he was content to continue the voyage as planned.

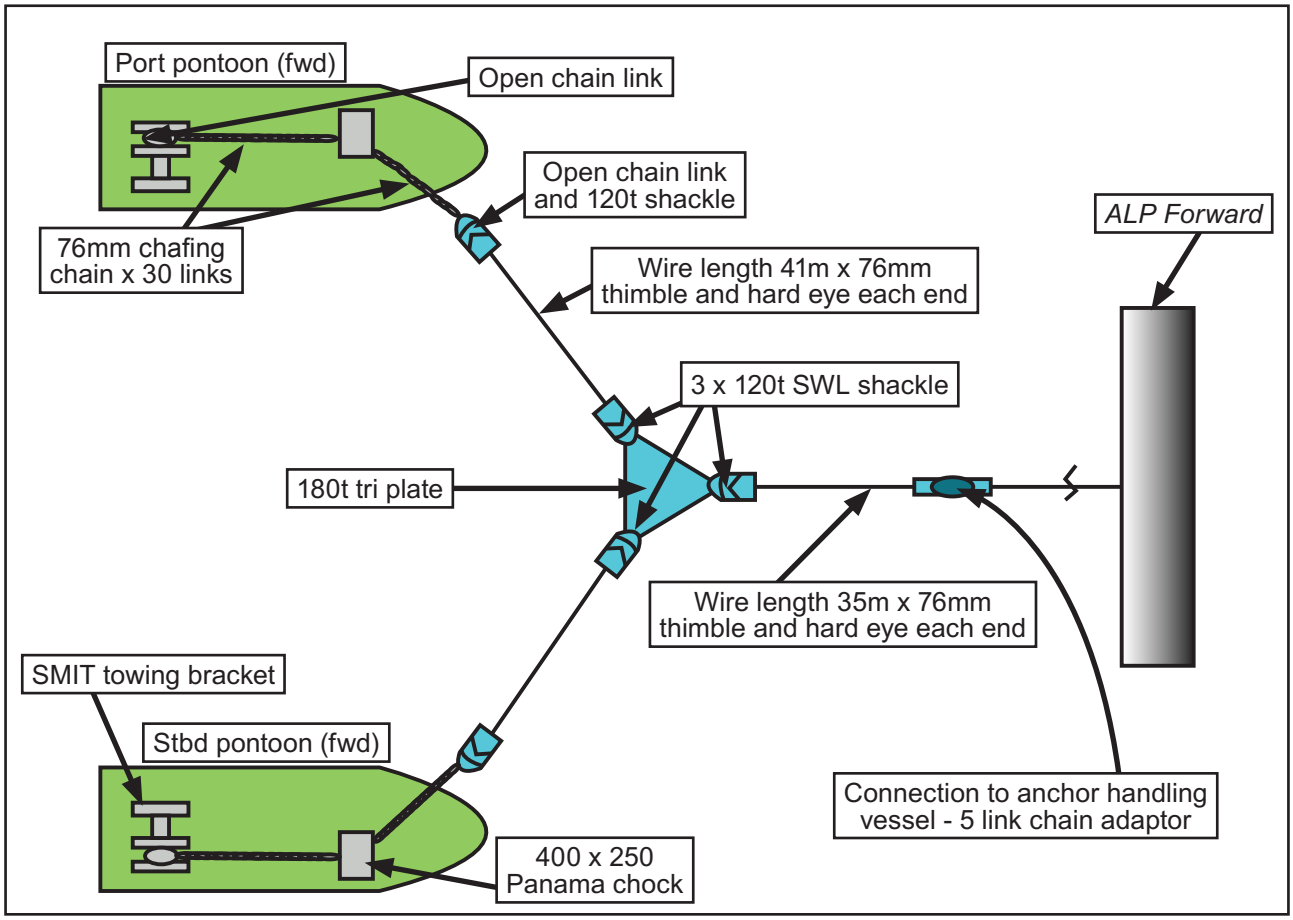


Figure 1: *Transocean Winner* main towing arrangement

The tug and tow progressed as expected and, at 0300 on Friday 5 August, reached waypoint 11 on its passage plan, south of the Shetland Islands **(Figure 2)**. *ALP Forward* then altered course to follow the passage plan, which would take the tug and tow north of the Orkney Islands, to the north-west of the Flannan Isles and west of Saint Kilda before running down the west coast of Ireland and on to the Bay of Biscay.

On Saturday 6 August, at approximately 0656, the tug and tow passed abeam of the Flannan Isles on course 227° (heading of 229°), with a SOG of 7.5kts **(Figure 3)**. The wind was south-easterly at 12kts and the forecast was for it to strengthen to a severe gale that evening with gusts of 42kts **(Annex A)**. By 1200 the low pressure in the North Atlantic Ocean had deepened and the sea and wind conditions had deteriorated with gusts of up to 35kts, reducing the SOG of the tug and tow to 5.7kts.

Shortly after 1400, the effect of the wind and seas on *Transocean Winner* began to overcome *ALP Forward*'s ability to control the tow, and the tug's course became erratic. The master instructed his deck officers to maintain a maximum of 120 tonnes (t) of tension[1] on the tow line by varying the pitch on the vessel's propellers. Although concerned, the master remained confident that the tug and tow would still pass south of the forecast stormy weather.

The master continued to follow the planned passage and, at 1500, in a position 12.85nm to the north-west of Saint Kilda, he altered *ALP Forward* onto a course of 194°. The SOG was now 5kts and the master increased the length of the tow line to 909m to help control the tension in the line as the two vessels moved on the worsening seas. The water depth was approximately 156m.

Throughout the afternoon and into the early evening, the tug's speed decreased as the weather worsened. By 2115 the forces exerted on the tow line by *Transocean Winner*, under the influence of the wind and the seas, overcame the 120t tension limit set by the master and the tug began to be dragged backwards on a meandering northerly track **(Figure 3)**.

At 2259 *ALP Forward*'s master submitted the daily position report as usual, **(Figure 4)**. This report did not indicate that the tug and tow were moving backwards due to the wind and seas. The master decided to remain on the bridge until the tug and tow were once again moving ahead.

The tug and tow were taken north until 0035 on Sunday 7 August when the wind veered to the south-west and they began to track north-east, almost parallel with the Scottish coastline **(Figure 3)**.

Having passed within 11.5nm north of Saint Kilda, the master decided to attempt to manoeuvre the tug and tow away from the Flannan Isles, which the vessels were drifting towards. The master manoeuvred the tug across the wind to put the tug and tow onto a more northerly track, away from the islands. At 0900 his efforts were rewarded and the tug and tow adopted a north-north-east course. However, by 0941 the wind had increased to gale force, making it impossible for *ALP Forward* to maintain control, and the tug and tow again began to track towards the Flannan Isles.

[1] The tension on the tow line was monitored via a tension meter located on the main winch, which had a relayed display located in the wheelhouse.

Figure 2: Planned route around Scotland

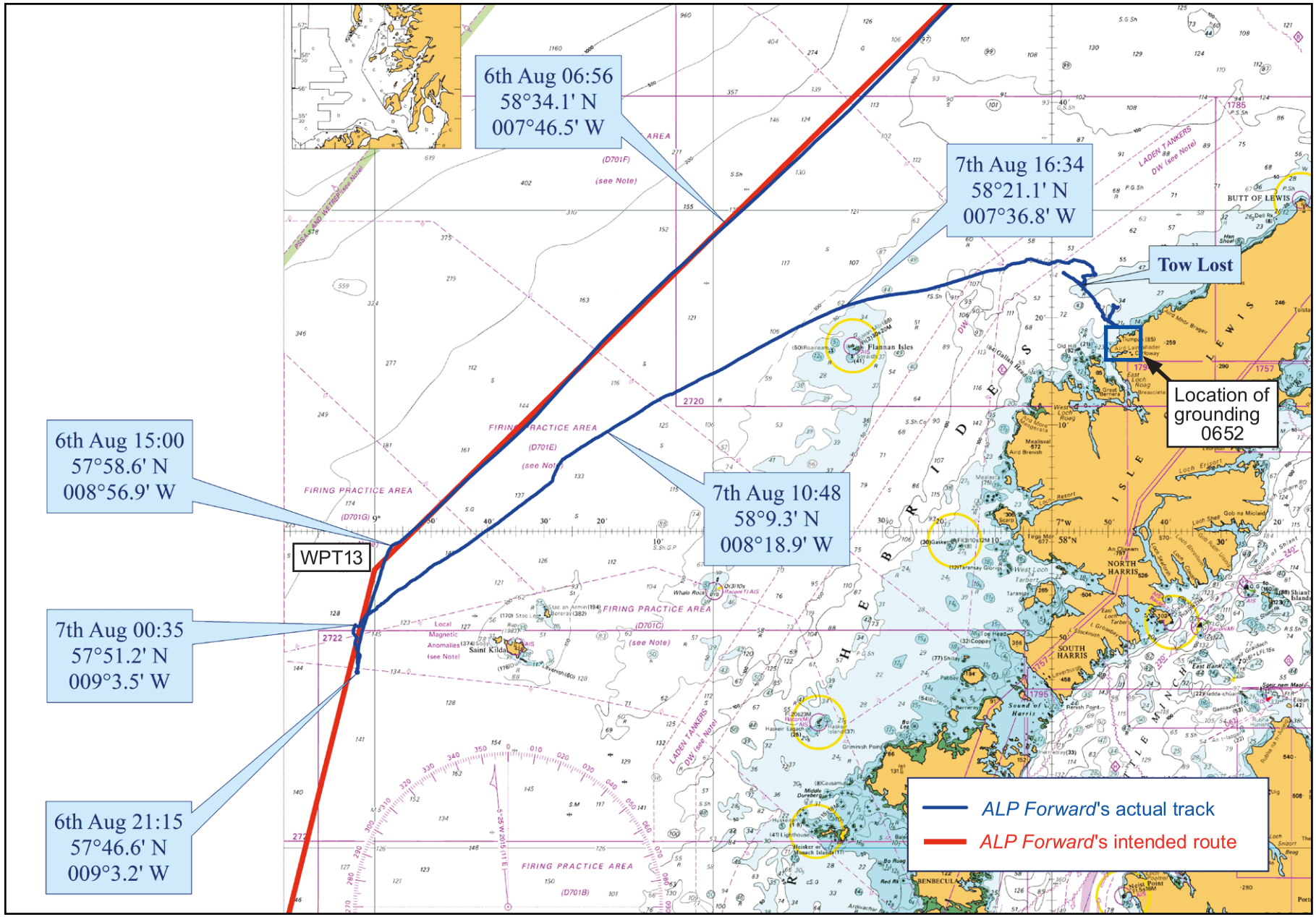


Figure 3: *ALP Forward*'s track and positions 6 – 8 August

Position report					
Tug	ALP FORWARD				
Tow	SSDR Transocean Winner				
Project number					
Date 23.59 lt	6-8-2016				
LT = UTC +/-	2				
Port of Deprture	Amoeyfjorden / Stavanger				
Position	57	°	58,5	'	N
	9	°	2,9	'	W
Running hours since last DPR	24	Hrs			
Distance covered since last DPR	124	M			
Running hours since departure	82	Hrs			
Distance covered total	509	M			
Average voyage speed	6,2	Kn			
Present course	270	°			
Speed on the Ground	2,0	Kn			
Speed through the water	2,0	Kn			
Wind	45	Kn	225	°	
Sea (wind waves)	7	m			
Swell	5	m	157	°	
Water depth	145	m			
To (FPOC)	Malta - Valetta				
Distance togo	2481	M			
ETA	22-8-2016		8:00	LT	
To (Final)					
Distance togo		M			
ETA				LT	
Average pull	110	Tonnes			
Maximum surge	120	Tonnes			
Wire length	909	M			
Hours at reduced speed		Hrs			
Deviation		M			
	roll		pitch		Yawing
Tow behaviour	10		10		6

General remarks	0000 - 2359 Vessel towing SSDR Transocean Winner 1555 - Tow wire lengthenet to 844+65 bridle 2000- Reduced speed due to bad weather General maintenance of the ship

	kW	Pitch
Propulsion PS	4090	47
Propulsion SB	4130	44

	kW	%
ME1	1770	59
ME2	2320	58
ME3	2360	59
ME4	1770	59

	kW
Shaft gen PS	130
Shaft gen SB	140
Aux gen #1	0
Aux gen #2	0
Aux gen #3	0

	Cons 24hrs		ROB	
HSFO	36,3	Tonnes	1092,0	Tonnes
ULSFO	0,0	Tonnes	0,0	Tonnes
MGO	0,0	Tonnes	297,5	Tonnes
MGO for A/E	0,0	Tonnes	83,0	Tonnes
MELO storage	0	Ltr	37500	Ltr
MELO sumps	0	Ltr	17200	Ltr
AELO	0	Ltr	900	Ltr
Pot water	3,0	Tonnes	31,0	Tonnes

Figure 4: 6 August daily position report

At 1048 *ALP Forward*'s master called ALP's Designated Person Ashore (DPA)[2] and informed him that the rig was dragging the tug astern, towards the Flannan Isles. The master explained that he expected the weather to abate shortly and it was agreed that he would keep the DPA fully informed.

The winds reached severe gale force at around midday on 7 August and then abated to gale force or lower at times. *ALP Forward*'s master decided to use this as another opportunity to manoeuvre the tug in an attempt to influence the direction of drift away from the approaching coast. To achieve this, at 1420 he shortened the tow line to 568m and again placed the wind on the beam. He then increased power to the tug's propellers to apply additional tension on the tow line in an attempt to turn the tug and tow to the north. During this manoeuvre, the gog-chain[3] broke and the tow line swept across the tug's main deck with such force that it struck the tow stop on the starboard side, slicing it off before sweeping back again and striking the port tow stop **(Figure 5)**. As a result, the master was forced once again to limit his control of the tow to maintaining tension on the tow line against the direction of drift, thereby reducing the speed at which the tug and tow were being driven backwards by the weather conditions.

Figure 5: Port and starboard tow stops

At 1634 the tug and tow passed approximately 3.7nm north-west of the Flannan Isles. The wind then veered to the north-west and increased in strength again to gale force, pushing them towards the Isle of Lewis with a SOG that peaked at 4.7kts **(Figure 3)**.

The wind strength remained consistently above 30kts, with rough seas and, at 1805, the master telephoned the United Kingdom coastguard at Stornoway and informed them of the situation. At 1844, having reviewed all the available towage in the area,

[2] Designated Person Ashore. The responsibility and authority of the designated person should include monitoring the safety and pollution-prevention aspects of the operation of each ship and ensuring that adequate resources and shore-based support are applied, as required.

[3] Gog chain – a chain that is used to move the effective towing point close to the vessel's stern.

the coastguard tasked the contracted Emergency Towing Vessel (ETV) *Herakle*s, which was stationed in Kirkwall, Orkney Islands. The ETV's estimated time of arrival on scene was 0615 on 8 August.

The coastguard contacted both ALP and Transocean to ensure that they were aware of the situation. The Secretary of State's Representative for Maritime Salvage and Intervention (SOSREP)[4] was also informed.

Throughout the evening and during the early hours of the next day, the tug and tow continued to be blown towards the Isle of Lewis. The wind had backed a little to the west, but it remained at gale force. At 0236 the wind had dropped sufficiently for them to make headway, and the master lengthened the tow line to 740m and manoeuvred west, away from the coastline. At 0421 the tow line between *ALP Forward* and *Transocean Winner* failed 123m from the connection between the two vessels **(Figure 1)**.

The master ordered the remaining tow line to be recovered; the crew then began to make preparations to recover *Transocean Winner*'s emergency tow line. However, despite many attempts the master was unable to find the wave rider buoy at the end of the emergency tow line messenger. In addition, despite the tug approaching within 1 cable of the rig, the messenger itself could not be reached as it was streaming between the rig's pontoons as *Transocean Winner* was blown towards the coast.

At 0536, *ALP Forward*'s master informed the coastguard that he was unable to establish the emergency tow but would monitor the rig's progress. At 0652 *Transocean Winner* grounded on the north coast of the Isle of Lewis **(Figure 3)**.

1.3 SALVAGE

Immediately after *Transocean Winner* had grounded, SOSREP oversaw the co-ordination of the salvage operations with Transocean's appointed salvors, SMIT, and the Maritime and Coastguard Agency (MCA). *Transocean Winner* had grounded on rocks and, as the rig moved in the rough seas, the fuel tanks in its starboard pontoon were damaged, releasing approximately 53m^3 of diesel oil. This diesel oil was dispersed in the waves and there was no pollution on the shore.

After a protracted operation beset by inclement weather, *Transocean Winner* was finally refloated on 22 August. Thirty tonnes of hydraulic oil were released during the operation, but this was also dispersed by the rough seas. The rig was later loaded onto the carrier ship *Hawk* and transported to Malta.

1.4 *TRANSOCEAN WINNER*

1.4.1 General

Constructed in 1983 by Gotaverken Arendal AB, Gothenburg, *Transocean Winner* was a midwater semi-submersible rig registered with the Marshall Islands. Upgraded in 2006, the rig was equipped with a thruster system to enable it to maintain its position when anchored during seabed operations. The thruster system was not suitable for transits from one site to another.

[4] On behalf of the Secretary of State for Transport, SOSREP was tasked to oversee, control and, if necessary, intervene and exercise 'ultimate command and control', acting in the overriding interest of the United Kingdom in salvage operations within UK waters.

Transocean Winner had two pontoons each 80.56m in length, 16m beam and 7.50m high, that ran fore and aft. The pontoons contained a number of ballast, diesel oil and drilling mud storage tanks. The fore end of each pontoon was fitted with a SMIT towage bracket rated for loads of up to 400t. Running athwartships at a height of 11.21m above keel (3.71m above the top of the pontoons) were two transverse bracings. These maintained the square orientation of the four columns of the rig **(Figure 6)**.

Transocean Winner's Stability Book[5] contained information on the rig's stability in various conditions. There was also a Marine Operations Manual[6], which provided information such as the rig's windage data and guidance on the numerous operations that the rig could be expected to undertake, including being towed. Both documents were reviewed by Det Norske Veritas - Germanischer Lloyd (DNV GL) and were required to be carried on board *Transocean Winner*. Section 12.3 of the Marine Operations Manual provided graphs showing the effect of wind and current on *Transocean Winner*. The windage graph for a transit draught of 10.98m[7] is shown in **Figure 7**. This information was not contained in the Towing Manual[8] and neither ALP staff nor *ALP Forward*'s master were aware of this windage information as they had not requested and were not provided with a copy of the Marine Operations Manual.

In 2012 Transocean, the owners of *Transocean Winner*, decided that a number of its rigs were no longer required, and started an identification and removal programme. *Transocean Winner* was over 30 years old and had been added to the list of possible units to be sold or scrapped. In 2015, it was decided that *Transocean Winner* would be taken to Malta for de-commissioning or sale.

Figure 6: *Transocean Winner* aground

[5] Revised October 2014, amended in 2015.

[6] Revised April 2016.

[7] The graph for the nearest draught to *Transocean Winner*'s assumed draught.

[8] Towing Manual – tow specific manual containing information on the vessels, equipment, route and emergency arrangements, including ports of refuge.

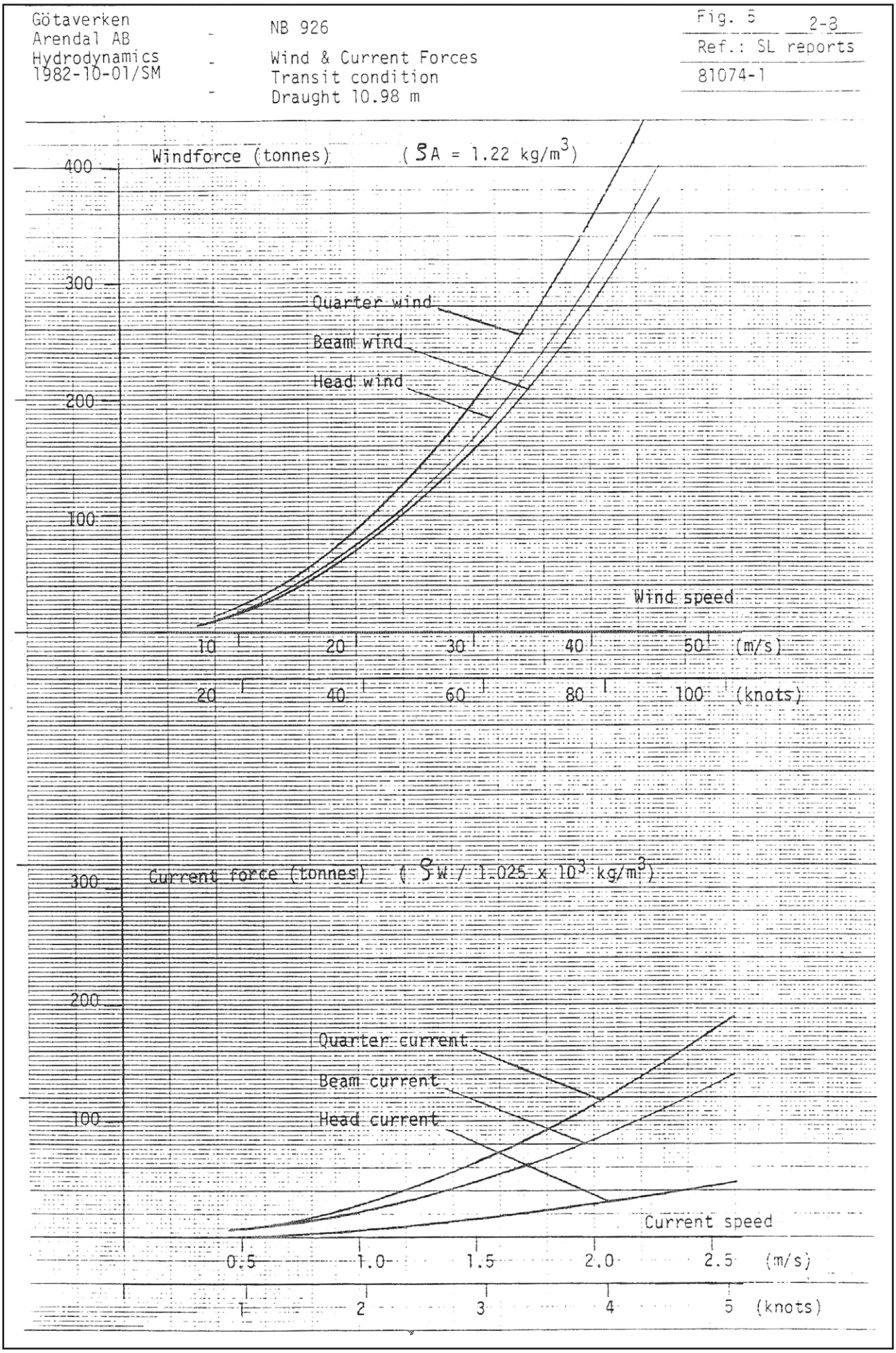


Figure 7: Wind and current forces for draught of 10.98m

1.4.2 Decision to tow unmanned

In ocean towage, it was common practice to tow an operationally-ready rig to station with the rig manned. However, un-manned towage was more cost effective for longer voyages, especially when relocating a rig for decommissioning or sale.

Transocean's decision to have *Transocean Winner* towed unmanned to Malta had been approved by its assurance surveyors, Aqualis.

1.4.3 Draught

Aqualis recorded that *Transocean Winner* had been ballasted to a draught of 9.85m forward and 10.25m aft. No subsequent changes were recorded and, given that the rig's anchors had already been removed, it is considered unlikely that the rig's draught would have changed significantly prior to departure. This was consistent with the 7.22m transit draught without thrusters (which added approximately 2.3m) that was stated in the Marine Operation Manual, though slightly less than the 10.98m draught stated for the wind and current forces diagram **(Figure 7)**.

ALP Forward's master did not personally inspect *Transocean Winner* to verify its draught, but assumed the rig's draught to be 9.5m, as stated in the Towing Manual.

1.5 *ALP FORWARD*

1.5.1 General

ALP Forward was a DP2[9] anchor handling tug constructed in Cuxhaven, Germany in 2008 and registered in the Netherlands. The tug had been owned by Harms Offshore AHT Ursus GmbH & Co KG, Hamburg, Germany until sold, as one of a fleet of eight vessels, to ALP in 2015. The tug was equipped for fire-fighting and was designed to be used for both port and ocean towage.

ALP Forward's main propulsion was diesel-electric, with four engines providing a total 14,000kW, driving two controllable pitch propellers. The tug's bollard pull was 218t continuous, with a maximum of 227t.

On the main deck, the electric main towing winch was capable of hauling 300t at 5m/minute. The winch was fitted with a tension sensor **(Figure 8)** with a local display and a repeater in the wheelhouse. Also located on the main deck were two drums holding the main and spare tow lines. Each tow line was 76mm diameter 'Super Titan' steel wire rope, which were 1600m and 1200m long respectively.

1.5.2 Management

ALP Maritime Services BV was formed in January 2010 and specialised in ocean towage and anchor handling projects. After an initial period of ship management, ALP acquired the Harms Offshore fleet in 2015. When the company was bought out by Teekay Offshore Partners LP in the same year, ALP placed an order for four anchor handling tugs each with a bollard pull of 309t.

[9] DP2 – Dynamic Positioning Class 2 equipped vessel, which has sufficient redundancy so that no single fault in an active system will cause the system to fail.

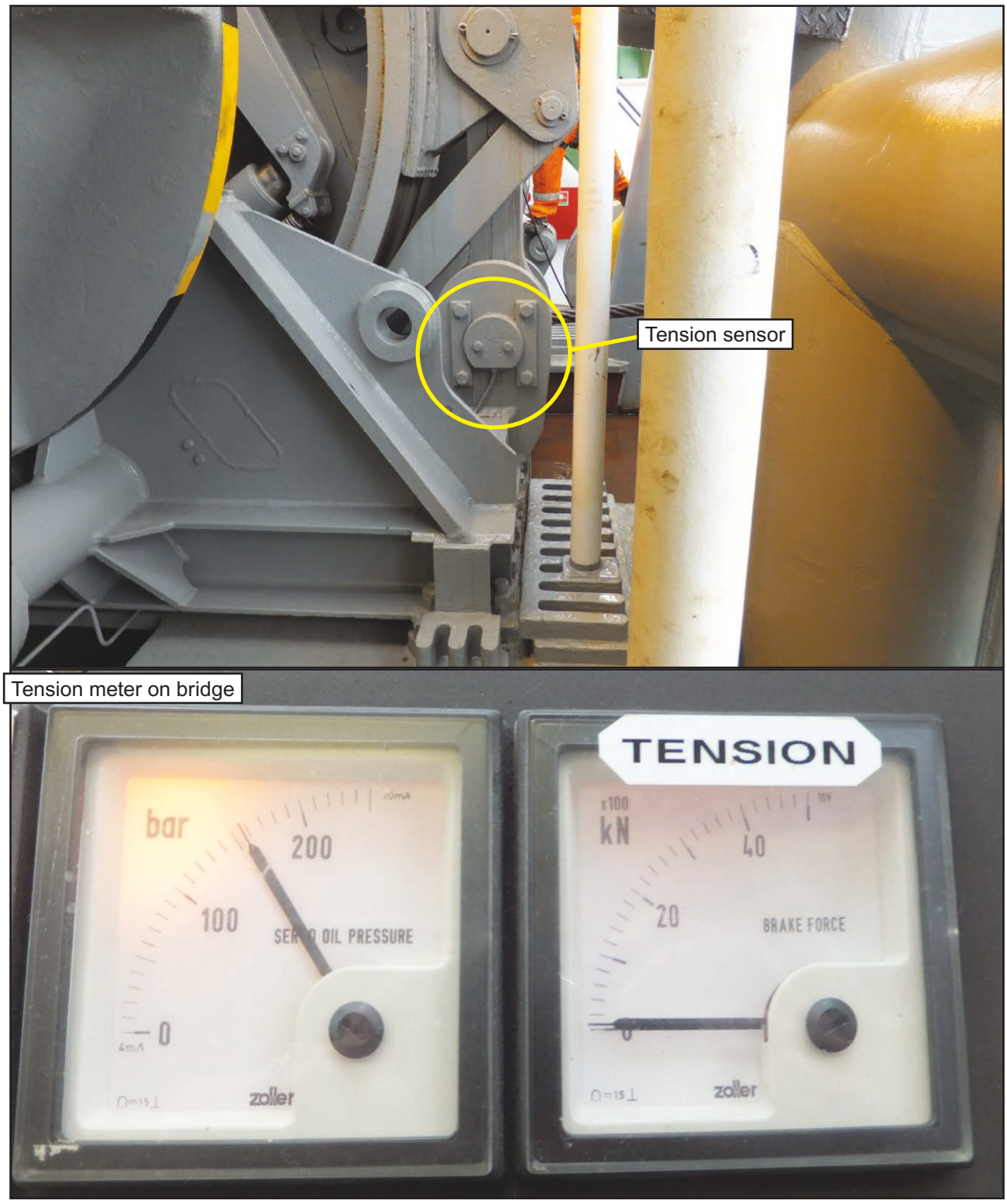


Figure 8: Tension sensor and wheelhouse tension meter

1.5.3 Crew

ALP Forward had a multinational crew of 17. The deck department consisted of the master, chief officer, second officer and third officer.

The master had 12 years' experience in ocean towage and had served on board *ALP Forward* as master for 5 years. He held an STCW II/2 certificate of competency as master for vessels of up to 3000gt issued in Croatia with a certificate of equivalent competency issued in the Netherlands. He also held professional qualifications in bridge resource management and dynamic positioning.

1.5.4 Daily position reports

In accordance with the Towing Manual, at 2359 local time each day, the master sent position reports to ALP by email. These provided basic information regarding the progress of the tow and the condition of the tug and tow, including the tug's position, the weather, the voyage speed to date and the length of tow line deployed. On receipt, the emails were read by ALP's operations assistant who then forwarded them to Transocean and Aqualis.

1.5.5 Weather forecasts

Two independent sources of long range weather routing forecasts were available on board *ALP Forward*:

- UK Met Office SafeVoyage forecasts with summaries and tabulated data, updated every 12 hours, and
- Ship Performance Optimisation System (SPOS) Onboard forecasts provided by MeteoGroup, also updated every 12 hours.

ALP Forward's master preferred to use the SPOS Onboard information which was designed to provide masters with the weather information required to enable optimum routing, both in terms of safety and efficiency. The SPOS package displayed forecast information visually by means of software installed on board *ALP Forward*.

1.6 TOWAGE GUIDANCE

1.6.1 International Maritime Organization guidance

The International Maritime Organization's (IMO) MSC/Circ.884 of 1998 provides guidelines for the planning, preparation and standards for safe ocean towage. These guidelines state that the towage planning should include the following:

- The maximum anticipated environmental conditions.
- The windage of the tow.
- A contingency plan for adverse weather, with particular reference to taking shelter or heaving to.
- The weather forecast should cover at least the next 48 hours.

In preparation for the tow, an inspection of the tow should be completed and the tow itself should not commence until the environmental conditions permit the tug and tow to achieve sufficient sea room so that the tow is not endangered by navigational hazards or lee shores. For a long tow, the worst sea characteristics and state should be used when assessing the watertight integrity of the towed object.

MSC/Circ.884 also states that the continuous bollard pull of the towing vessel should be sufficient to maintain control of the towed vessel in the following environmental conditions:

Wind: 20 m/s[10] *(38.8kts)*
Significant wave height: 5m
Current: 0.5 m/s (0.97kts)

[10] m/s = metres per second.

With regard to the towing arrangements, the guidelines state that tow lines should have a breaking load of at least twice the bollard pull of the tug and that connecting shackles should have a minimum breaking load 50% greater than the towing arrangement.

The circular also makes the following recommendation:

> *Emergency towing equipment should be provided in case of bridle failure or inability to recover the bridle. This equipment should preferably be fitted at the bow of the towed object and should consist of a spare bridle or towing pennant fitted with a floating rope and buoy allowing it to be picked up without any significant hazard.*

Should the tow present a danger to navigation, offshore structures or coastlines, the guidelines refer to the master's obligations under Chapter V, Regulation 2 of the International Convention for the Safety of Life at Sea, 1974, as amended. This requires him *to communicate the information by all the means at his disposal to ships in the vicinity, and also to the competent authorities at the first point on the coast with which he can communicate.*

1.6.2 Industry guidance

Guidance for industry was originally drafted by the global offshore and marine consulting firm Noble Denton Group, which merged with Germanischer Lloyd in 2009. This guidance has been updated and is now offered by DNV GL within its *Marine operations and marine warranty* document DNVGL-ST-N001 issued in June 2016. This document was preceded by Noble Denton GL Technical Standards Committee's document *Guidelines for Marine Transportations* 0030/ND, issued in 2015, which was the version referred to by all parties involved in this accident.

0030/ND required the production of a Towing Manual, the purpose of which was to provide the tug master, together with other interested parties, with information about the cargo (including stability information), routing (including possible deviations to shelter points if required), what to do in an emergency, relevant contact details and the responsibilities of all parties.

1.6.3 ALP Ocean Towage and Anchor Handling manual

ALP had issued company guidance to its masters in the form of the *ALP Ocean Towage and Anchor Handling Manual,* in September 2015. This document referenced both MSC/Circ.884 and 0030/ND.

1.7 PLANNING

1.7.1 Warranty assurance

Aqualis initially completed a feasibility study of the proposed tow, before being appointed by Transocean to act as assurance surveyors for the tow on behalf of the underwriters.

Aqualis considered the route from Norway to Malta, and examined the weather and sea conditions that could be expected en-route using data collected during weather observations between 1980 and 2015. Initially a route south from Stavanger and through the English Channel was assumed. The data identified the Bay of Biscay as

the region where weather was of primary concern. However, the data showed that this area was least affected by poor weather in the summer and autumn months, so Aqualis recommended that the tug and tow departed Stavanger no later than 15 October 2016.

The study also calculated the maximum permissible sea state to avoid damage to the rig's transverse braces. For an assumed draught of 7.22m[11] this was calculated to be a significant wave height of 4.0m. Based on this, the minimum bollard pull for the towing vessel was calculated to be 150t.

Through its brokers, Transocean sought bids from a number of its approved towage contractors, including ALP. The bids were then considered and ALP's bid was accepted. Once awarded the contract, ALP tasked *ALP Forward*, which had a bollard pull of 218t continuous and proposed a route to the west, avoiding the English Channel (see 1.7.6).

Aqualis reviewed ALP's proposed route and inspected *ALP Forward* in Rotterdam on 23 July. On 1 August 2016, Aqualis inspected the tug and tow, including *Transocean Winner*, and issued a Certificate of Approval **(Figure 9)**, which listed a number of generic recommendations.

1.7.2 Towing Manual

In preparation for the tow, ALP produced a Towing Manual *to identify and assess all towage related significant hazards and effects, and put control measures in place to manage any consequences should any of the hazards be realized, with appropriate recovery plans to mitigate any major losses due to an occurrence.*

The manual referred to both MSC/Circ.884 and 0030/ND and was distributed to ALP, *ALP Forward*'s master, Transocean and Aqualis.

The Towing Manual included the following relevant information:

- *Environmental Criteria for departure are:*
    - *Max. Wind: 15 knots (4 Bft[12])*
    - *Wave Height Sign. max. 2.0 meters*

    A favourable weather forecast with above criteria should be on hand for the first 3 days after scheduled departure.

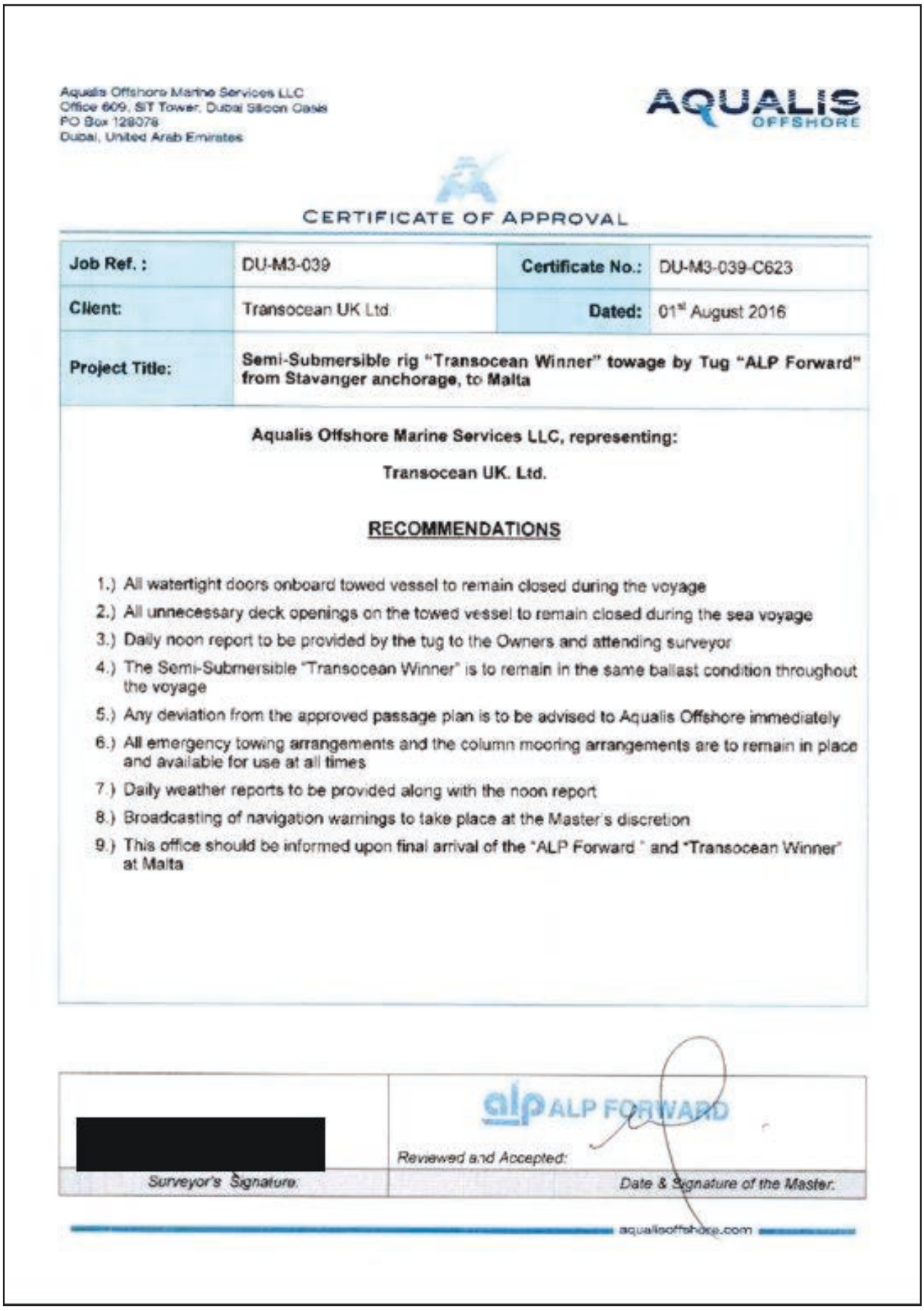
- *Port(s) of refuge*

    Between Stavanger and Malta various proper ports of refuge areas are available along the intended route. For emergency calls to receive spare-parts/technical personnel, if required, following ports have been determined:

    Aberdeen
    Galway
    Lisbon
    Gibraltar

[11] Assumed draught was obtained from Transocean's Marine Operations Manual.

[12] Bft = Beaufort.



Aqualis Offshore Marine Services LLC
Office 609, ST Tower, Dubai Silicon Oasis
PO Box 128078
Dubai, United Arab Emirates

AQUALIS OFFSHORE

CERTIFICATE OF APPROVAL

Job Ref. :	DU-M3-039	**Certificate No.:**	DU-M3-039-C623
Client:	Transocean UK Ltd	**Dated:**	01st August 2016
Project Title:	**Semi-Submersible rig "Transocean Winner" towage by Tug "ALP Forward" from Stavanger anchorage, to Malta**		

Aqualis Offshore Marine Services LLC, representing:

Transocean UK. Ltd.

RECOMMENDATIONS

1.) All watertight doors onboard towed vessel to remain closed during the voyage
2.) All unnecessary deck openings on the towed vessel to remain closed during the sea voyage
3.) Daily noon report to be provided by the tug to the Owners and attending surveyor
4.) The Semi-Submersible "Transocean Winner" is to remain in the same ballast condition throughout the voyage
5.) Any deviation from the approved passage plan is to be advised to Aqualis Offshore immediately
6.) All emergency towing arrangements and the column mooring arrangements are to remain in place and available for use at all times
7.) Daily weather reports to be provided along with the noon report
8.) Broadcasting of navigation warnings to take place at the Master's discretion
9.) This office should be informed upon final arrival of the "ALP Forward " and "Transocean Winner" at Malta

[redacted]

Surveyor's Signature:

alp ALP FORWARD

Reviewed and Accepted:

Date & Signature of the Master:

aqualisoffshore.com

Figure 9: Certificate of approval

- *Length of tow line and Tow line – shortening*

  In areas of shallow water, water depths less than 100 meters, the Tug master will determine well in advance to shorten towline and adjust speed accordingly. Crossing over water depths less than 200 mtr must be avoided where possible during the sea passage, in view of the catenary of the towing line and the maximum draft of the tow. Proper calculations of the catenary are being carried out every watch accordingly.

  The tow line length will be determined during the voyage by the Tug master, according to weather and sea conditions and available water depth. During the voyage the towing line length will be adjusted every 24 hours to avoid chafing of the wire at the stern roller.

- *When the convoy meets deteriorating weather conditions, which have not been predicted in the daily weather forecasts, the Tug Master will inform ALP Maritime immediately.*

  ALP Maritime Services will contact and discuss with the Companies designated Meteorological Agency and request for immediate weather updates for the vessel. The weather updates must include the expected weather conditions and extra weather outlook services.

  Upon receipt of the weather updates and weather outlook the master will decide if course/speed alterations are required, all in line with the Motion Assessment[13] of the Transocean Winner. In consultation with the OIM \Master and Tug Master, at any time during the passage whenever the sea/swell/ waves increase sufficiently to cause heavy slamming on the lower horizontal bracings, the unit should be ballasted down to survival draught until such time as conditions improve to allow the passage to continue. The unit is to be stopped in the water during ballast and de-ballasting operations. [sic]

To facilitate the required catenary calculations, a catenary table was posted on *ALP Forward*'s bridge, **Figure 10**. This gave the depth of the catenary for a given tension and length of tow line, assuming stable conditions.

1.7.3 Tow line

ALP Forward's bollard pull was 218t and the tow line fitted to the vessel had a minimum breaking load of 485t when new. This exceeded the relevant standards of both MSC/Circ 884 and 0030/ND. The tow line had been in service since May 2014 and re-spooled in December 2014. It had been used for approximately 28770 miles over 180 days at a maximum recorded tension of 140t **(Figure 11)**.

MSC/Circ 884 and 0030/ND both stated the following calculation for the minimum deployable length of tow line:

$$\text{Minimum length of tow line} = \frac{\text{Continuous bollard pull}}{\text{Minimum breaking load of wire}} \times 1800\text{m}$$

Using this formula, the minimum deployable length of the tow line was 809m. Neither this figure nor the calculation was included in the Towing Manual.

[13] The term Motion Assessment is not defined in either the Towing Manual or ALP's Ocean Towage and Anchor Handling procedures.

In addition to the Towing Manual's guidance on the length of tow line to be deployed, ALP's Ocean Towage and Anchor Handling Guidance stated that:

> *Consideration should be given to water depth and catenary. The goal is to pay out as much wire as possible in relation to the anticipated water depth, as this gives maximum protection against shock loads.*

Table 1 shows the adjustments made to the length of the tow line throughout the tow.

Date	Time UTC+1	Towline length (m)	Tension (t)	Approx water depth (m)	Max wind strength (kts)	Max gusts (kts)	Wave height (m)
5-Aug	3:00	740	100-120	99	13	-	2
5-Aug	7:00	760	100-120	77	13	-	2
5-Aug	11:00	760	100-120	159	9	-	2
5-Aug	15:00	760	100-120	94	9	-	2
5-Aug	19:00	760	100-120	99	9	-	2
5-Aug	23:00	760	100-120	123	9	-	2
6-Aug	3:00	760	100-120	160	6	-	1
6-Aug	7:00	761	100-120	130	11	-	1
6-Aug	11:00	761	100-120	129	16	-	1.3
6-Aug	15:00	909	100 -120	156	28	37	2.4
6-Aug	19:00	910	80-100	142	22	33	6
6-Aug	23:00	910	80-100	142	30	39	3.1
7-Aug	3:00	910	-	>100	33	47	5.9
7-Aug	14:20	568		>100	27	37	8.3
8-Aug	2:22	-	150-240	~50	20	27	6.1
8-Aug	4:20	740	180-220	<50	15	-	5.8
8-Aug	4:21	Loss of tow line	-	-	15	-	5.8

Table 1: Tow line length adjustments and water depth

TOW WIRE CATENARY FOR AHT ALP FORWARD

DIA (MM)	WT IN WATER(Kg/m)										
76	25.0						WIRE LENGTH (M)				
WIRE TENSION	200	300	400	500	600	700	800	900	1000	1100	1200
10	12.50	28.13	50.00	78.13	112.50	153.13	200.00	253.13	312.50	378.13	450.00
20	6.25	14.06	25.00	39.06	56.25	76.56	100.00	126.56	156.25	189.06	225.00
30	4.17	9.38	16.67	26.04	37.50	51.04	66.67	84.38	104.17	126.04	150.00
40	3.13	7.03	12.50	19.53	28.13	38.28	50.00	63.28	78.13	94.53	112.50
50	2.50	5.63	10.00	15.63	22.50	30.63	40.00	50.63	62.50	75.63	90.00
60	2.08	4.69	8.33	13.02	18.75	25.52	33.33	42.19	52.08	63.02	75.00
70	1.79	4.02	7.14	11.16	16.07	21.88	28.57	36.16	44.64	54.02	64.29
80	1.56	3.52	6.25	9.77	14.06	19.14	25.00	31.64	39.06	47.27	56.25
90	1.39	3.13	5.56	8.68	12.50	17.01	22.22	28.13	34.72	42.01	50.00
100	1.25	2.81	5.00	7.81	11.25	15.31	20.00	25.31	31.25	37.81	45.00
110	1.14	2.56	4.55	7.10	10.23	13.92	18.18	23.01	28.41	34.38	40.91
120	1.04	2.34	4.17	6.51	9.38	12.76	16.67	21.09	26.04	31.51	37.50
130	0.96	2.16	3.85	6.01	8.65	11.78	15.38	19.47	24.04	29.09	34.62
140	0.89	2.01	3.57	5.58	8.04	10.94	14.29	18.08	22.32	27.01	32.14
150	0.83	1.88	3.33	5.21	7.50	10.21	13.33	16.88	20.83	25.21	30.00
160	0.78	1.76	3.13	4.88	7.03	9.57	12.50	15.82	19.53	23.63	28.13
170	0.74	1.65	2.94	4.60	6.62	9.01	11.76	14.89	18.38	22.24	26.47
180	0.69	1.56	2.78	4.34	6.25	8.51	11.11	14.06	17.36	21.01	25.00
190	0.66	1.48	2.63	4.11	5.92	8.06	10.53	13.32	16.45	19.90	23.68
200	0.63	1.41	2.50	3.91	5.63	7.66	10.00	12.66	15.63	18.91	22.50
210	0.60	1.34	2.38	3.72	5.36	7.29	9.52	12.05	14.88	18.01	21.43
220	0.57	1.28	2.27	3.55	5.11	6.96	9.09	11.51	14.20	17.19	20.45

Figure 10: Tow wire catenary table displayed on *ALP Forward*'s bridge

MAIN TOW-WIRE LOG

Tow wire record "ALP Forward"

Total days previous page: 0
Total miles previous page: 0

Certificate: 130756-1

Length: **1600 metres**
Diameter: **77mm**
Break Load: **485**

Date received wire o/b: 08.05.2014
Date wire was spooled to towdrum: 09.05.2014
Date last external inspection: 05.07.2016
Proofload applied: 05.07.2016
Date re-socketed: 05.07.2016

Wire data:
1600 mtr x 77mm 6x36 IWRC
RHOL Super Titan Wire
Certificate link
Socket: Closed spelter 228 - AFW 0019

No.	tow	start	end	Days:	From :	To :	stretcher:	max. tens:	Length paid out, weather conditions, other remarks	Tow miles	Remark	Condition
1	Spooled On	N/A	N/A	0.125	09/05/2014 07:00	09/05/2014 10:00	No	40	1600 metres spooled out and re-spooled with 50ton tension	N/A	New Wire received from Saipem.	**New**
2	Castoro 7	Guaranao, Venezuela	Caracas Bay, Curacao	2.375	10/05/2014 07:00	12/05/2014 16:00	No	120	600 metres, 120ton max tension, water depth +40 metres	133	Washed and greased during recovery	**Good**
3	JackUp Rowan Gorilla III	Off shore Trinidad	Oilbird Field	1.05	19/07/2014 09:30	20/07/2014 10:43	No	130	280 meters, 80ton, positioning 130ton, water depth 60 meters	11	Washed and greased during recovery	**Good**
4	Castoro 7	Caracas Bay, Curacao	Giuria Venezuela	6	05.09.2014 06:15	12/09/2014 03:15	No	120	700 metres, water depth min 100 metres	462	Tow wire transfered to Castoro 7	**Good**
5	Castoro 7	Chaguaramas Trinidad	Chaguaramas Trinidad	0.2	14.12.2014 09:00	14.12.2014 14:00	No	90	1500 metres, water depth 40 metres	N/A	Respooled from C7, wound on with 30Te	**Good**
6	Castoro 7	Chaguaramas Trinidad	Caracas Bay, Curacao	4	18.12.2014 05:30	22.12.2014 05:30	No	90	600 metres, water depth 100 metres	450	Washed and greased during recovery	**Good**
7	SSDR "Sedco 707"	Offshore Macae, Brasil	Durban, South Africa	33.38	27.01.2015 15:30	02.03.2015 00:30	No	115	1390 meters, water depth variable	4046	Washed and greased during recovery	**Good**
8	Swiber PJW 3000	Punta Arenas,Chile	Colombo,Sri Lanka	47.95	05.11.2015 11:30	23.12.2015 17:15	No	130/140	1280 meters, water depth variable	8391	Washed and greased during recovery	**Good**
9	SSDR "Songa Enabler"	Okpo, S. Korea	Singapore	12.30	03.04.2016 21:45	16.04.2016 05:10	No	130/140	1370 meters, water depth variable	2540	Washed and greased during recovery	**Good**
10	SSDR "Songa Enabler"	Singapore	Port Louis, Mauritius	14.6	17.04.2016 13:00	05.05.2016 02:25	No	110/130	1219 meters, water depth variable	2901	Washed and greased during recovery	**Good**
11	SSDR "Songa Enabler"	Port Louis, Mauritius	Walvis Bay, Namibia	15	06.05.2016 08:00	21.05.2016 07:10	No	120/130	1219 meters, water depth variable	3128	Washed and greased during recovery	**Good**
12	SSDR "Songa Enabler"	Walvis Bay, Namibia	Las Palmas	19	21.05.2016 21:30	09.06.2016 16:00	No	110	1125/1121,1115 meters,water depth variable	3890	Washed and greased during recovery	**Good**
13	SSDR "Songa Enabler"	Las Palmas	Bergen	12.4	15.06.2016 17:30	28.06.2016 03:45	No	120	941/1002,728,413 meters,water depth variable	2267	Washed and greased during recovery	**Good**
14	SSDR "Transocean Winner	Amoyfjord Stavanger	Amoyfjord Stavanger	7.3	27.07.2016 06:55	03.08.2016 14:00	No	85	200 meter,good, 105 m water depth	1	Heading control	**Good**
15	SSDR "Transocean Winner	Amoyfjord Stavanger	Malta	4.5	03.08.2016 14:00	08.08.2016 05:20	No		910 meter, strong gale wind and heavy swell	550		

total days: 180

total miles: 28770

Figure 11: Main tow wire log

1.7.4 Towing bridle

The components for the towing bridle were supplied new by Transocean. The bridle comprised a pennant wire rope that was attached to a fish plate at one end and to *ALP Forward*'s tow line at the other. The fish plate had two more pennant wire ropes attached to it, each attached to a chafing chain connected to the SMIT towing bracket on the forward part of *Transocean Winner*'s port and starboard pontoons.

The bridle's dimensions are shown in **Figure 1**.

1.7.5 Emergency towing arrangement

In ocean towage operations, the emergency towage arrangements are intended to act as the main tow line if the original tow line becomes unusable. The emergency tow line is arranged such that it can be retrieved by a tug picking up a floating line with a buoy at the end. Where bridles or other connections on the tow are required these may be lowered from the tow, if manned, or secured to an unmanned tow using weak links that are designed to break away when the connection is established. The tug's ability to safely pick up the floating line with which to establish the emergency tow is, necessarily, weather dependent as rough seas can expose tug crews on the open deck to unacceptable levels of risk from shipped seas.

The emergency towing arrangement **(Figure 12)** for *Transocean Winner* was rigged as specified in the Towing Manual as required by MSC/Circ 884 and 0030/ND, and in accordance with Transocean's Marine Operations Manual. It consisted of 60m of 76mm 450t minimum breaking load wire rope attached to the port pontoon's aft anchor chain. This wire rope was secured to the rig's handrails by weak links, such that it would break free of the handrails under tension without the need for personnel to board the rig. The end of the wire rope was secured to 150m of 80mm buoyant mooring line, which connected to the 150m of 25mm messenger line. To help the tug's crew locate the messenger line a wave rider buoy with a flashing light was connected to its free end.

Ideally, the emergency tow line for *Transocean Winner* would have included a bridle like that used in the main tow line, to provide a straight tow, connected at the stern. However, Transocean assessed that the weight of the bridle arrangement would have made the use of weak links impossible and so a single line arrangement was used. The arrangement had been assessed and considered adequate by Aqualis.

1.7.6 Passage plan

ALP Forward's master was tasked with planning the route for the tug and tow from Stavanger to Malta, either via the English Channel or to the north of Scotland and then to the west of Ireland. The master had completed towage operations in both areas before and he dismissed the route through the English Channel as he anticipated high numbers of recreational craft, fishing vessels and crossing traffic, particularly in the Dover Strait. Additionally, he was concerned that the relatively shallow water on that route would have necessitated continual adjustment of the length of the tow line to avoid the wire being dragged along the seabed.

The second officer drew up the northern route in accordance with the master's directions. This would take the tug and tow north-west from Stavanger, south of the Shetland Islands and across the north coast of Scotland before turning to the south

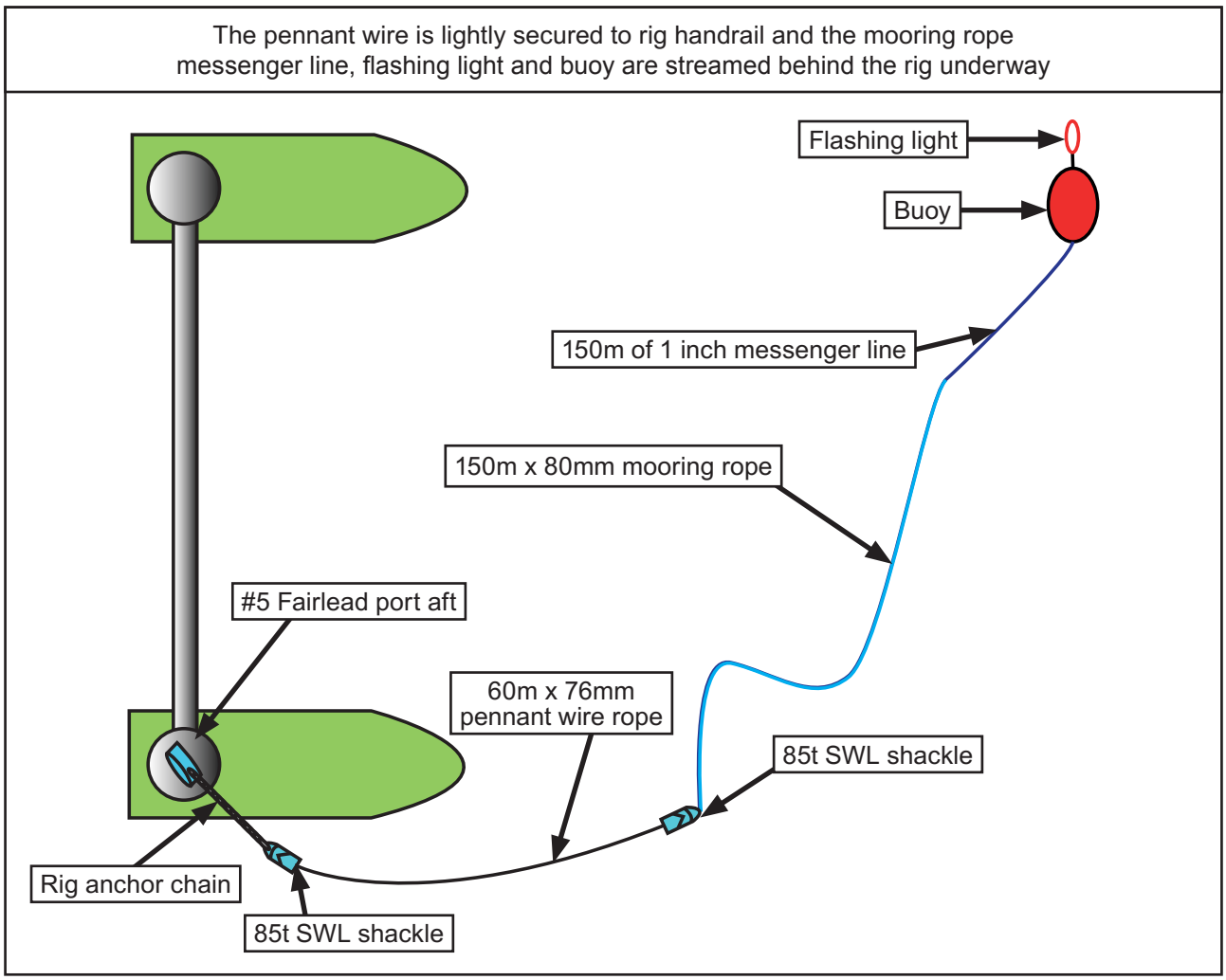


Figure 12: *Transocean Winner* emergency tow arrangement port aft

and west of Ireland. The tug and tow would then head south to transit the Bay of Biscay before entering the Mediterranean towards its destination of Malta. The near coastal sections of the route were planned to be at least 12nm off the coast as the master wanted to keep outside territorial[14] waters, to maintain sea room and avoid recreational traffic **(Figure 2)**.

When planning the passage, the second officer did not make an assessment of the expected weather conditions or likely shelter havens for the voyage. After checking the planned route, the master approved the passage plan and sent a copy to ALP for further approval. Aqualis's surveyor also included a copy in his tow approval report that was sent to Transocean following his visit to the vessel on 23 July.

1.8 EMERGENCY TOWING VESSEL

1.8.1 ETV *Herakles*

Built in 1980 as the tug *Salvageman*, the 1641gt *Herakles* was 69.06m in length and had a service speed of 17kts. The vessel was powered by four Ruston diesel engines driving through two controllable pitch propellers to generate 170t continuous and 180t maximum bollard pull, and had two fixed pitch, athwartships thrusters rated at 440kW (598bhp).

[14] As defined by the United Nations Convention on the Law of the Sea (UNCLOS).

Formerly *Anglian Prince*, *Herakles* was one of the UK's four ETVs from 1996-2010. After the UK government ended the contracts for the ETVs, *Anglian Prince*'s owner, JP Knight, sold the vessel to Nestor Rederi AB, a subsidiary of the Swedish company Marine Carrier AB, in 2011, when it was renamed *Herakles*.

1.8.2 UK ETV - background

The first vessels of the UK's ETV fleet were introduced in 1994 following the recommendations of Lord Donaldson's report '*Safer Ships, Cleaner Seas*' published in May 1994 following the MV *Braer* oil spill off the coast of Shetland, Scotland.

The fleet of four ETVs - *Anglian Prince*, *Anglian Princess*, *Anglian Sovereign* and *Anglian Monarch* - was based in strategic locations around the UK: two covered the south coast of England from bases in Falmouth, Cornwall and Dover, Kent, and two covered Scottish waters from bases at Stornoway, the Western Isles (the Outer Hebrides), and Lerwick in the Northern Isles (Shetland and Orkney). The 4-strong ETV fleet was intended to be operational 24 hours a day 365 days a year and maintained at 30 minutes' readiness to sail. One tug was allocated to each of the four operating areas on a rotational basis, worked around maintenance schedules. The ETV stationed at Dover was funded jointly with French maritime authorities.

In 2010, the Government announced that as part of its Comprehensive Spending Review, the ETV fleet would no longer be funded by the MCA from September 2011, saving £32.5m over the Spending Review period. The Department for Transport stated: "*Emergency towing vessels are mainly deployed when vessels break down. The government believes state provision of ETVs does not represent a correct use of taxpayers' money and that ship salvage should be a commercial matter between a ship's operator and the salvor.*"[15]

On 30 September 2011 it was announced that the two ETVs operating in the Minch and the Shetland Islands would remain for an additional 3 months, with interim funding by the United Kingdom's government. However, this was reduced to just one ETV for a fixed period of 90 days, stationed in Kirkwall on the Orkney Islands. Subsequently, the vessel was funded until the end of the UK government spending review (March 2015). The review concluded that retention of the vessel "was not a spending priority", signalling its removal as of March 2016.

Following lobbying by Scottish MPs, local authorities and special interest groups, the MCA undertook a series of meetings with all interested parties between February and May 2016. Three working groups were formed covering ETV capability, environment and funding, and risk mitigation. These delivered their findings and recommendations in May 2016. In addition, the MCA commissioned an independent report from London Offshore Consultants (LOC) to explore the requirements and specification of an ETV, and the risks arising from a potential shipping incident in Scotland. This agreed the MCA's revised risk assessment and made specific recommendations for the future provision of an ETV within the region. The assessment concluded, inter alia, that:

> *An analysis performed for this assessment looked at the likely proportion of vessels which visit the area and might be assisted by an ETV over a range of bollard pull capacities. This was found to be a useful and simplistic way of assessing risk reduction against the range of bollard pull capacities. When*

[15] Department for Transport, Transport Spending Review 2010, 20 October 2010.

associated with other risk factors, the conclusion was that an ETV with a bollard pull of about 120t would be likely to provide for a reduction in risk posed by drifting or disabled vessels into the ALARP (as low as reasonably practical) range.

On the basis of the working group's recommendations and the LOC report, *Herakles* was retained on station until the end of December 2016 when a new 5 year contract was awarded to *Ievoli Black*, a 70m towing vessel of 2283gt and a bollard pull of 139t. *Ievoli Black* had previously operated as an ETV for the Netherlands.

1.9 WEATHER HINDCAST

Following the accident, the MAIB commissioned the UK Met Office to produce a hindcast of the weather experienced by the tug and tow. The summary of the hindcast report stated:

All the available evidence indicates that the platform Transocean Winner encountered gale or severe gales from both the southwest and then the northwest on the 7th August and into the 8th August. Total sea was generally rough or very rough, increasing high for a time during daylight hours of the 7th.

Modelled significant wave height peaked at approximately 8.4 metres at 1300 UTC beginning the 7th August with a zero upcrossing period[16] *of 10 seconds. An individual maximum wave height of 16.8 metres could have been experienced at this time during a 3 hour sampling time.*

The hindcast shows the winds of 36 - 42kts gusting to 59kts during the afternoon of 7 August. The full report is included at **Annex B**.

1.10 TOW LINE TESTING

With the co-operation of ALP, Transocean and the Stornoway harbourmaster, four sections from the main tow line were recovered on behalf of the MAIB and sent to TTI Testing Ltd (TTI) for inspection and testing. The conclusions reached by TTI, included at **Annex C**, were that:

- The main tow line had low levels of lubricant and the wire rope had begun to corrode.
- The main tow line's core was in very poor condition.
- It was likely that the main tow line had degraded further through fatigue damage during the storm before it finally broke due to a one-off overload.
- Break load tests on sections of the main tow line suggest that at the time of failure the wire rope strength was reduced by 21.3%.

1.11 HOLDING CALCULATIONS

Following the grounding, ALP commissioned Vuyk Engineering Rotterdam BV (Vuyk) to perform holding calculations on *Transocean Winner*. The study, the results of which are reproduced at **Annex D**, calculated the loads generated by the action of

[16] MAIB note: Zero upcrossing period is a method of measuring wave periodicity.

wind and waves on the rig for six specified sets of environmental conditions **(Table 2)**. The calculations were completed for draughts of 6.5m, and 22.5m to investigate the effect of ballasting the rig to its survival draught.

Condition	Wind speed @10m - m/s (kts)	Wind speed @40m - m/s (kts)	Significant wave height - m	Current speed - m/s
1	10.0 (19.4)	12.2 (23.7)	2	0.4
2	15.0 (29.2)	18.3 (35.6)	5	0.4
3	20.0 (38.8)	24.4 (47.4)	5	0.5
4	20.0 (38.8)	24.4 (47.4)	8	0.4
5	25.0 (48.6)	30.5 (59.3)	10	0.4
6	29.5 (57.3)	36.0 (70.0)	10	0.4

Table 2: Environmental conditions as defined by Vuyk Engineering Rotterdam BV

The report concluded that *ALP Forward* was able to hold *Transocean Winner* under the 0030/ND requirement of sufficient combined bollard pull in the standard weather condition for marine operations in open seas[17], noted as environmental condition 3. However, when the environmental loads increased, tug efficiency was significantly reduced, and the calculations showed that in such conditions it was impossible for *ALP Forward* to maintain control of *Transocean Winner*. The report also concluded that ballasting the rig to its survival draught would not have improved the situation.

[17] The environmental condition is also specified in MSC/ Circ.884. [See 1.6.1].

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 ACCIDENT

Transocean Winner grounded as *ALP Forward* was incapable of controlling the tow in the high winds and seas experienced. The voyage planning concentrated on significant wave heights and did not consider the effect of high winds on *Transocean Winner*. By the time the master realised that the tug and tow would not pass clear of the worsening weather, he had insufficient sea room to wait for it to pass. In his attempts to maintain control of the tow the master placed sufficient strain on the tow line to cause damage, which ultimately led to its failure.

In the prevailing conditions, once the tow line had parted there was no possible recovery of the rig, and the grounding was inevitable.

2.3 THE FAILURE OF THE TOW LINE

2.3.1 Loading

The tow line failed at 0421 on 8 August while deployed to 740m and subjected to between approximately 180t and 220t load in lessening, but still near gale force winds and very rough seas. These conditions lie between conditions 2 and 3 of Vuyk's calculations. Their calculated total frontal loads, that is the static force required to hold the rig head up into the wind and waves, are consistent with the 180-220t logged on board *ALP Forward*, **Table 1**, as it started to make headway into the wind.

The largest loads experienced by the tow line are likely to have occurred on the afternoon of 7 August, when the Met Office hindcast shows peak significant wave heights of 8.4m and a possible individual maximum wave height of up to 16.8m. This coincided with severe gales with gusts up to 59kts and the master's decision to shorten the tow line to 568m. These conditions are broadly in line with environmental condition 6 used in Vuyk's calculations, which resulted in a calculated total frontal load of 3624.6kN for a draught of 6.5m. This is equivalent to 369t, over three times the tension being maintained on the tow line, leading to the tug and tow being taken backwards at up to 4.7kts.

The TTI report calculates the theoretical maximum dynamic loads experienced by the tow line under three specific sets of conditions based on an initial tension of 120t, as maintained by *ALP Forward*'s crew:

1. 568m tow line deployed in 8.4m significant wave heights, leading to a peak load of 360t. As hindcast for 1300, 7 August 2015.

2. 568m tow line deployed in seas with an individual maximum wave height of 16.8m, leading to a peak load of 599t. As hindcast for 1300, 7 August 2015.

3. 740m tow line deployed in 5.8m significant wave heights, leading to a peak load of 347t. As hindcast for the time of failure, 8 August 2016.

It is accepted that the winch drum would have rendered under continuous high loading. However, the report considered that sudden, or shock, loading resulting from the relative motion of the vessels in the seas could be applied to the line before the winch was able to respond.

The potential for fatigue loading leading to failure is also explored and the report states that for a peak tension of 240t and a period of 14 seconds, such failure would occur after about 22 hours.

The load on the tow line measured on the ship's tension meter was not automatically recorded. Manual readings were noted sporadically but these logs were insufficient for this investigation to gain a full understanding of the actual loads experienced by the tow line. However, the calculations show the potential for much higher loading than the logs show. In the worst case, the load was well in excess of the minimum breaking load of the tow line when new, so it is possible that a new tow line would have broken under the same conditions.

2.3.2 Catenary

For a given load, the shorter the tow line is, the less catenary there will be, and this reduces the tow line's ability to absorb sudden loading (and hence the greater the proportion of such loading acting on the tow line). According to the guidance contained in MSC/Circ 884 and 0030/ND, the minimum deployable length of tow line required to provide sufficient catenary to protect it from the effects of loading it to the continuous bollard pull of the tug, was 809m. It can be seen from **Table 1**, that this length of line was not deployed when the vessel was in the worst weather.

Neither ALP's Towing Manual, nor its Ocean Towage and Anchor Handling Manual provided the master with any specific guidance as to what would be an appropriate catenary, or length of tow line, for this tow. The Towing Manual referred to the potential dangers associated with towing in depths of less than 200m and required the catenary to be calculated during every watch. This instruction caused the master to prioritise keeping the tow line clear of the seabed, over the provision of an adequate catenary to protect the line from sudden loading. No evidence could be found of the catenary calculations that were required by the ALP Towing Manual. Had such calculations been carried out it is possible that the master would have taken steps to ensure an adequate catenary was maintained.

On the afternoon of 7 August, when the tug and tow experienced the worst of the weather, the tow line was at its shortest, with 568m deployed. The TTI report estimates that in the sea conditions hindcast, the tow line could have been experiencing sudden loading up to about 599t, more than double the continuous bollard pull of the tug. Without accurate figures for the actual loads on the tow line, it is not possible to calculate the length required to ensure an adequate catenary to protect the line from sudden loading in these sea conditions. However, it is clear that the required length would have been well in excess of the minimum 809m for normal conditions. Therefore, it is considered likely that the tow line sustained significant damage during this period.

On the afternoon of 7 August, the tug and tow were in an area where the water depth varied between 50m and 100m **(Table 1)**. With 568m tow line deployed and 120t of static load, the table on the bridge **(Figure 10)** predicted a catenary depth of less than 9m. Had 1200m of line been deployed, this would have increased to 37.5m. It is understood that the tow line can be expected to drop lower than the predicted catenary depth as the vessels move relative to one another in the seas.

However, the danger of potential damage to the tow line from abrasion on the seabed needs to be assessed in the context of the damage sustained by the tow line as a result of sudden loading due to insufficient catenary.

2.3.3 Condition of the tow line

The TTI report stated that, as a result of poor lubrication, the tow line was in a generally poor condition, with disintegration of the core leading to a significant loss of strength. In addition to the loss of core strength, the disintegrated core was unable to provide adequate support to the outer strands, leading to further damage and weakening. The report states that at the time of the incident the tow line strength was reduced by 21.3% to about 389t.

The report concluded that, the condition of the core of the tow line was very poor and that it is likely that the line had become further degraded as a result of fatigue damage during the earlier part of the storm.

2.3.4 Tow line summary

As identified by the report by TTI, a number of factors increased the likelihood that the tow line would fail in the early hours of Sunday 8 August when, as the weather conditions had abated somewhat, *ALP Forward*'s master was attempting to manoeuvre the rig away from the Isle of Lewis. These included: pre-existing degradation of the tow line as a result of poor lubrication; stressing of the tow line due to inadequate catenary, which was exacerbated by shock loading due to non-synchronous movement of the tug and tow in large seas; and repeated loading of the tow line leading towards fatigue failure. It has not been possible to determine whether one of these was the dominant factor, but it is considered that all played a part.

An improved maintenance and inspection routine could have ensured that the tow line did not deteriorate or, if deterioration had occurred, it was appropriately discarded. In addition, improved guidance to tow masters on the importance of maintaining catenary and avoiding shock loading could have helped *ALP Forward*'s master mitigate the effects the heavy weather had on the tow line. Together, these precautions could have resulted in a tow line fit for purpose once the weather abated.

2.4 PLANNING

2.4.1 Route

ALP Forward's master chose to route north of Scotland and west of Ireland to avoid the high traffic volumes and density of recreational craft he expected would be encountered in the English Channel route. Had he considered the weather off the north-west coast of Scotland in his planning, it is unlikely that he would have been concerned. He would likely have come to the same conclusion as Aqualis; that high winds and seas were only a remote possibility during the summer and autumn months. The master's decision to plan the route to the north was reasonable given the information available to him at the time, and was not challenged by ALP, Transocean or Aqualis.

The master's planned route allowed a minimum distance off the Scottish coastline of 12nm. Although the master could have routed within United Kingdom territorial waters, through his right to innocent passage, he decided to remain 12nm off in

order to avoid any recreational or coastal fishing vessels. However, planning a passage that at times passed close to the coastline left limited sea room for the tug and tow to drift in the event of bad weather. When *Transocean Winner* took control of the tug under the influence of the wind and seas, the master had no alternative but to allow the tug and tow to drift. Although such occurrences are not unusual in ocean towage, it is vital that there is sufficient sea room to drift safely until the weather passes and control is regained.

The passage plan did not specify any suitable areas to heave-to in the event of the tug and tow encountering adverse weather or mechanical difficulties. The Towing Manual listed a number of ports of refuge. However, these were aimed at providing technical support, and since none were in the west of Scotland they were of no value to the master in sheltering from the weather.

2.4.2 The Towing Manual

The Towing Manual was provided by ALP to *ALP Forward*'s master, Transocean and Aqualis. Together with the surveys of the two vessels and the towage equipment, it formed the basis of the latter's approval of the tow. However, the Towing Manual failed to provide the information necessary to safely complete the tow in that:

- It contained no windage information for *Transocean Winner*.
- The draught stated for *Transocean Winner* was not explicit for the tow.
- It did not contain any contingency plan for adverse weather or refer to suitable shelter or heave-to areas. Furthermore, no ports of refuge had been identified for the north-west coast of Scotland.
- It offered no guidance on a suitable minimum length of tow line to protect from sudden loading.
- There was no explicit instruction to the master to inform ALP in the event that the weather took control of the tug and tow.

In addition, the Towing Manual included instructions that, in the event of heavy weather slamming on *Transocean Winner*'s cross members, *the unit should be ballasted down to survival draught until such time as conditions improve to allow the passage to continue.* This was impossible with the rig unmanned and it is unclear why none of the manual's recipients questioned the instructions.

Once Aqualis had issued the Towing Approval certificate *ALP Forward*'s master had overall responsibility for the safety of the tug and tow. However, the lack of essential information, instruction or guidance in the Towing Manual meant that he had insufficient information with which to manage this responsibility. The fact that the master did not question the failings of the Towing Manual or check the actual draught of the tow may be indicative that such arrangements are not unusual in ocean towage.

2.5 DECISION MAKING

2.5.1 Departure from Stavanger

The voyage to Malta was not time bound and there was no commercial pressure to set sail on a particular day. All parties had agreed on the need for a clear 3-day weather window prior to departing Stavanger, and this was confirmed in the Towing

Manual, which specified environmental criteria for departure as a maximum wind of [no more than] 15kts and significant wave height of [not more than] 2.0m. *ALP Forward*'s master and a representative of Transocean agreed that such a weather window was in place on the morning of 3 August.

The forecasts on which the decision to sail were based have not been made available to the MAIB, but it is clear, from the Met Office SafeVoyage forecast issued to *ALP Forward* on 3 August at 1754 **(Annex A)**, that strong winds and high seas would build from midday on 6 August. While the screen shots of the SPOS Onboard forecasts **(Annex A)** show more favourable winds, the assessment of the weather window at departure was borderline and should have alerted ALP and the master to the potential for the weather to worsen. Poor weather in the North Atlantic in summer was not typical. Therefore, in light of the lack of commercial pressure, it is surprising that the forecast did not lead to a reconsideration of the proposed sailing.

2.5.2 Position reports

In accordance with the Towing Manual, *ALP Forward'*s master submitted a daily position report to the nominated parties at 2359 local time each day. In addition to the tug's position, the weather, voyage speed to date and length of tow were also stated.

The position report for 6 August showed a reduced distance covered over 24 hours compared to previous reports submitted by *ALP Forward*'s master. However, the position report for 6 August did not contain a reference to the difficulties being experienced, despite the loss of control and that the tug and tow had been pushed backwards for approximately 12 hours.

With the exception of ALP's operations assistant, no-one was monitoring the reports for anomalies and so the opportunity for the experience of Aqualis and Transocean to be applied to the developing situation at an early stage was lost.

2.5.3 Control of the tow

Given the location of the tug and tow when the effect of the wind on *Transocean Winner* caused *ALP Forward* to lose control, it was very likely that *Transocean Winner* would ground regardless of whether the tow line held or parted.

The Towing Manual did not contain any windage information and this had been neither requested by, nor supplied to ALP. The windage graph from *Transocean Winner*'s Marine Operations Manual for a transit draught of 10.98m **(Figure 7)** shows that a headwind of 56kts, the approximate strength of the forecast winds, would be sufficient to overcome the 120t tension limit the master applied to the tow line (in practice, a lower wind speed was needed since the draught was less). Despite the master's recognition that the weather was worsening, and the concerns raised by ALP's operations manager in his telephone call of 4 August, ignorance of the rig's windage and the effect it would have had, led the master to remain confident that the tug and tow would be able to pass ahead of the worst weather conditions.

Had the windage information been available, the master would have been able to predict the tug's inability to hold the rig, enabling him to change his passage plan in time to seek shelter or greater sea room.

2.6 EMERGENCY RESPONSE AND PREPAREDNESS

2.6.1 Emergency towing arrangements

ALP Forward's main tow line failed in severe weather conditions with rough seas. The wave rider buoy at the end of the emergency tow line's messenger line was missing, and the line had been overrun by the rig. Therefore, it was not possible for the emergency tow line to be recovered in the prevailing conditions and there was nothing *ALP Forward*'s master could do to resolve the situation once the main tow line had parted.

Although, on this occasion, it was not possible to reconnect the tow using the emergency towing arrangement, had it been possible, the arrangement as rigged would have been of limited use. By accepting that a second towing bridle would be too heavy to be secured by weak links, the emergency towing arrangement was attached to only one pontoon. This would have resulted in the rig being towed at an asymmetric angle, which would have reduced the speed at which it could be towed, increased the strain in the tow line for a given speed and made directional control difficult. Where emergency towing arrangements cannot replicate those of the main tow, this limitation should be taken into account in tow planning.

2.6.2 Assistance by emergency towing vessel

Based in Kirkwall, Orkney, the ETV *Herakles* was 12 hours transit time away from the tug and tow when *ALP Forward*'s master notified the coastguard that they were heading towards land. Other than *ALP Forward* itself, the ETV was the closest available large towage asset.

It could be argued that the ETV should have been tasked to follow areas of expected bad weather, as such circumstances have historically led to shipping incidents where emergency towage is required. This would have reduced the time taken for *Herakles* to reach the scene. However, there would be no guarantee that an incident would not occur in more benign weather elsewhere.

Aqualis had calculated that a minimum 150t bollard pull was required to tow *Transocean Winner*. Since *Herakles* had a continuous bollard pull of 170t, the vessel would have been sufficiently powerful to tow *Transocean Winner* in appropriate conditions. However, the best towage asset available was *ALP Forward*. It had significantly higher bollard pull than *Herakles*, was on scene, and was familiar with *Transocean Winner* and its towage arrangements.

Transocean Winner's emergency towage arrangement had become inaccessible. However, had the wave rider buoy been visible and clear of the rig, it is by no means certain that it would have been possible for any vessel to safely recover it in the severe weather conditions.

Had *Herakles* been on scene from the point at which *ALP Forward* began to be pulled astern, it is very unlikely that it would have been able to provide any practical assistance in maintaining control of *Transocean Winner*, given the severe weather conditions and the nature of the emergency towage arrangements.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. *Transocean Winner* grounded as *ALP Forward* was incapable of controlling the tug and tow in the high winds and seas experienced. [2.2]

2. The guidance in the Towing Manual led the master to prioritise keeping the tow line clear of the seabed over the provision of an adequate catenary. [2.3.2]

3. Had significantly more tow line been deployed, it is likely that the line would have suffered less damage from sudden loading, and it might not have failed. [2.3.2]

4. *ALP Forward*'s tow line was in a generally poor condition, with partial disintegration of the core leading to significant loss of strength, and an inability of the core to provide adequate support to the outer strands. An improved maintenance and inspection routine could have ensured that the tow line did not deteriorate or, if deterioration had occurred, it was appropriately discarded. [2.3.3, 2.3.4]

5. Improved guidance to tow masters on the importance of maintaining catenary and avoiding shock loading could have helped *ALP Forward*'s master mitigate the effects the heavy weather had on the tow line. [2.3.4]

6. Planning a passage so close to the coastline left limited sea room for the tug and tow to drift in the event of bad weather. [2.4.1]

7. The Towing Manual contained insufficient information to enable the master to manage the safety of the tug and tow. [2.4.2]

8. When the effect of the wind on *Transocean Winner* took control of the tug and tow, it was very likely that *Transocean Winner* would ground regardless of whether the tow line held or parted. [2.5.3]

9. Had the windage information been available, the master would have been able to predict the tug's inability to hold the rig, enabling him to change his planned passage in time to seek shelter or greater sea room. [2.5.3]

10. Where emergency towing arrangements cannot replicate those of the main tow, these should be taken into account when planning the tow. [2.6.1]

3.2 OTHER SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. Once the main tow line had parted, in the prevailing conditions there was nothing *ALP Forward*'s master could do to resolve the situation. [2.6.1]

3.3 SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. The passage plan did not specify any suitable areas to heave-to in the event of the tug and tow encountering adverse weather or mechanical difficulties. [2.4.1]

2. Ineffective monitoring of daily reports meant that the opportunity for the experience of Aqualis and Transocean to be engaged at an early stage was lost. [2.5.2]

3.4 OTHER SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. Had ETV *Herakles* been on scene, it is very unlikely that it would have been able to provide any practical assistance in maintaining control of *Transocean Winner*. [2.6.2]

SECTION 4 - ACTIONS TAKEN

Transocean Offshore International Ventures Limited has:

Started an internal investigation into the accident and reviewed its Marine Compliance Procedures Manual. The investigation has yet to be finalised, however the following actions have been completed. It has:

1. Revised the Rig Move Planning Checklist to be used as a single document by all parties for the execution of non-self-propelled rig moves with a sign-off section that must be completed prior to commencing a move.

2. Updated the Rig Move Plan Template, ensuring trigger, hold points and required actions are defined. This is to be used as a single document by all parties for the execution of non-self-propelled rig moves and includes a Responsibility Table.

3. A Transocean approved Rig Move Supervisor holding a Marine Warranty certificate is to be on board the towing vessel of unmanned tows.

4. Daily Reports for voyages and extended tows are to include, inter alia, the tow line tension and the percentage of MBL applied.

SECTION 5 - RECOMMENDATIONS

ALP Maritime Services BV is recommended to:

2017/135 Review its procedures with regard to the production of towing manuals to ensure that the guidance provided in them:

- Complies with the guidelines issued by the International Maritime Organization in MSC/Circ.884 of 1998.
- Provides those responsible for the safety of the tow with all the necessary information, including tow-specific guidance on:
  - the need to consider sea room and lee shores during passage planning
  - the provision of an adequate catenary
  - the need to report when control of the tow is lost
  - the limitations/functionality of the emergency towing arrangement when in adverse weather.
- Provides its vessels' crews and maintenance staff with comprehensive guidance on the maintenance, inspection and discard of tow lines.

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

Marine Accident Report

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