Report on the investigation

into the loss of the tug

Ijsselstroom

in the port of Peterhead

14 June 2009

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The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AB	-	Able Seaman
AIS	-	Automatic Identification System
bhp	-	brake horse power
BST	-	British Summer Time
BTA	-	British Tugowners Association
cable	-	0.1 nautical mile
DOTS	-	Dynamic oval towing system
ETA	-	Estimated Time of Arrival
Girting	-	Risk of capsizing due to high athwartships towing forces
GMDSS	-	Global Maritime Distress and Safety System
GPS	-	Global Positioning System
GRT	-	Gross registered tonnage
GT	-	Gross tonnage
kW	-	kilowatt
m	-	metre
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
mm	-	millimetre
nm	-	nautical miles
PMSC	-	Port Marine Safety Code
PMSP	-	Port Marine Safety Plan
PPC	-	Peterhead Port Control
Set	-	The direction in which a tidal stream or current is flowing
SMS	-	Safety Management System

STCW	-	Standards of Training, Certification and Watchkeeping (Convention for Seafarers 1995)
t	-	tonnes
UTC	-	Universal co-ordinated time
VHF	-	Very High Frequency radio
WDC	-	Westminster Dredging Company Ltd

Times: All times BST (UTC+1) unless otherwise stated.

Ijsselstroom

SYNOPSIS

The tug *Ijsselstroom* had been working on the construction of a new berth and breakwater in the Port of Peterhead. On the morning of 14 June 2009 she was tasked to act as a stern tug for the barge *Tak Boa 1,* which was arriving off the port with a cargo of 5000 tonnes of large rocks from Sweden.

Ijsselstroom's skipper chose to deploy her towline over her stern and intended to maintain position and heading relative to the barge by using differential ahead power on her two engines. A bridle wire was not rigged. As the lead tug increased speed, the skipper found that he was unable to control *Ijsselstroom'*s yawing motion effectively, and 5 minutes after connecting to the barge, the vessel took a large sheer to starboard, girted and capsized.

The investigation identified a number of factors that contributed to the accident, including:

- Van Wijngaarden Marine Services relied too heavily on the individual knowledge and experience of its skippers to carry out a safe operation and did not have a formal staff training programme. However, the skippers' knowledge and experience were never assessed.
- For a conventional tug, towing over the stern, while running astern, is an inherently unstable mode of operation.
- The tow speed was too high to replicate earlier, successful entries using *Ijsselstroom* as the stern tug.
- The lack of a bridle wire or gob rope meant there was no physical safety device to prevent *Ijsselstroom* from girting when directional control of the tug was lost.
- *Ijsselstroom*'s skipper had not been trained in the use of the emergency brake lift control, had not tested it or witnessed its effect, and did not operate it when the tug got into difficulties.
- The pilot had not adhered to the port's procedures regarding risk assessments prior to the arrival of *Tak Boa 1.* Specifically, he had not discussed the barge entry with the skipper of *Ijsselstroom* and had no knowledge of the skipper's intended towing method or operational limitations.
- The Peterhead Port Authority's Safety Management System (SMS) had some inaccuracies that were not identified in the annual review and which could have prompted the pilot to select a more suitable tug for the task.

Recommendations have been made to Van Wijngaarden Marine Services to introduce a training programme for its skippers, review the suitability of its tugs for the tasks in which they may be involved and introduce the use of risk assessments and briefings as a standard operating procedure. Peterhead Port Authority has been recommended to audit actual working practices against those laid down in its SMS and to ensure that the operational limitations and working practices are understood when non Peterhead Port Authority tugs are working in the harbour. The British Tugowners Association and the UK port authorities have been recommended to promulgate the lessons learned from this accident to their members.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *IJSSELSTROOM* AND ACCIDENT

Vessel details

Registered owner	:	Van Wijngaarden Marine Services B.V.
Port of registry	:	Hardinxveld-Giessendam
Flag	:	Netherlands
Type	:	Tug
Built	:	1992 by Den Breejen (Hardinxveld)
Classification society	:	Bureau Veritas
Construction	:	Steel
Length overall	:	19.5m
Gross tonnage	:	71
Engine power and/or type	:	2 x Caterpillar type 3408, 450HP (330kW) each
Service speed	:	11 knots
Other relevant info	:	2 fixed pitch propellers in fixed Kort nozzles, twin synchronised rudders 15 tonnes bollard pull

Accident details

Time and date	:	0440 BST Sunday 14 June 2009
Location of incident	:	4 cables south-east of the entrance to Peterhead Bay
Persons on board	:	3
Injuries/fatalities	:	Nil
Damage	:	Declared constructive total loss

1.2 NARRATIVE

1.2.1 Background

In January 2009, a joint venture between Westminster Dredging Company Ltd (WDC) and R J McLeod was awarded the construction contract for the redevelopment of the Smith Embankment area of Peterhead port **(Figure 1)**. The project included the construction of a 200m long all weather deep water berth and the reclamation of 13,000 square metres of adjacent land.

The first phase of the development was the dredging of the approaches to the new quay and the construction of an 85m long extension to the Albert Quay breakwater. To construct the breakwater extension, small barges of stone were to be loaded on the south breakwater and towed across to the Albert Quay. Larger rocks would be used for the final stages of construction. Unavailable locally, these large rocks would be shipped by barge from Sweden.

1.2.2 The role of *Ijsselstroom*

The tug *Ijsselstroom* was owned and operated by Van Wijngaarden Marine Services B.V. of the Netherlands. She was registered under the Dutch flag and, as such, was required to be entered with and maintained in accordance with the rules of a classification society. WDC chartered her as a general workboat/tug, and she was mainly used to move small barges carrying stone from the south breakwater to the construction site.

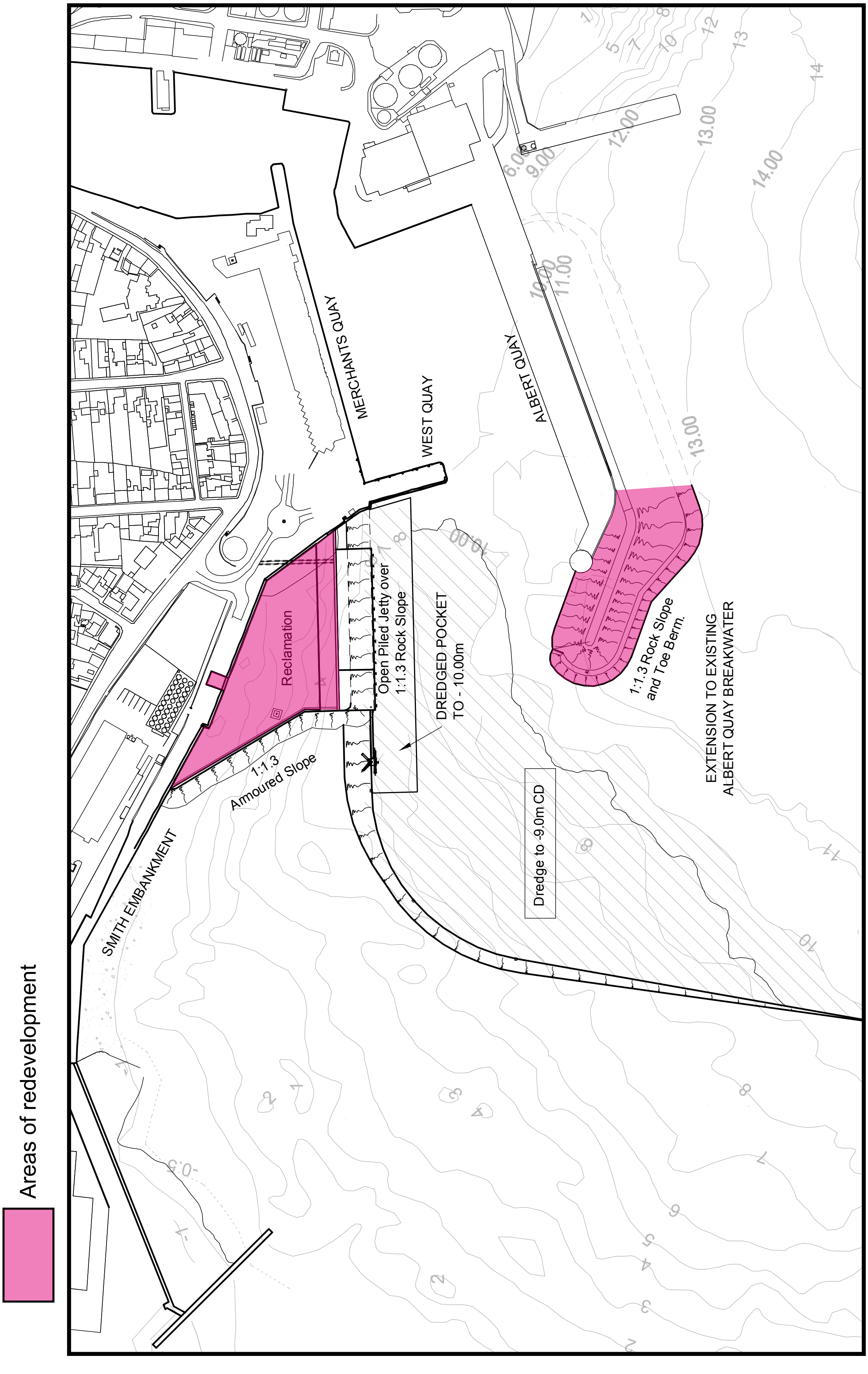
WDC had used *Ijsselstroom* before, and when contracting in tugs to work on the Smith Embankment project the project manager specifically requested that Van Wijngaarden Marine Services supply her on this occasion. Because of this previous relationship and the project manager's familiarity with the tug, Van Wijngaarden Marine Services did not deem it necessary to obtain precise details of the work that *Ijsselstroom* would be required to perform.

1.2.3 The shipment of Swedish rocks

WDC contracted Kittilsen Shipping of Norway to transport 30,000 tonnes of rock from Sweden to Peterhead. This was to be done in six shipments of 5000 tonnes each, spread over several weeks. The rocks were carried on *Tak Boa 1*, a 73m long barge with a beam of 24m **(Figure 2)**.

The first three deliveries of rock were towed from Sweden by the tug *Boa Siw*, a 286GRT azimuth stern drive tug. The delivery on 14 June was towed by *Lucas*, a conventional, single shaft tug of 277GRT **(Figure 3)**.

Figure 1



Artist's impression of the redevelopment of the Smith Embankment area of Peterhead port

Figure 2

Tak Boa 1

Figure 3

Lucas

Lucas and *Tak Boa 1* left Sweden during the evening of 9 June 2009. The master's only instruction was to take the barge to Peterhead pilot station, with no arrival time specified. The passage was largely uneventful except for a period of 36 hours of force 6 winds that forced the master to reduce speed. As the weather improved he was able to give Peterhead an ETA of 0300 on 14 June 2009, but did not specify whether this was UTC or BST. Later, the master was advised by Peterhead Port Control (PPC) to embark the pilot at 0317 in order to conduct the approach at slack water. He assumed this time was UTC. In fact, the pilot had left instructions with PPC that he was to board *Lucas* at 0317 BST in order to make slack water at the entrance 1 hour later at 0417 BST.

1.2.4 Arrival at Peterhead

Conditions for the arrival were favourable. Winds were light at 1 to 4 knots, the sea was calm with a low swell and visibility was good. Civil twilight occurred at 0250 and sunrise at 0352. The tidal stream was near neaps and the pilot had calculated that the high water slack would occur at 0417.

The pilot had been told of *Tak Boa 1*'s arrival 2 or 3 days earlier, and had left PPC written details of the time of slack water, the time that he wanted to board the tug *Lucas* 2 miles off the harbour entrance, and an approximate time that he wanted to be called by the port controller. The pilot left no other instructions and had no direct contact with either *Ijsselstroom* or *Lucas.*

The pilot was contacted by port control at 0300, nearly 1 hour later than he had expected to be called. However, since the weather was reported as good, and the pilot knew that the tidal stream was near neaps, he was satisfied that an entry could be made. He was further reassured because he had been the pilot on a previous entry of the barge with *Ijsselstroom* acting as stern tug, when conditions were slightly worse and the passage through the breakwater had been successfully conducted 20 minutes after slack water.

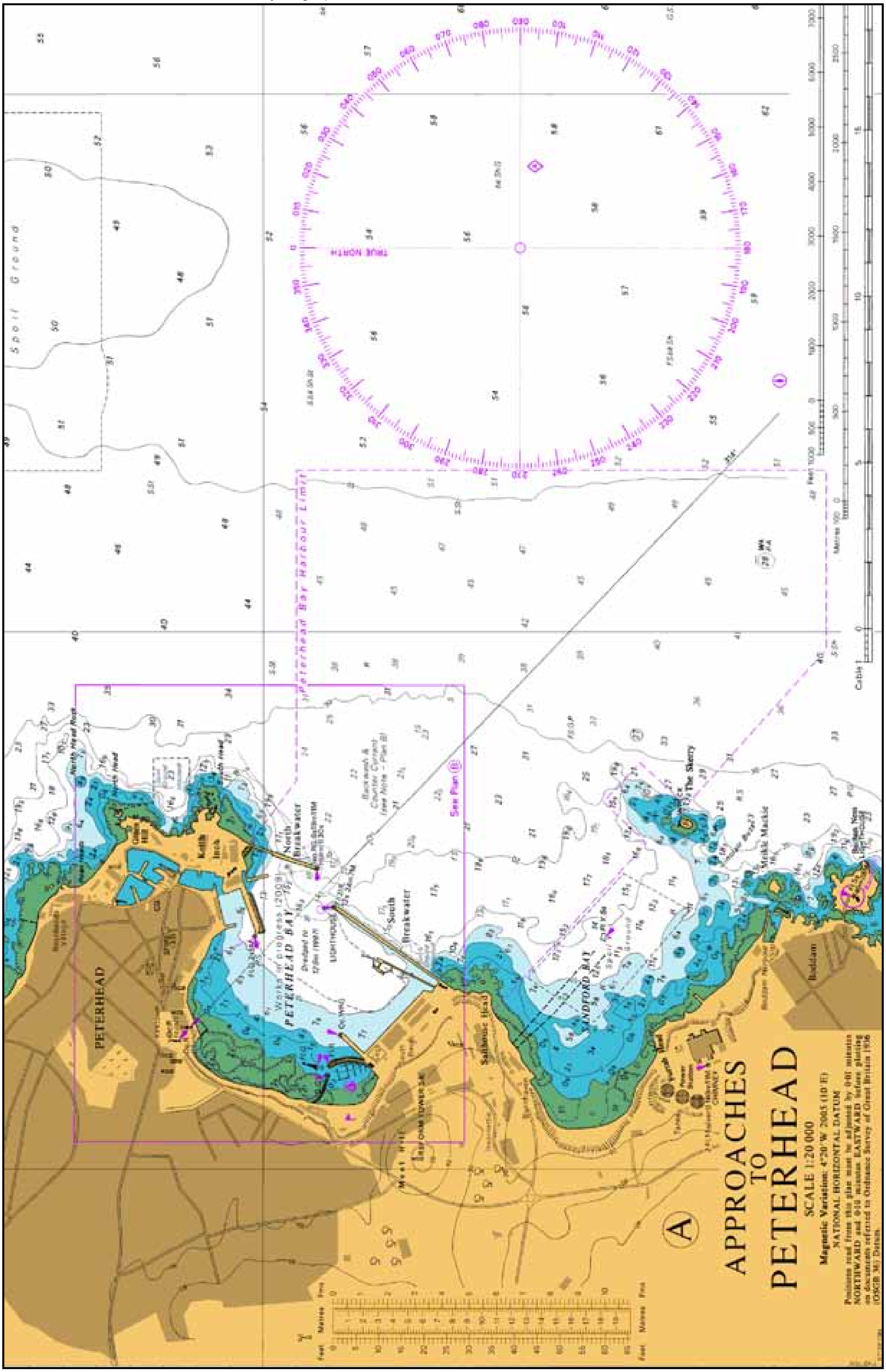
Lucas continued to head for the pilot boarding position at 6 knots and shortened in her towing wire from 200m to 50m. WDC had instructed *Ijsselstroom*'s skipper that he was to act as stern tug for the barge the previous afternoon, and at around 0330 the tug left her berth on the southern breakwater to meet *Lucas*.

At 0345, *Marineco India,* a second workboat that was working with WDC, left her berth to assist with the barge's entry. It was intended that two of *Marineco India*'s crew would transfer on to the barge to make fast the towing wire that would be sent across from *Ijsselstroom.*

At 0355, the pilot boarded *Lucas* 2.8nm from Peterhead breakwaters **(Figure 4)**. He had a brief exchange with the master, during which time he identified that it was the master's first call to Peterhead. The pilot described the southerly set experienced out at sea and the counter-current which would set north as they closed to within 0.5 mile of the entrance. The pilot informed the master that, once inside the bay and clear of any set, they would stop the tug and tow to discuss the details of berthing *Tak Boa 1.*

Reproduced from Admiralty Chart BA 1438 by permission of the Controller of HMSO and the UK Hydrographic Office

Figure 4



Approaches to Peterhead

1.2.5 Girting of *Ijsselstroom*

At 0406, and now 2.3nm from the breakwaters, *Ijsselstroom*'s skipper called *Lucas* by VHF to ask if it was possible for her to slow to a maximum of 2 knots so that *Marineco India* could put two men on the barge and connect *Ijsselstroom.* The pilot rejected this request and informed *Ijsselstroom*'s skipper that he wanted to get as close as possible to the harbour before reducing speed. *Ijsselstroom*'s skipper acknowledged this intention.

At 0407 the pilot informed PPC of his intention to maintain his present course and speed until closer to the entrance. PPC approved the pilot's plan.

At 0428 the pilot contacted *Marineco India* to ask if she was going to act as stern tug for *Tak Boa 1. Marineco India*'s skipper informed the pilot that *Ijsselstroom* would be the stern tug and *Marineco India*'s crew would be on the barge making her fast. The rocks blocked the pilot's view of the aft end of the barge, so he called *Ijsselstroom* to see if she had already made fast.

Once it was established that *Ijsselstroom* had not made fast, the pilot informed her skipper that he was about to reduce speed. *Ijsselstroom*'s skipper again requested that *Lucas* reduce speed to 2 knots while his vessel was being connected to *Tak Boa 1.*

At 0430 *Lucas* and her tow were 8 cables from the entrance to Peterhead Bay. The pilot informed *Ijsselstroom* that he was reducing *Lucas's* speed. *Ijsselstroom*'s skipper acknowledged this and replied that he would start to make fast. He then manoeuvred *Ijsselstroom*'s stern to the barge and the tug's towing wire was passed to *Tak Boa 1* **(Figure 5)**.

Figure 5

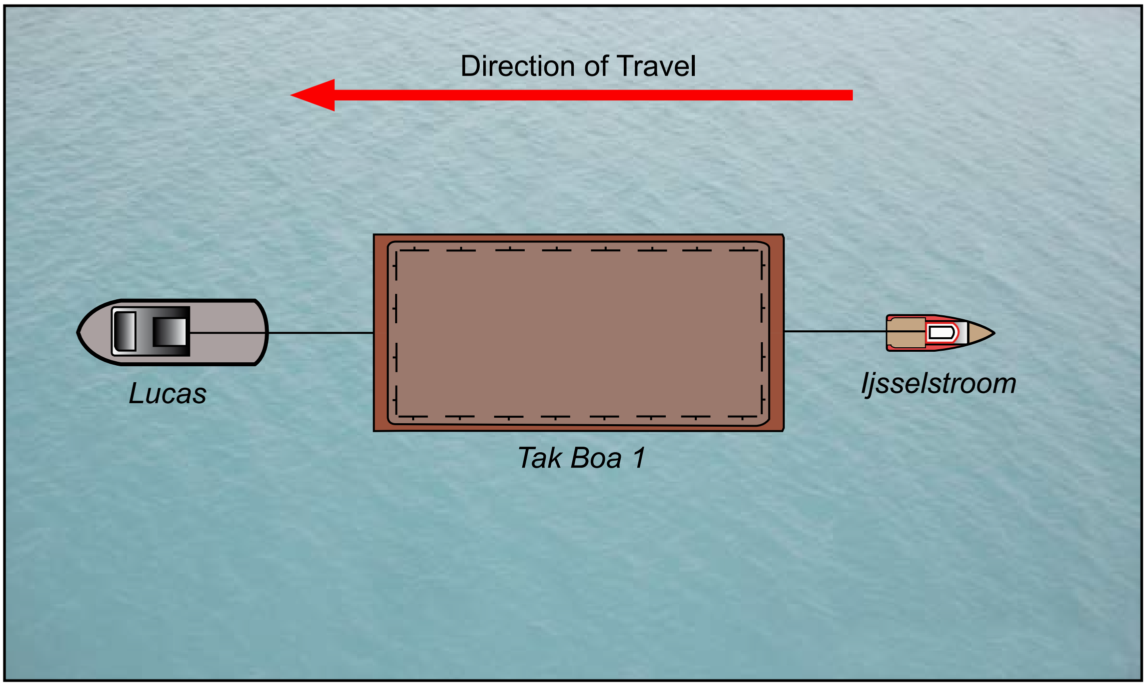


Diagram of the towing arrangement

Ijsselstroom was conned from a swivel chair that could be locked in a forward or stern facing position. *Ijsselstroom*'s skipper had placed the chair in the normal forward facing position as he followed *Lucas* and *Tak Boa 1* towards the entrance to Peterhead **(Figure 6)**. Once the skipper had manoeuvred his vessel's stern towards the barge, he swivelled the chair to face astern.

Figure 6

Conning position showing skipper's chair facing forward

The skipper approached the barge with *Ijsselstroom*'s rudder amidships and used only differential power on the two engines to maintain position and heading. Once in position, *Ijsselstroom*'s crew passed the towing line over the stern to the men waiting on *Tak Boa 1* and the eye was placed on the barge's centre line bitts. The skipper then veered approximately 30m of towing line by leaning across to the cradled winch controls (now on his left side) and using his right hand while his left hand controlled the engines when necessary.

Once the skipper was satisfied that the towing line was made fast and that the tug's heading was steady, he swivelled the chair back to the forward facing position. *Ijsselstroom*'s skipper remained with his chair facing forward for the remainder of the towing operation as his tug gathered sternway.

At 0434, he informed the pilot on *Lucas* that *Ijsselstroom* had been made fast to the barge. The pilot informed the skipper that he intended to increase speed and proceed into the harbour. They agreed that, once in the harbour, both towlines would be shortened before the barge was manoeuvred onto her berth. The pilot instructed *Ijsselstroom*'s skipper to maintain position astern of the barge until inside the harbour. The skipper acknowledged this instruction.

As the barge was towed towards the harbour, *Ijsselstroom*'s skipper frequently looked over his left and right shoulders to monitor the position of *Ijsselstroom* relative to the barge. He adjusted her position using differential power on her engines and occasional minor rudder movements to keep the tug in line with the barge while running astern.

At 0437, *Ijsselstroom*'s skipper contacted the pilot on *Lucas* and urged him to *"please take it easy otherwise I can't hold on".* The pilot responded immediately by informing the skipper that he was slowing down, which he quickly confirmed twice more before advising the skipper that *Lucas* was proceeding at "slow ahead". This was acknowledged by the skipper on *Ijsselstroom,* and there was no further communication between the two vessels.

At 0440 *Marineco India*'s skipper interrupted some unconnected port radio traffic to tell the pilot to stop towing as *Ijsselstroom* had nearly capsized. The pilot reduced speed immediately but, shortly afterwards, *Marineco India*'s skipper confirmed that the stern tug had capsized. At this time, *Ijsselstroom* was approximately 4 cables south-east of the harbour entrance.

1.2.6 Immediate actions

It was reported that *Ijsselstroom* capsized to starboard to around 90º for a few seconds before returning to an angle of approximately 30º, but with the aft deck submerged **(Figure 7)**.

Ijsselstroom's two crew members were on the open deck aft of the wheelhouse at the time of the incident; both were wearing lifejackets. They were both quickly recovered from the water by the crew of the pilot boat that was still in the area.

Ijsselstroom's skipper was in the wheelhouse, and as the tug sank by the stern he was unable to exit through the aft door. However, he was able to climb through the port forward window of the wheelhouse **(Figure 8)**. Having recovered the two men in the water, the pilot boat made its way to *Ijsselstroom,* which by then was lying vertically in the water with her stern fully submerged and her bow pointing up **(Figure 9)**. The skipper was found standing on the now horizontal wheelhouse front, and he was able to step off into the waiting boat. He was not wearing a lifejacket.

Figure 7

Still from Peterhead CCTV showing *Ijsselstroom* shortly after girting

Figure 8

Wheelhouse window through which the skipper escaped

Figure 9

Still from eyewitness' mobile phone showing *Ijsselstroom* just prior to sinking

Within 2 minutes of the accident, Aberdeen Coastguard called for assistance from any vessel in the Peterhead area. Although several vessels responded, the prompt actions of the pilot vessel meant that no assistance was required. At 0452 the pilot vessel's coxswain reported that *Ijsselstroom*'s crew had all been recovered.

Meanwhile, *Lucas* was committed to the approach into Peterhead Bay. As she passed the breakwaters the master turned her to port in order to stop *Tak Boa 1* drifting into Albert Quay. Now without the assistance of a stern tug to check the barge's speed, the weight on the towing wire proved too much and it parted leaving the barge to drift free. The pilot called port control to ask for the harbour workboat *Ugie Runner* to assist, but *Marineco India* was on scene faster and was able to assist connecting *Tak Boa 1* back to *Lucas* using the tug's emergency towing wire. The three vessels eventually manoeuvred the barge alongside the north breakwater.

1.3 PERSONNEL

1.3.1 *Ijsselstroom*

The 31 year old skipper of *Ijsselstroom* was a Dutch national who held STCW II/3, III/1, IV/2 certificates and was qualified to sail as master on vessels less than 500GT and a propulsion power less than 3000kW engaged on near coastal voyages. He had worked on tugs for 6 years, 4 as skipper and the last 1½ years on *Ijsselstroom.* He was employed on a rotation of 4 weeks on board, followed by 4 weeks leave.

The first deck rating was also a Dutch national. He first went to sea 40 years earlier as a fisherman, but had been working on tugs for the last 19 years. He held an STCW II/4 watch rating certificate and had been employed by Van Wijngaarden Marine Services for 2 years, joining *Ijsselstroom* 3 months before the accident. He also worked a rotation of 4 weeks on board followed by 4 weeks leave.

The second deck rating was a local man who had started working on the tug 2 months earlier. Most of his 34 year career at sea had been spent on fishing boats, and this was the first time he had worked on a tug. He did not hold a certificate of competency, but held numerous safety related certificates that had been issued during his time as a fisherman. He was employed by WDC to work 6 days a week until the first stages of the port redevelopment were complete and the workboats were no longer required.

At the time of the accident, *Ijsselstroom*'s crew were coming to the end of an 18 hours shift. Their normal work pattern was 12 hours on duty and 12 hours off duty. However every Saturday the day and night crews would carry out a single duty period of 18 hours to enable them to change from day shift to night shift, and vice versa. This work pattern was a local arrangement that had been agreed between the crews without the knowledge of the WDC.

1.3.2 *Lucas*

The Danish master of *Lucas* started his career at sea in 1988. He held STCW II/1, II/2, V/1 certificates and was qualified to sail as master on vessels of less than 3000GT. He had previously worked in a sea school and as master on a sail training vessel. *Lucas* was his first tug and he had been with her for 2½ years, most of which he had spent as master.

1.3.3 Peterhead pilot

The pilot began his career as an apprentice pilot on the Humber over 40 years earlier. He left there and pursued a deep sea career for 12 years before returning to the Humber from 1984 to 2002. There he reached the senior position of “Super Pilot”, a position ranked above the normal first class senior pilot position. He then served briefly as master on a coaster before taking a 3-year appointment as pilot in Guinea. He had been a pilot at Peterhead for 3 years.

1.4 *IJSSELSTROOM*

1.4.1 Construction and general layout

Ijsselstroom was well equipped with radar, electronic chart system, autopilot, echo sounder, GPS, AIS and the required GMDSS radio equipment. She had accommodation for five persons and had operated worldwide.

On deck, *Ijsselstroom* had a single drum towing winch, a quick release towing hook and a single hydraulic crane, all sited on the centre line just aft of the main accommodation **(Figure 10)**.

Figure 10

Ijsselstroom aft deck gear

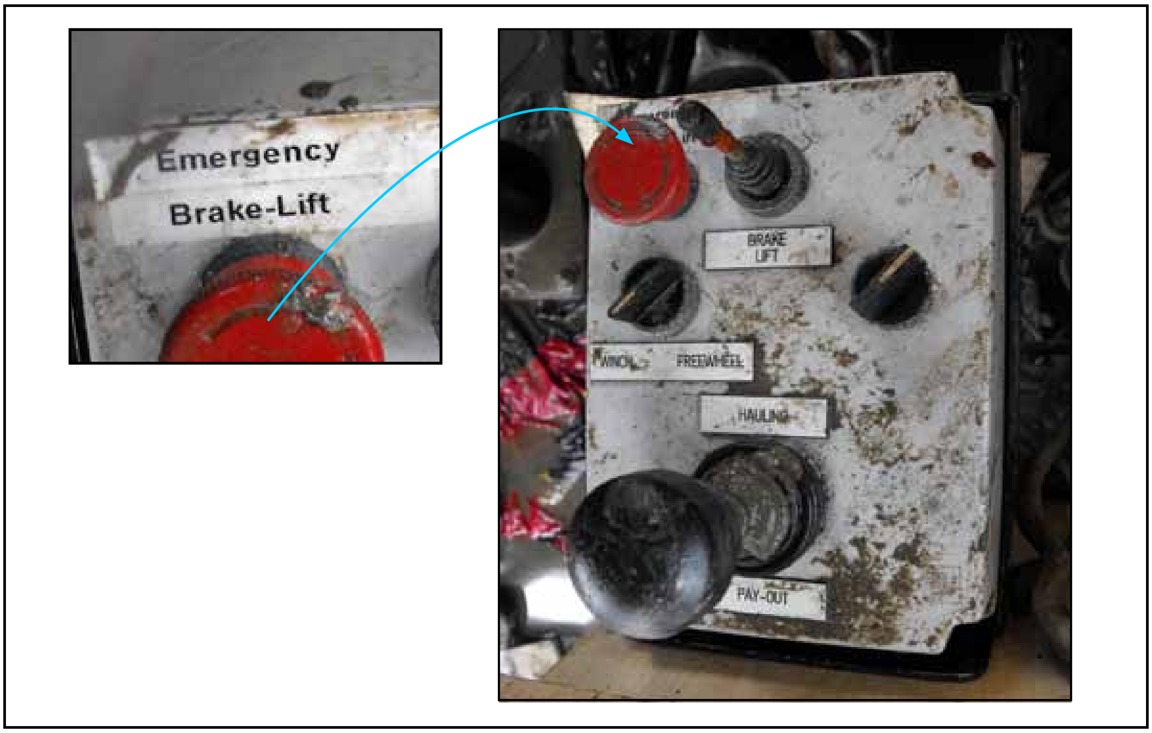
1.4.2 Towing arrangements

Ijsselstroom was connected to *Tak Boa 1* using the tug's 28mm wire which was stowed on the towing winch. The eye of the wire was shackled to one eye of a 10.4m stretcher of 76mm polypropylene rope. The second eye of the stretcher was placed over a single bitt, close to *Tak Boa 1*'s centre line, aft. The wire parted at a point close to the tug's towing winch. The short end of the wire was recovered from *Tak Boa 1* and was measured at 18.6m. Therefore the total length of the line deployed at the time of the accident was 29m.

1.4.3 Towing winch emergency release system

Ijsselstroom's towing winch had two modes of operation: "winch" and "freewheel" **(Figure 11)**. "Winch mode" allowed the skipper to easily adjust the length of the towing line by using the hauling / payout joystick. For this reason the skipper chose to carry out the arrival in "winch mode".

Figure 11



Wheelhouse winch control unit

The hydraulic system of the winch brake was powered by a power take-off from the starboard shaft. If the starboard engine failed for any reason then the brake would be permanently applied. It is not known when the starboard engine stopped during *Ijsselstroom*'s capsize at Peterhead.

In "freewheel mode", the winch is out of gear and held on the brake. Lifting the brake lift lever releases the brake and allows the towing wire to pay out if it is under tension.

In "winch mode", the winch is in gear and so the towline does not pay out if the brake is released.

The skipper of *Ijsselstroom* and managers at Van Wijngaarden Services believed that activation of the "emergency brake lift" button removed hydraulic power to the system and applied the brake to the winch. This belief appears to conflict with the literal meaning of the label on the button, but it was not possible to test the system after the capsize.

1.4.4 Wheelhouse controls

Ijsselstroom was conned from a swivel chair which had a joystick rudder control attached to the left arm **(Figure 12)**. When the chair faced in the forward position the floor standing engine controls were just forward of the chair's right armrest **(Figure 13)**. The winch control unit was attached to a chart table just abaft the engine controls **(Figure 14)**. The VHF unit was mounted to the deck head above the bridge window and its handset suspended by a short line, within reach of the conning chair **(Figure 6)**.

When the swivel chair was turned to face aft, the joystick rudder control, being fixed to the left arm, remained in that position. However, the floor standing engine controls remained stationary and would then be positioned slightly behind the skipper's left elbow. The winch controls would normally still be attached to the chart table to the left of the skipper, but could be removed from the bracket and held by hand if so required.

The skipper had three options as to how to conn *Ijsselstroom*: standing facing aft but with the chair facing forward **(Figure 6)**; sitting, with the chair facing aft; or sitting, with the chair facing forward.

Figure 12

Joystick rudder control

Figure 13

Engine controls

Figure 14

Winch control unit

1.5 VAN WIJNGAARDEN MARINE SERVICES

1.5.1 Background

Van Wijngaarden Marine Services was founded over 30 years ago in Sliedrecht, the Netherlands. The company provides small workboats, tugs and launches for charter to dredging, construction and offshore companies operating worldwide.

1.5.2 Fleet

The Van Wijngaarden Marine Services fleet comprised 5 small workboats, an 18.6m/80GRT floating pontoon and 8 tugs ranging from 10t to 46t bollard pull.

1.5.3 Crew training

Ijsselstroom's skipper had joined Van Wijngaarden Marine Services in 1999 as an AB. After gaining the appropriate qualification he worked his way up to chief mate and finally skipper. Van Wijngaarden Marine Services did not have a formalised in-house training or assessment procedure when promoting a chief mate to skipper. Typically the chief mates would understudy the company's most experienced skippers and would move around the fleet to gain as wide an experience as possible. When an opportunity for promotion arose, the managing director would consult with skippers who had worked with the candidate and ask for feedback on his ability. Provided that the feedback was good, no additional interview or assessment was carried out prior to promotion.

Van Wijngaarden Marine Services did not have a SMS or any form of towing guidelines. The company expected its skippers to use their knowledge and experience to guide them. However, this knowledge and experience was never assessed. It was not normal for the skippers to carry out a risk assessment, and one was not conducted on board *Ijsselstroom* for this operation in Peterhead.

1.6 THE PORT OF PETERHEAD

1.6.1 Overview

Peterhead is the most easterly town on the Scottish mainland and lies 33 miles to the north of Aberdeen. A natural deep water inlet protected from the sea by two breakwaters, it has traditionally served the fishing sector but underwent large development around the North Sea oil and gas industry in the 1970s **(Figure 15)**.

Although the oil industry still forms the core activity of the port, in recent years it has diversified to handle a range of vessels and commodities including cruise vessels, project cargo, frozen fish and pleasure yachts.

Photograph courtesy of Peterhead Port Authority

Figure 15

Aerial view of Peterhead

1.6.2 Background

The port comprises two areas: Peterhead Bay Harbour and the inner harbour that consists of a series of harbours and basins which provide facilities for the North Sea fishing industry.

Peterhead Port Authority came into being on 1 January 2006 with the merger of Peterhead Bay Authority and Peterhead Harbour Trustees. The new organisation became responsible for the management, operation and development of the port of Peterhead.

1.6.3 Port Marine Safety Plan

Peterhead Port Authority had a SMS and produced a Port Marine Safety Plan (PMSP) to ensure compliance with the Port Marine Safety Code (PMSC). The PMSC requires that harbour authorities should conduct a formal safety assessment of all aspects of their operation and, from this, derive a register of the risks involved and an effective SMS to control them.

The Peterhead Port Authority PMSP referred to a separate Towage Procedures document **(Annex A)**. This document was the responsibility of the harbourmaster and was reviewed on an annual basis. It detailed guidelines and procedures that should be considered when making a towing risk assessment and before carrying out towing operations. The Towage Procedures document was due for review in October 2009.

Peterhead Port Authority had a risk assessment for towing operations, and this was required to be used as the basis for a task specific risk assessment covering the arrival of any towed barge into the port. This risk assessment was due for review in August 2009.

1.6.4 Previous arrivals of *Tak Boa 1*

The table below shows how the first four deliveries of Swedish rock were handled in the port. Environmental conditions were similar on each occasion, but 14 June was the first time that this combination of pilot, *Lucas, Ijsselstroom* and her crew had been used for the arrival of *Tak Boa 1.*

Date	12 May 2009	22 May 2009	1 June 2009	14 June 2009
Bow tug	*Boa Siw*	*Boa Siw*	*Boa Siw*	*Lucas*
Pilot	Pilot 1	Pilot 2	Pilot 1	Pilot 2
Stern tug	*Ugie Runner*	*Ijsselstroom*	*Ijsselstroom*	*Ijsselstroom*
Stern tug crew	Peterhead crew	Crew A	Crew B	Crew B

1.6.5 *Ugie Runner*

Ugie Runner is a 13m long, steel hull, twin screw vessel designed for towing and general harbour duties including lifting and plough dredging **(Figure 16)**. She was delivered to Peterhead Port Authority in June 2008.

Figure 16

Ugie Runner

Ugie Runner has an 8.5t bollard pull and incorporates a dynamic oval towing system (DOTS), developed by Mampaey Offshore in the Netherlands. The system consists of an oval shaped rail integrated in to the vessel's structure with free moving carriages on the rail supporting the towing installation. This allows the towing point to move 360º around the vessel and therefore reduces the angle of heel when the tug is subjected to high athwartships towline forces. DOTS significantly reduces the risk of *Ugie Runner* girting.

Having an awareness of the risks associated with girting, it was the harbourmaster who urged the board of Peterhead Port Authority to approve the expenditure to have their new harbour workboat fitted with DOTS.

1.6.6 Peterhead pilots

Peterhead Port Services employs three full time pilots, each working a rotation of approximately 2 days on duty followed by 2 days on stand-by for a period of 2 weeks, followed by 1 week on leave. The senior assistant harbourmaster is able to cover some pilotage duties if required.

Trainee pilots have to complete a specific number of vessel movements in different conditions and on different types of vessel, as observer and as pilot, prior to authorisation. They are also required to complete a ship simulator course which simulates port movements within Peterhead. The details of each training programme are individually tailored to the trainee's past experience.

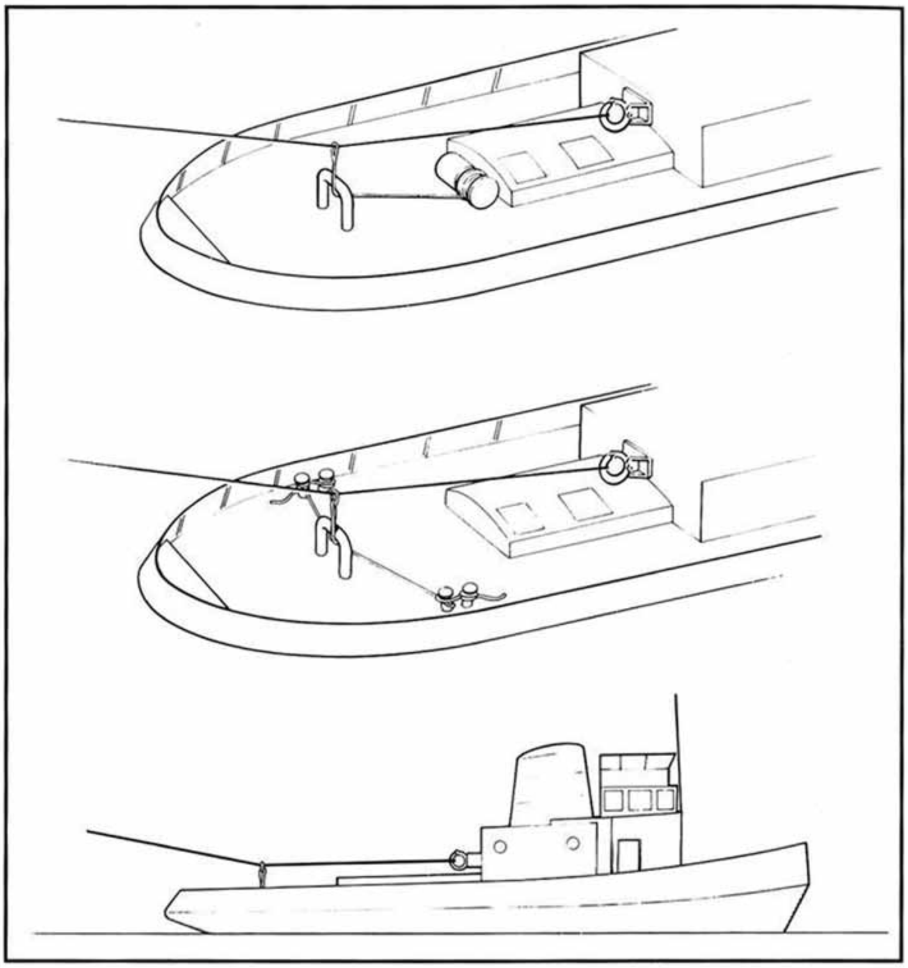
Pilots are authorised after passing an oral examination with the harbourmaster and senior pilot. Further refresher courses follow using a ship simulator or on manned models as the pilot's career develops.

1.7 USE OF BRIDLES, GOB ROPES AND STOP PINS

The use of a bridle, gob or gog rope is a method used to effectively move the tow point closer to the towing vessel's stern. This gives the skipper greater control of the tow and prevents the towline from being taken across the tug's beam, thus subjecting her to the danger of being capsized. Bridle wires are commonplace on conventional tugs in the UK, and are commonly used when a tug is running astern behind a vessel to act as braking / steering tug.

A bridle wire can be rigged in two ways **(Figure 17)**. Firstly by using a length of wire secured to the tug that passes through a fairlead or H-shaped bollard on the centre line of the work deck. The end of the wire holds a large shackle which is attached around the towline. The large shackle is free to slide along the towline. When the towline moves towards the tug's beam, the bridle wire comes tight and keeps the towing point aft and close to amidships.

Figure 17



Bridle arrangements

A second method of rigging a bridle wire is to have a separate gob rope winch with the bridle wire, or gob rope led through a central swivel at the aft end of the tug. Again, a shackle is used to slide along the towline. The winch is then used to vary the length of the gob rope. This cannot be done when the gob rope is under tension.

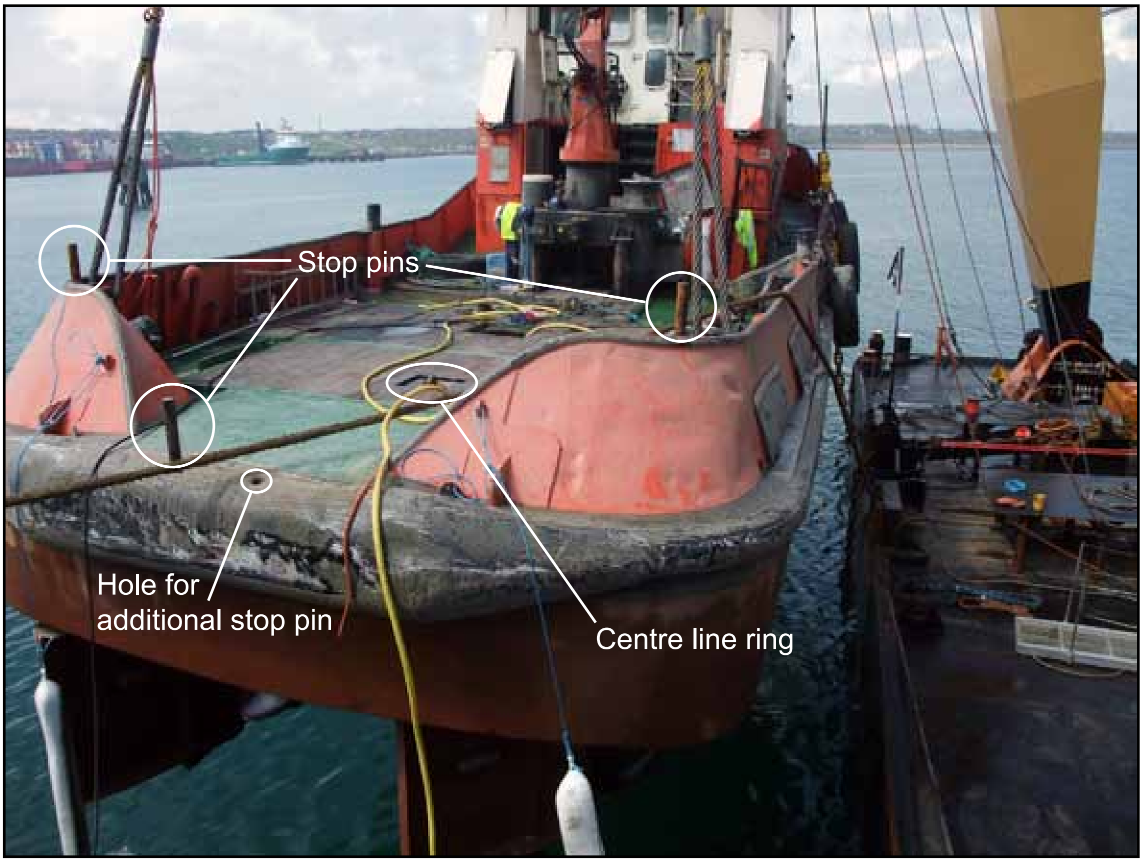
Ijsselstroom did not have a gob winch, centre line fairlead or H-shaped bollard, though she did have a ring through a centre line pad eye on the aft deck **(Figure 18)**. However, it is not known if this had sufficient strength to support a gob rope, and it had not previously been used for this purpose. *Ijsselstroom*'s skipper never used gob ropes and felt that they would hinder his ability to handle the tug.

Another way to prevent a towing wire moving on to the tug's beam is by using stop pins. These are normally found on both quarters and either side of the centre line at the after end of the working deck. They can be fixed, removable or hydraulically raised and lowered. *Ijsselstroom* had removable pins, but none were in use for the arrival of *Tak Boa 1* because the skipper felt that the lead of the towline would be too steep to make them effective. **Figure 19** shows port and starboard quarter pins rigged and ready for use, and one removable pin fitted to port of the centre line.

Figure 18

Centre line ring

Figure 19



Stop pins and centre line ring

1.8 SIMILAR INCIDENTS

Since 1998 MAIB has received seven reports of tug boats or workboats girting. Of these, two led to full investigations by MAIB.

On 8 September 1998, the workboat *Trijnie* was acting as a stern tug to the 7686 GRT tanker *Tillerman* for her manoeuvre to the entrance lock for Milford Docks. As *Trijnie* attempted a peel off turn, from where she was running on the tanker's starboard quarter to her port quarter, the towline became tight across the tug's port beam, heeling her over to port and allowing water over the after deck. Despite best efforts, the coxswain could not break out of the girting, and *Trijnie* capsized and sank with the loss of one life.

The investigation found that *Trijnie* did not have a gob rope or bridle wire rigged; the emergency tow release was not connected; the operations manager who assigned *Trijnie* did not know what towing mode she would use; and the pilot did not know that this was the first time that the skipper had undertaken such an operation.

On 19 December 2007, the tug *Flying Phantom* girted and sank with the loss of the lives of three of her four crew members. She was acting as a bow tug for the bulk carrier *Red Jasmine* during a transit of the River Clyde in thick fog.

The investigation's findings included: that the tug's emergency release system had not operated quickly enough; the tug's operators had no operational limits or procedures for operating in fog; the port risk assessment was poor; and the port did not have a suitable audit system in place to highlight any gaps in the SMS.

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 FATIGUE

Ijsselstroom's workload was not onerous and the local practice of extending the work shift from 12 to 18 hours, to facilitate the changeover between day and night working, was an arrangement that was popular with both of the vessel's crews. Analysis of the crew's work patterns in the days leading up to the accident indicates that in this case fatigue is unlikely to have been a factor.

The pilot worked a rotation 2 weeks of 2 days on duty and 2 days on stand-by. That 2 week period was followed by 1 week off duty. He had not been called out during his stand-by days, and had slept undisturbed prior to being called for the arrival of *Lucas.*

*Lucas'*s master was on duty 3 hours earlier than normal for the arrival in to Peterhead. However the previous days' records show he had a regular work pattern of 6 hours on duty and 6 hours off, and he had felt well rested.

Fatigue is not, therefore, considered a contributory factor in this accident.

2.3 STABILITY AND DYNAMIC CONTROL ISSUES

2.3.1 Scope of the Stability Studies

Two separate studies were undertaken to assist the investigation into the loss of *Ijsselstroom.* BMT Isis Ltd was commissioned to assess the hydrodynamic stability of the towing arrangement and the suitability of *Ijsselstroom* to act as the stern tug **(Annex B)**; the MAIB conducted an analysis of the static stability condition of *Ijsselstroom*: examining the circumstances of the capsize and subsequent foundering; and establishing the most likely loss mechanism for the vessel **(Annex C)**.

2.3.2 Directional stability of the towing arrangement

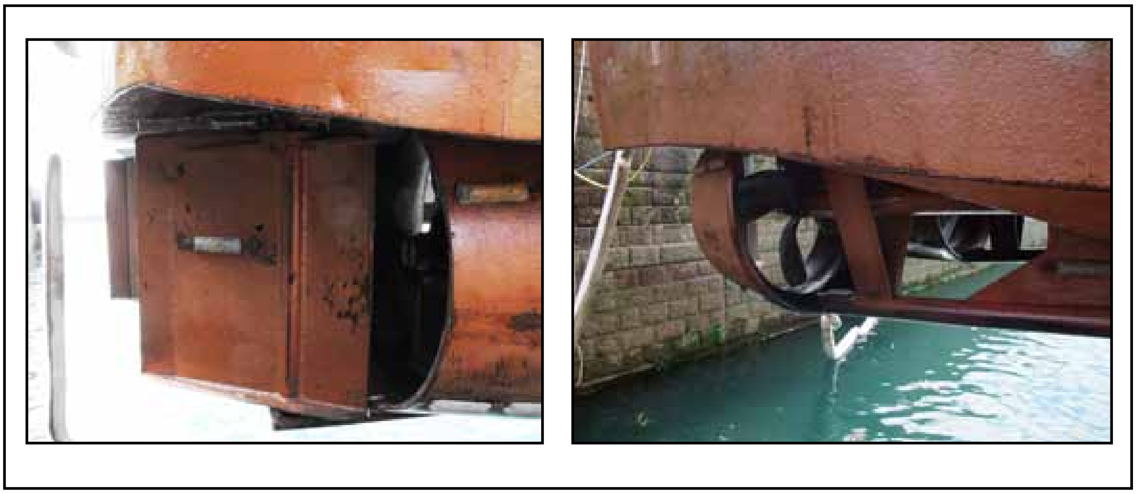
Tow stability can be improved in conventional tugs, such as *Ijsselstroom,* by using a bridle rope to shift the tow point aft. This achieves two, related effects. Firstly, if the tug is towing from a winch or hook positioned near the centre of the vessel and the propulsion is aft, once the pull of the tow and the direction of thrust become misaligned a destabilising couple is generated. The force generated will rotate the tug around its vertical axis until it is checked, either by using the rudder / propulsion system, or the couple disappears once the tug has turned through 180º. Using a bridle rope moves the effective towing point of the tug to a position between the tow and tug's propulsion, such that any misalignment of tow direction and thrust creates a moment that will resolve to realign the two. Secondly, on most tugs, use of a bridle rope reduces the distance between the point of application of the propulsive thrust and the tow point, and therefore reduces the magnitude of the destabilising couple or moment that they produce. *Ijsselstroom*'s skipper's decision not to use a bridle rope arrangement meant that as *Ijsselstroom* moved along astern of the barge, with her thrusters operating ahead, once the pull of the tow and the direction of the thrust became misaligned, the towline was producing a destabilising couple.

BMT confirmed that if *Ijsselstroom*'s propellers were thrusting ahead while the tug was moving astern, the propeller blades could stall[1] and the water flow over her rudders could become poor, compromising control. Loss of control could then result in the tug sheering to one side, usually athwartships, and so induce girting.

2.3.3 Hydrodynamic design of *Ijsselstroom*

BMT noted that the large A-frames that supported the ducts, the braces for the propeller shafts, the hard chine edges of the hull and the unbalanced rudder, all created underwater obstructions towards the stern of the vessel **(Figure 20)**. When moving astern, these obstructions could all have added to the destabilising moment, and the destabilising effect would increase as the speed astern increased.

Figure 20



Stern gear showing 'A' brackets, nozzles and rudders

1 A stall occurs when the water flow meets the rotating propeller blade at such an angle that it separates from the blade instead of travelling smoothly across it, resulting in a loss of thrust.

2.3.4 The final sheer

BMT used *Ijsselstroom'*s continuous heading changes and her movement from one quarter of the barge to the other over the last 2 minutes and 20 seconds of the operation, to demonstrate that the skipper had little control over the tug's yawing motion. The report suggests that to control the yaw in a fast changing situation by using twin screwing techniques with the engine driving ahead might have resulted in unsteady thrust, making control of the sheer more difficult. This situation would have been exacerbated as the speed of the tow increased. If one shaft had been used astern with the other turning ahead, control would have been compromised further still.

2.3.5 Girting

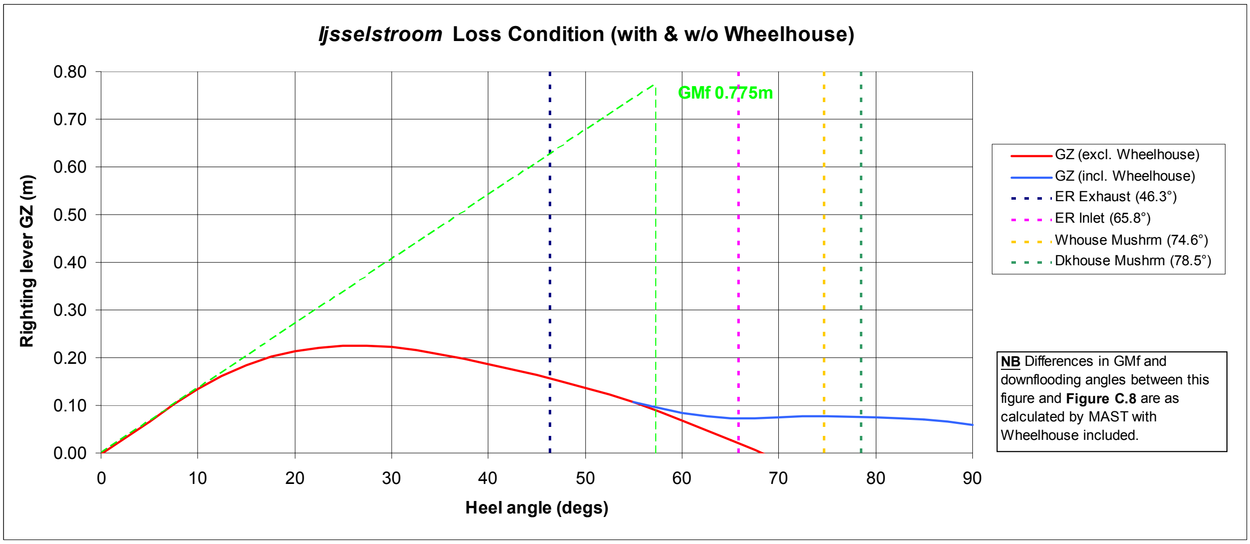
The BMT report states that the main elements acting on the tug at capsize would be the couple formed from the towline tension acting above the water, and the hydrodynamic forces resisting this as the tug moved laterally through the water. The report calculates that when *Ijsselstroom* girted she would have heeled to an initial angle of about 13º. Heeling to such an angle would be sufficient to cause deck-edge immersion and flood the freeing ports on the main deck. As the angle of the deck increased, so did the hydrodynamic resistance. This would have increased the heel further until the effect led to the eventual capsize.

2.3.6 *Ijsselstroom's* intact loss condition

Computer modelling of *Ijsselstroom*'s intact loss condition was undertaken and the points of deck edge immersion, downflooding points and angle of vanishing stability identified.

Ijsselstroom had a very low freeboard, and it was calculated that the aft working deck would have become immersed at an angle of only 7.6º. The first major downflooding point was the starboard engine room exhaust at 46.4º; the second was the inboard face of the starboard funnel at 65º; the third was the wheelhouse mushroom vents at 73.2º; and the fourth was the deckhouse mushroom vents at 75.7º. The angle of vanishing stability, that is the angle at which the vessel would capsize and not be able to right herself, was found to be 67.9º. However, at further angles of heel the volume of the deckhouse acted to provide a righting moment **(Figure 21)**.

Figure 21



Righting lever curve

2.3.7 Hypothesis

Amalgamating the findings of the BMT Isis and MAIB studies creates a credible set of circumstances that probably led to the foundering of *Ijsselstroom.*

The towing arrangement of a conventional tug acting as stern tug, while towing over the stern and from a towing point amidships without the use of a bridle rope, created an inherently unstable situation.

The skipper's ability to control *Ijsselstroom* and correct any sheer was severely hampered by the lack of effectiveness of the propellers and rudders when moving astern with her engines turning ahead. The higher the tow speed the more difficult this would become as the propeller blades stalled, rudders became unbalanced and ineffective, and the underwater area aft was acted upon by the flow of water. As the speed of tow increased, *Ijsselstroom*'s skipper needed increasing amounts of thrust to control the vessel's direction. It is likely that he either ran out of effective thrust or, given the poor ergonomics of the engine and rudder controls for operating astern, it is possible that he made an incorrect control movement that exacerbated a turn instead of countering it (see 2.4.1).

When the final sheer to starboard led the towline over *Ijsselstroom*'s starboard beam, she would have needed to heel only a few degrees to submerge the edge of the working deck **(Figure 7)**. This would have increased the hydrodynamic forces on the hull, causing a greater angle of heel. This effect would have escalated rapidly, submerging the freeing ports, then the funnel intakes and the mushroom vents, allowing downflooding at an angle of a little over 46º.

Survivors recall *Ijsselstroom* heeling over to more than 90º, then righting herself to "about 30º", before finally heeling over again and sinking by the stern. MAIB's view is that, more probably, *Ijsselstroom* was heeled to an angle of about 90º by the towline, with downflooding commencing as the vessel passed 46.4º. With the vessel at 90º, the hydrodynamic drag would have been such as to cause the towline to part. The buoyant volume of the deckhouse then caused the vessel to partially right itself. It has been calculated that *Ijsselstroom* would have needed to have been held over on the towing wire for as little as 10 seconds for sufficient water to enter the engine room to settle the tug at a free floating angle of 46.4º. From this angle the engine room would have continued to fill with water, and this accounts for the final bow up position of the tug, which she held for at least 12 minutes before finally sinking **(Figure 9)**.

2.4 *IJSSELSTROOM*'S WHEELHOUSE CONTROLS

2.4.1 The conning position

Van Wijngaarden Marine Services gave no instruction or guidance to skippers regarding the conning position or use of controls on board *Ijsselstroom* when making sternway and towing over the stern. The skipper recalls that when he observed other skippers during his training period, each had their own preference. Some would sit facing forward, others swivelled the chair and sat facing aft, and some would stand.

Due to the layout of the wheelhouse, all three methods had positive and negative points.

- Sitting with the chair facing aft would have been the easiest way to monitor the barge, the towing wire and the tug's attitude. However, there was no rudder indicator at the aft end of the wheelhouse and because the skipper would have been controlling the rudders using the self centring joystick on the left arm of the chair, he would have needed to look over his shoulder to check their position. A further complication would be that moving the joystick towards one side of the vessel or the other would generate the reciprocal effect to that with the chair facing forward. This would have been, at best, confusing. However this did not seem to be an issue when making fast because the rudder was little used. Finally, it is unlikely that the handset lead of the VHF, used to communicate with the pilot, would have stretched far enough for the skipper to use from the seat when fixed in the aft facing position.

- Standing facing aft but with the chair facing forward would have made it easier for the skipper to check the instrumentation and VHF communication. However, his view of the tow might have been obscured by the chair back if not fully reclined **(Figure 6)**.

- Sitting with the chair facing forward, as he chose to do, allowed the skipper the best view of his instruments, and gave the best access to the controls and bridge equipment. However it required him to almost constantly be looking over his shoulder in order to monitor the tow. This would not have been easy and might have delayed his realisation that *Ijsselstroom* was beginning to yaw or that the towing line had moved off *Ijsselstroom*'s centre line.

Although *Ijsselstroom* had a well equipped wheelhouse, when operating astern it was not easy to monitor both the vessel's position and the controls, and the configuration of the controls increased the risk of the operator making an incorrect control movement. Had more thought been given to the ergonomics of operating the steering and engine controls while travelling astern, it is possible that the early signs of the girting could have been recognised more quickly, and remedial actions required of the skipper made easier to execute.

2.4.2 The emergency brake release

*Ijsselstroom'*s skipper reported that he had not received any guidance or instruction on whether to use "winch mode" or "freewheel mode" when engaged in towing operations, nor had he discussed with other skippers any scenarios when he might have needed to use the emergency brake lift. He also had never tested or witnessed the effect of operating the "emergency brake lift" button, and erroneously believed that its operation would remove all power from the system, instead of releasing the brake and allowing the towing wire to pay out.

It was not possible to test the operation of the towing controls and emergency brake lift systems following the vessel's salvage. However it is considered probable that had *Ijsselstroom* been towing in "freewheel mode", against the brake, and had the skipper been familiar with the operation of the emergency brake lift, he would have been able to release the towline quickly enough to prevent the tug from girting.

2.5 METHOD STATEMENTS, RISK ASSESSMENTS AND BRIEFINGS

2.5.1 Peterhead Port Authority Towing Procedures document

Section 10.5.19 of the PMSP detailed a flowchart showing how Peterhead Port Authority's SMS ensured compliance with the PMSC **(Annex D)**. A component of the flow chart was the use of risk assessment.

Several documents had been produced to aid risk assessment in Peterhead. The "Towing Procedures" document **(Annex A)** was the responsibility of the harbourmaster, and was reviewed on an annual basis. This stated that *"The following guidelines and procedures should be considered when making risk assessment and before carrying out towing operations"*. It went on to say that when towing barges *"a specific assessment will be made using the existing risk assessment as a basis".*

The Towing Procedures document mentioned the use of harbour tugs from other European ports, but focused on the capabilities of larger tugs with Voight Schneider or tractor type propulsion systems rather than the smaller conventional tugs such as *Ijsselstroom.* Assumptions were made about the capability of *Ijsselstroom*. The harbourmaster had visited the vessel when she first arrived, and witnessed one towing operation from *Ugie Runner*. However he met only one crew, and no information was passed to the other crews. The pilot had not visited either *Ijsselstroom* or *Marineco India.*

The last review of the Towing Procedures document occurred some months after Peterhead Port Authority had taken delivery of the specialist workboat *Ugie Runner.* However, no mention was made of her in the section that listed specific vessels likely to be used for towing operations within the port. *Ugie Runner*'s 360 degree oval towing system had been used successfully for the first arrival of *Tak Boa 1,* and trials had demonstrated that such a tug was impossible to capsize due to girting. Had a risk assessment been carried out in conjunction with an updated Towing Procedures document, it is probable that *Ugie Runner* would have been recognised as the most suitable tug for the task.

2.5.2 Peterhead Port Authority Generic Towage Risk Assessment

The generic towing risk assessment **(Annex E)**, referred to in the Towing Procedures document, required the pilot and each tug skipper to discuss the impending operation, and agree the towing position of each towing vessel in relation to the vessel being towed. It also required that copies of the risk assessment be placed on each vessel involved. Prior to the first entry of *Tak Boa 1,* such a discussion did take place between the pilot (not the duty pilot on 14 June) and the skipper of *Ugie Runner*, the vessel which was to act as stern tug. No evidence could be found that risk assessments and briefings had occurred prior to the entries of *Tak Boa 1* on 22 May and 1 June 2009.

No briefing was held between the pilot and the skipper of *Ijsselstroom* prior to *Tak Boa 1*'s arrival on 14 June. Had such a discussion taken place it is likely that *Ijsselstroom*'s skipper would have alerted the pilot to his tug's limitations while running astern at speeds in excess of 2 knots. This, in turn, would have made the pilot aware of *Ijsselstroom*'s intention to run astern behind *Tak Boa 1* and perhaps raised his awareness of the risk of the tug girting. Due to the barge of rocks obstructing the view of *Ijsselstroom* from the wheelhouse of *Lucas,* the pilot was never aware whether the stern tug was towing over the stern or over the bow.

The generic risk assessment of towing operations also underestimated the severity of the hazard posed by girting. It stated the consequence of such an event to be "minor injuries" when a more accurate assessment should have been "multiple deaths". This would have changed the residual risk rating.

2.5.3 Peterhead Port Authority Specific Barge Risk Assessment

The Peterhead Port Services Towing Procedures document **(Annex A)** contained instructions that barges arriving at Peterhead should also have a specific risk assessment made using the existing generic towing risk assessment as a basis. On this occasion, neither a generic nor a specific risk assessment was made.

2.5.4 Westminster Dredging Company

Prior to the first delivery of Swedish stone, WDC's safety manager had travelled to Sweden to brief the master of the tug *Boa Siw*. He gave him a general health and safety induction regarding the project site, passed on a Peterhead port guide, tidal data and a project information sheet. Specific manoeuvring of the barge was not discussed, but *Boa Siw*'s master was informed of the tugs and workboats that would be available.

WDC received only 3 days notice of the change of tug from *Boa Siw* to *Lucas* for the fourth delivery of stone. This prevented WDC's safety manager from providing a brief to the new tug's master. In effect, the only brief provided to the master of *Lucas* was the instruction from his vessel's owner to tow *Tak Boa 1* to Peterhead pilot station.

2.5.5 *Ijsselstroom*

Van Wijngaarden Marine Services did not provide training and relied on the individual knowledge and experience of its skippers to safely carry out each operation its vessels were engaged in. It did not require them to carry out a formal risk assessment or briefing.

Ijsselstroom's skipper had not been given the Peterhead Towing Procedures guide, and he had not met with the pilot to discuss the barge entry. The skipper made no attempt to contact the pilot to discuss *Ijsselstroom*'s role in the arrival of *Tak Boa 1.*

The skipper was unaware that it was preferable for the barge to pass the breakwater during slack water, or that *Lucas* was a single screw conventional tug. Discussion of these issues with the pilot would almost certainly have identified the possibility that the tow speed on approach to the bay could be higher than on previous occasions. This in turn could have prompted *Ijsselstroom*'s skipper to volunteer information about his own speed constraints, triggering a discussion about towing methods.

SECTION 3 - CONCLUSIONS

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

- The lack of a bridle rope meant that once the pull of the tow and direction of thrust became misaligned, there was no physical barrier to prevent the towline leading dangerously on the beam. In this position, as *Ijsselstroom* made sternway with her propellers thrusting ahead, the towline produced a destabilising couple. (2.3.2)

- Operating *Ijsselstroom*'s engines ahead to control the tug's motion as she moved stern-first through the water behind *Tak Boa 1* became progressively less effective as the speed increased, due to: the tendency for the propeller blades to stall, resulting in reduced or unsteady thrust; reduced water flow over the rudders; and the destabilising moment generated by the significant underwater structure at the tug's stern. (2.3.2, 2.3.3, 2.3.4)

- *Ijsselstroom*'s deck-edge would have immersed at an angle of heel of only 7.6º. This would have increased the hydrodynamic resistance that opposed the towline tension, further increasing the angle of heel until the tug capsized. (2.3.5)

- *Ijsselstroom* would only need to have been held over for a period of about 10 seconds for sufficient water to enter the engine room to settle the tug at a free floating angle of 46.4º. At this angle the starboard exhaust flooding point would have been submerged and the engine room would have continued to flood until the tug eventually sank. (2.3.7)

- Van Wijngaarden Marine Services gave no instruction or guidance to its skippers regarding the benefits or hazards associated with towing in "winch mode" against "freewheel mode". (2.4.2)

- *Ijsselstroom*'s skipper was unfamiliar with the emergency brake release system and had not tested it or witnessed its effect. (2.4.2)

- The pilot and *Ijsselstroom*'s skipper did not discuss the entry of *Tak Boa 1* prior to the barge's arrival. (2.5.2)

- Neither a generic, nor the required specific, risk assessment was carried out by the pilot prior to *Tak Boa 1*'s arrival. (2.5.3)

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

- Van Wijngaarden Marine Services gave no instruction or guidance to its skippers regarding the conning position when towing over the stern and making sternway. *Ijsselstroom*'s skipper's decision to sit facing forward and monitor the tow by looking over his shoulders might have made it difficult for him to recognise the early stages of girting. (2.4.1)

- Although *Ijsselstroom* had a well equipped wheelhouse, had more thought been given to the ergonomics of conning while travelling astern, it is possible that the early signs of the girting could have been recognised more quickly and remedial actions required by the skipper made easier to execute. (2.4.1)
- Peterhead Port Authority made assumptions about the capability of *Ijsselstroom*. (2.5.1)
- Van Wijngaarden Marine Services did not require its skippers to undertake a risk assessment or briefing prior to any towing operation. Consequently the skipper of *Ijsselstroom* did not meet or attempt to make contact with the pilot prior to the entry of *Tak Boa 1,* and was therefore unaware that the tow speed was likely to be higher than on previous occasions. (2.5.5)

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

- *Ijsselstroom*'s crew were working an 18 hours shift. (2.2)
- Peterhead Port Authority's Towing Procedures Document had not included the specialist tug/workboat *Ugie Runner* in the latest revision. Had an up to date version of this document been consulted during a risk assessment for the barge entry, it is probable that *Ugie Runner* would have been recognised as the most suitable tug for the task. (2.5.1)
- Peterhead Port Authority's generic towage risk assessment underestimated the severity of harm for a tug girting. (2.5.2)

SECTION 4 - ACTION TAKEN

Peterhead Port Authority has:

- Revised its Towing Procedures Document to include *Ugie Runner*
- Revised the generic towage risk assessment to increase the severity of harm due to a tug girting, from minor injuries to multiple deaths.

Van Wijngaarden Marine Services has:

- Tasked its Technical Director to brief all crews on the operation of the towing winches.
- Instructed its skippers to ensure that they have a full briefing with the site manager regarding the working procedures to be employed.

Westminster Dredging Company Ltd has:

- Directed that its subcontractors stop the local practice of 18 hours shift periods.
- Issued a memo reminding project managers and works managers of their duty to monitor the working time of sub-contractors, and stated that it will prioritise this area in forthcoming company audits.
- Declared its intention to promulgate the findings of this report.

The **British Tugowners Association** (BTA) and **National Workboat Association** have been developing, with the **Maritime and Coastguard Agency** (MCA), towage endorsements for holders of Boatmasters or other certificates that wish to operate harbour and inshore tugs; and in addition the BTA is revamping the STCW II/3 Tug Masters' and Tug Watchkeepers' qualifications (MGN 209) in co-operation with the MCA and the Merchant Navy Training Board. Their target is for a unified qualification, which serves both Boatmaster and STCW certificate holders, to be available from Spring 2010. Although the towage endorsements will be voluntary for Boatmasters' certificates, they are expected to become the industry standard for tug operators in the UK.

SECTION 5 - RECOMMENDATIONS

Van Wijngaarden Marine Services is recommended to:

2010/103 Develop a training programme that ensures that its skippers fully understand:

- The control issues and hazards associated with a conventional tug acting as a stern tug.
- The benefits of using a bridle rope.
- The capabilities and limitations of the towing winch operating modes, and the use of their associated safety systems.

2010/104 Review its fleet and identify tugs that are unsuitable to make sternway while acting as a stern tug due to:

- Low freeboard and the possibility of the tug shipping water at speed or low angles of heel.
- Sub surface stern clutter adding to a destabilising moment.
- Poor ergonomics making it difficult to monitor the tow and easily control the tug at the same time.

2010/105 Introduce a system of risk assessments and briefings to be used by its tug skippers as standard operating procedures prior to engaging in towing operations.

Peterhead Port Authority is recommended to:

2010/106 Ensure when tugs are assigned to work within the port, the working procedures and limitations of the vessels are fully assessed before allowing them to commence operations.

2010/107 Introduce a system that audits actual working procedures against those laid down in the port's SMS. This should in particular focus on the effectiveness and scope of risk assessments and briefings.

UK Major Ports Group/British Ports Association and **British Tugowners Association** are recommended to:

2010/108 Promulgate this report and the lessons learned to their members.

Marine Accident Investigation Branch
April 2010

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