

**A report on the investigation of the capsizing and
foundering of the workboat/tug
Trijnie
with the loss of one life
in the approach channel to Milford Docks,
Milford Haven, on 8 September 1998**

Marine Accident Investigation Branch
First Floor Carlton House
Carlton Place
Southampton
SO15 2DZ

**Extract from
the Merchant Shipping
(Accident Reporting and Investigation)
Regulations 1994**

The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the causes with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

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GLOSSARY OF ABBREVIATIONS

| | |
|-------|--|
| DETR | Department of the Environment, Transport and the Regions |
| EPIRB | Emergency Position Indicating Radio Beacon |
| GPS | Global Positioning System |
| gt | Gross tonnage |
| kW | kilowatts |
| m | metres |
| MAIB | Marine Accident Investigation Branch |
| RNLI | Royal National Lifeboat Institution |
| UK | United Kingdom |
| UTC | Universal Co-ordinated Time |
| VHF | Very High Frequency (radio) |

SYNOPSIS

Trijnje, a 15.7m long workboat/tug, capsized at about 0744 (UTC+1) on 8 September 1998 while assisting the 7,686 gt tanker *Tillerman* to enter the lock for Milford Docks. The MAIB was notified shortly after the accident by Milford Haven Port Authority. Captain P Kavanagh carried out the investigation.

Tillerman was to move the short distance from No3 berth at the Texaco oil refinery across the Haven to the entrance lock for Milford Docks. Before letting go from the berth, the pilot decided *Trijnje*, one of the two tugs that were to assist in the move, should be the stern tug as she had the greater bollard pull. *Trijnje* was made fast by placing the eye of one of the ship's mooring lines on to her towing hook, while the other end was made fast to a set of bitts on *Tillerman*'s poop deck. The ship let go from the berth and made her way to the approach channel for the lock. With an easterly setting tidal stream across the channel, the pilot warned *Trijnje*'s coxswain that he would need her on the ship's port quarter as she entered the lock. To prepare for this the coxswain decided to make a peel-off turn from where *Trijnje* was running on the ship's starboard quarter. The tug altered course to starboard but after turning through between 60° and 90°, she would not turn any further. Instead, the tug began to heel to port and started to take water over the after deck. Despite trying to turn to port, the tug's heel increased and more water was taken on board. The coxswain left his helm position in the wheelhouse, went to the aft door where his crewman was standing and told him to abandon the tug. The coxswain then climbed over the starboard side and jumped into the water. The tug capsized very shortly afterwards.

The capsizing was seen by a number of people and, having been alerted to the accident, many craft sailed to the scene. The coxswain was picked up very quickly and he told his rescuers a crewman had been with him on the tug. A surface search for the missing crewman was started. *Trijnje*, although held temporarily with her bows out of the water by a large harbour tug, eventually foundered. The body of the crewman was retrieved from *Trijnje* when she became partially exposed at low water.

The investigation found that *Trijnje* had been tasked as a one-off stand-in for another tug which usually carried out this type of operation. It found that the coxswain had not been trained to operate her as a stern tug with a ship making significant headway, and that *Trijnje* had never acted as such in Milford Haven. There was no gog rope in place on the tug, which was essential for a safe peel-off manoeuvre. The emergency trip wire to the towing hook was not connected. The operations manager who assigned the tug did not know what towing mode would be employed for *Trijnje*, and the pilot did not know that the coxswain had never carried out this type of operation before. The pilot could not see the tug from the bridge and assumed that she had been running with the ship stern-to-stern, from which position it would have been relatively easy for the tug to position herself on the ship's port quarter.

A number of recommendations have been made.



*Trijn*ie partially submerged at low water, prior to her salvage



SECTION 1 - FACTUAL INFORMATION

1.1 VESSEL AND INCIDENT DETAILS

1.1.1 Vessel details

| | | |
|------------------------|---------------------------------------|-----------------------------|
| Names | : <i>Trijnie</i> | <i>Tillerman</i> |
| Registered owner | : Maritime Craft Services (Clyde) Ltd | James Fisher and Sons plc |
| Manager | : Delta Catalytic (UK) Ltd | - |
| Port of registry | : Ardrossan | Gibraltar |
| Flag state | : UK | Gibraltar |
| Built | : 1976, at Gorinchem, the Netherlands | 1975, at Gothenberg, Sweden |
| Construction | : Steel | Steel |
| Classification Society | : Bureau Veritas | Det Norske Veritas |
| Type | : Workboat/tug | Petroleum products tanker |
| Length overall | : 15.70m | 142.48m |
| Gross tonnage | : 38 | 7,686 |
| Maximum draught | : 2.28m | 8.62m |
| Engine power | : Two engines each of 275kW | 4,266 kW |

1.1.2 Incident details

| | | |
|----------------------|-------------------------------|------------------|
| Injuries to persons | : One fatality One injury | None |
| Damage | : Superficial, waterlogged | None |
| Pollution | : Light oil sheen | None |
| Location of incident | : Approaches to Milford Docks | |
| Time and date | : 0744 (UTC+1) | 8 September 1998 |

1.2 NARRATIVE

(All times are UTC + 1 hour)

1.2.1 The events leading up to the capsize and foundering

Arriving from Belfast in ballast, *Tillerman* berthed at the Texaco oil terminal, Milford Haven, on the evening of Monday 7 September 1998. Once the ship had been made fast at No 3 berth, the master called Milford Haven Port Control and booked a pilot for 0645 the next morning. The ship was to move directly from the berth to the dry-dock in Milford Docks.

During Monday, an operator of the tug *Seamaid* asked the operations manager of Delta Catalytic if *Trijnie* would be available to assist in the *Tillerman* move the next morning. *Seamaid* (with a single fixed propeller and a bollard pull of 6.5 tonne) usually assisted ships to enter Milford Docks but was committed to other work. Texaco confirmed that *Trijnie* was not being used in ship movements for the period of the proposed move for *Tillerman*, and Delta Catalytic's operations manager then informed *Seamaid's* operator that *Trijnie* would be free for the *Tillerman* move.

Early on the morning of Tuesday 8 September, the day shift coxswain for *Trijnie* reported for work at the Delta Catalytic's offices in Pembroke Dock. From the job allocation board he saw that *Trijnie* was to assist *Tillerman*, and was taken by van to the Texaco oil terminal to begin his shift at 0700. On boarding *Trijnie*, he relieved the night shift coxswain and was joined by his crewman. The coxswain went to the engine room to make his routine checks. Returning to the wheelhouse, he tested the engines ahead and astern. The coxswain did not check the towing hook, a task which he assumed his crewman would undertake. Neither man was wearing a personal buoyancy aid.

The pilot who had berthed *Tillerman* the evening before was appointed to move the ship to dry-dock. With high water at 0814 and the tides on springs he sought to enter the lock at slack water because the *Tillerman's* breadth was close to the width of the lock. With the tide running across the entrance, the entry would have been difficult, at any other time. The draught of the ship was 3m forward and 5.1m aft.

Joining *Trijnie* for the move was the small tug *Neptune*, which had Voith Schneider propulsion and a bollard pull of 3.6 tonne. The pilot decided to use *Trijnie* as the stern tug, as she had the greater bollard pull of 7.4 tonne. The ship had a high dead slow speed of 5 to 6 knots and he wanted to use *Trijnie* to slow the ship down and to assist steerage when entering the lock. The pilot informed *Neptune* she was to stand-by in Milford Docks, where she was to be used to help to manoeuvre the ship into the dry-dock, and that *Trijnie* would be the stern tug.

As the manoeuvre would be at about high water, the lock gates were to be open to allow the ship to pass straight through into the dock.

As directed by the pilot (on the tug/ship VHF radio working frequency of channel 8, which was not being recorded by Port Control), *Trijnie* made fast to *Tillerman* by placing the eye of a ship's mooring line on the towing hook sited just aft of the wheelhouse. On board the ship, the line was led through the centre lead on the poop deck and made fast to a set of mooring bitts.

The ship began singling up at 0718. The pilot was accompanied on the bridge by the master. There was no helmsman. The third officer had two able seamen working with him at the aft mooring station.

Tillerman let go from the berth at 0736 and, on dead slow ahead, turned in a shallow curve to starboard across the Haven to the lock approach channel. *Trijnie* ran close on the ship's starboard quarter. The coxswain ensured that there was no weight on the line to affect the ship's steering. From his position on the bridge, the pilot could not see *Trijnie*.

Once in the approach channel, the pilot called *Trijnie* on VHF radio to warn the tug that he would need her on the ship's port quarter when the ship entered the lock. The coxswain thought the pilot had said he wanted *Trijnie* to push up with the bow on the ship's port quarter. As the coxswain knew this manoeuvre would be difficult to execute while still made fast to the ship, he warned the pilot that he was still attached (**Figure 1**). The pilot thought that the tug was running stern-to-stern to the ship. He did not understand the point of the coxswain's message and repeated his warning. The coxswain decided to manoeuvre the tug around to the ship's port quarter, by turning the helm to hard-to-starboard with the port engine on full ahead and the starboard engine on full astern. This began a peel-off manoeuvre with the tow line still secured.

When the tug had peeled-off to a point where her heading was between 60° and 90° from the ship's, the coxswain found she would not turn any further. With the tow line taking the weight on the port beam *Trijnie* began heeling to port (**Figure 2**). The coxswain initially retained his rudder angle and engine movements but soon afterwards, water began to flow over the after bulwarks. He reversed the engines and helm to bring the tug back to port but as soon as he had done so, he saw water starting to pour into the wheelhouse. He left the helm position, went to the aft door where his crewman was standing and told him to abandon the tug. The coxswain then climbed over the starboard side and jumped into the water.

From his vantage point on the aft mooring station, the third officer of *Tillerman* could see two men inside the tug's wheelhouse. When the tow line became tight, he saw the coxswain quickly turn the wheel to port as water began to spill over the port bulwarks. As the tug increased her heel to port the third officer realised that *Trijnie* was about to capsize. He called out a warning on his hand-held radio set. One of the seamen with the third officer threw a lifebuoy into the water. After hearing a number of repeated calls on the radio, the master and pilot registered what was happening and went to the starboard bridge wing. They saw the tug had capsized but was still made fast to the ship by the tow line. The ship's engine was stopped.

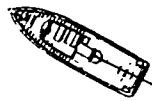
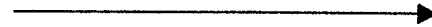
Approximate direction of wind (Force 5)
and tidal stream (less than 1 knot)



Pilot's anticipated position of
Trijnie towing on the ship's
port quarter

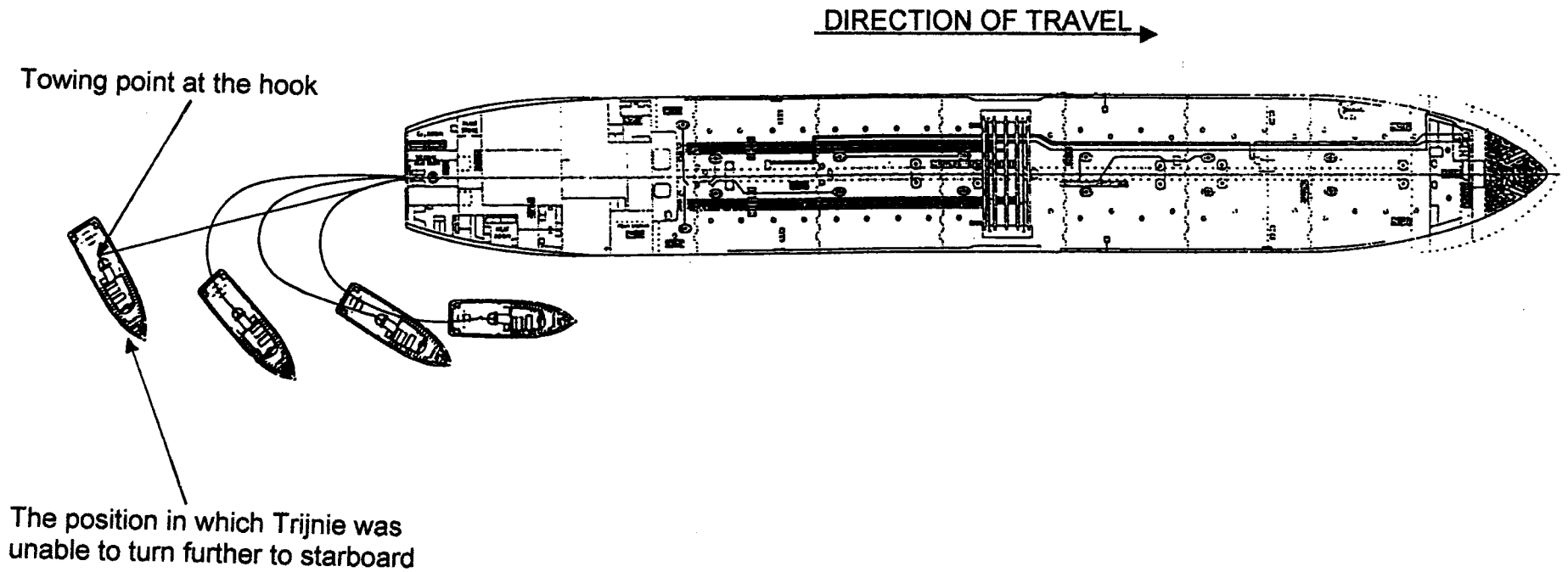
Coxswain's anticipated
position of *Trijnie* pushing on
the ship's port quarter

DIRECTION OF TRAVEL



Trijnie running alongside *Tillerman's*
starboard quarter

Approximate positions of *Trijnie* in relation to *Tillerman*
(Tug and ship to scale)



Trijnie making her peel-off manoeuvre to starboard without a gog rope
(Tug and ship to scale)

1.2.2 The rescue operation

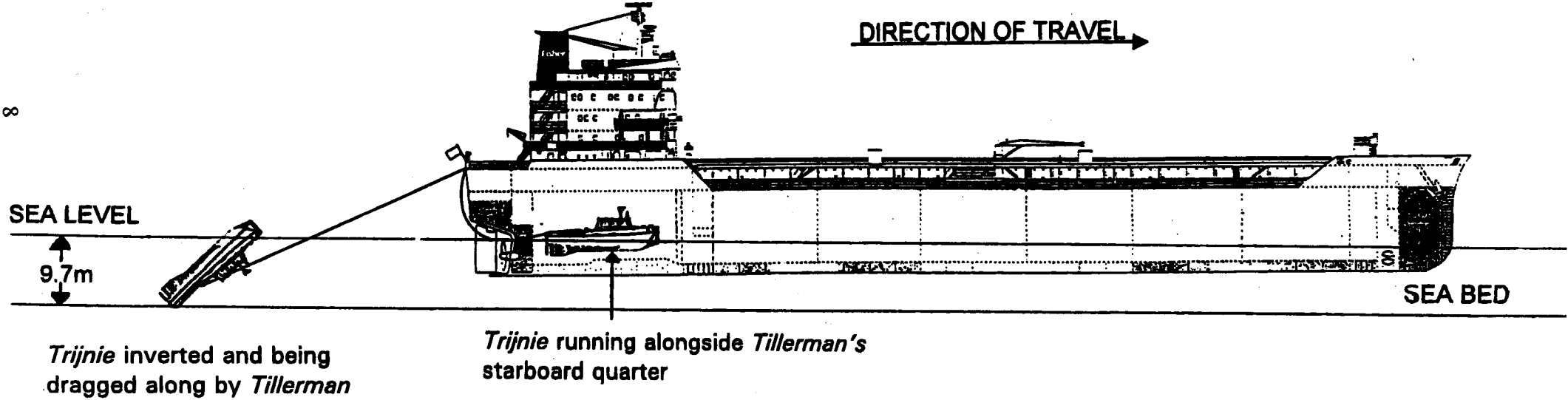
At 0747 the pilot informed Port Control that *Trijnie* had capsized and that it was an emergency situation. As the Port Control building overlooked the approach channel, one of the watch officers could see the capsized tug. The duty harbour tug *Anglegarth* was called but she had already heard the initial exchange and was reacting. The tug *Neptune*, still waiting for *Tillerman* in the dock, did likewise.

Milford Haven Coastguard was informed of the incident and the deputy district controller decided that Port Control should continue to co-ordinate the search and rescue operation as they were already in communication with the rescue vessels and could see the accident scene.

After jumping overboard, the coxswain submerged and became caught in the tug's turbulence. When he eventually surfaced, he saw *Trijnie* about 40 metres away.

At 0748 Port Control called the two pilot launches *Llanstadwell* and *Hakin*, and instructed them to head towards the accident scene. At 0750 the ambulance service was called to go to the Pier Head. At 0751 Port Control informed the launches that someone was in the water. At 0755 *Hakin* informed all stations that *Llanstadwell* had rescued a survivor from the water. On board the pilot launch, the coxswain informed his rescuers that there had been a crewman with him and this information was relayed to all stations. At 0805 the coxswain was landed ashore to an ambulance.

Following her capsize, *Trijnie* had taken up an inverted bows-up attitude. The mooring line, on which there was a lot of weight, was still attached to the ship (**Figure 3 and Photographs 1 and 2**). The pilot and Port Control discussed the implication of letting go the mooring line and whether the tug would sink. By this time fire brigade divers had been called to the scene to search the tug for the missing crewman. It was then suggested that *Anglegarth* could take over from *Tillerman* to keep *Trijnie*'s bow above water pending the arrival of the divers.



Profiles of *Trijnie* and *Tillerman*
(Tug and ship to scale)



1. *Tillerman* and *Trijnie*, with the latter in the capsized position



2. *Trijnie* in the inverted bows-up position

A rope from *Anglegarth's* bow was connected to *Trijnje* at 0805 but it was decided that the tow line from *Tillerman* to *Trijnje* should remain secure as a precaution. The divers arrived on scene.

At 0815 the mooring line from *Tillerman* to *Trijnje* freed itself. The ship had been making a slow turn to port and, now clear of the tug, she was able to clear the channel and make her way to an anchorage.

In the meantime, a number of small craft, including the RNLI lifeboat, had started searching for the missing crewman to the east of the approach channel. It was recognised, however, that the crewman could still be on the partially floating *Trijnje*.

At 0825, when a second rope from *Anglegarth* was being made fast to the tug, the first one parted. The divers, who were on board *Anglegarth* would not dive on *Trijnje* until a second rope had been made fast. This was achieved at 0832 (Photograph 3).



3. *Anglegarth*, close to the stern of *Tillerman*, with a line fast to *Trijnje*

Trijnje sank at 0836 with much weight on the lines to *Anglegarth*.

At 0857 rescue helicopter R169 was scrambled from Chivenor.

At 0908 the search and rescue operations were handed over from Port Control to Milford Haven Coastguard. As the tide ebbed, the surface search for the missing crewman was moved to the west of the approach channel.

At 0924 a diver entered the water and following a line still attached to *Trijnje*, found the tug upright and level on the seabed with a slight port list. The visibility was about 1 metre. He made his way around the wheelhouse until he found the aft door. Because of the debris there he could only go in about half his body length. After securing the wheelhouse door with rope, he checked the after deck, found one of the hatches fully open and closed it before returning to the surface. He returned briefly to attach a buoy to the tug but the rate of the ebb tide prevented further dives.

At 0926 rescue helicopter R169 arrived on scene and a fireman, with a thermal imaging camera, boarded to assist the search. At 0938 police helicopter PH12 joined the search.

As the tide ebbed, *Trijnje* became visible. Just before two fire brigade divers boarded the partially submerged tug at 1224, a body was seen inside the cabin on the starboard side. The divers managed to retrieve the body and place it on board a rescue boat.

At 1238 all search operations were terminated and all units were stood down.

Trijnje was salvaged and refloated later that day and taken into Milford Docks.

1.3 TRIJNIE

1.3.1 Prior to working at Milford Haven

Trijnje was bought in 1983 by Maritime Craft Services (Clyde) Ltd. Prior to her bareboat charter to Delta Catalytic (**Section 1.3.2**) she performed towing and seabed levelling duties. For her former towing duties, she was used in the following modes:

- short tow line - using the vessel's towing hook;
- long tow line - using the vessel's towing hook with no gog rope;
- alongside tow - using lines from a combination of forward, shoulder and aft bits; and
- stern tug - using the vessel's towing hook and gog rope.

In the last mode, *Trijnie*'s gog rope was rigged from one set of bitts, through the stern roller, around the tow line, back through the roller and then to the set of bitts on the other side.

No modifications were made to the tug before her bareboat charter to Delta Catalytic.

She was registered with the DETR's Marine Safety Agency (now Maritime and Coastguard Agency) and had been issued with loadline and safety equipment certificates for her class of vessel (VIII A). Her safety equipment included:

lifejackets;

fire extinguishers;

first aid kit; and

EPIRB

She was also equipped with a Decca navigator, GPS set, depth sounder, radar, helm indicator, magnetic compass and VHF radio.

1.3.2 At Milford Haven

After an accident involving the loss of control of a coastal tanker at the inside berths of the Texaco oil terminal in October 1996, the refinery operators decided to bareboat charter a small tug, with a bollard pull of 7.5 tonne. The tug's duties were to assist in the berthing and unberthing of ships up to 12,000 gt and the running of mooring ropes from ships to the piers and dolphins. *Trijnie* was chartered and brought to Milford Haven for these purposes.

Delta Catalytic modified *Trijnie* to make her more suitable for her new role at Milford Haven. Most of the equipment on top of the wheelhouse was removed or shortened to reduce her air draught and prevent damage when operating close under ships and terminal structures. The EPIRB was placed in a seat locker for safe keeping. A guard rail was erected around the after deck bulwarks. An inverted "U" shaped rail was erected to protect ships' mooring lines from snagging on the after deck hatches. A new tow hook release wire was rigged and led from the release mechanism to the top of a vertical stanchion, which was above and just forward of the hook, to an aperture just under the wheelhouse top, and then forward under the wheelhouse deckhead lining to a handle above the coxswain's helm position.

(Photographs 4, 5 and 6)



4. A general view of the fore part of *Trijnie*

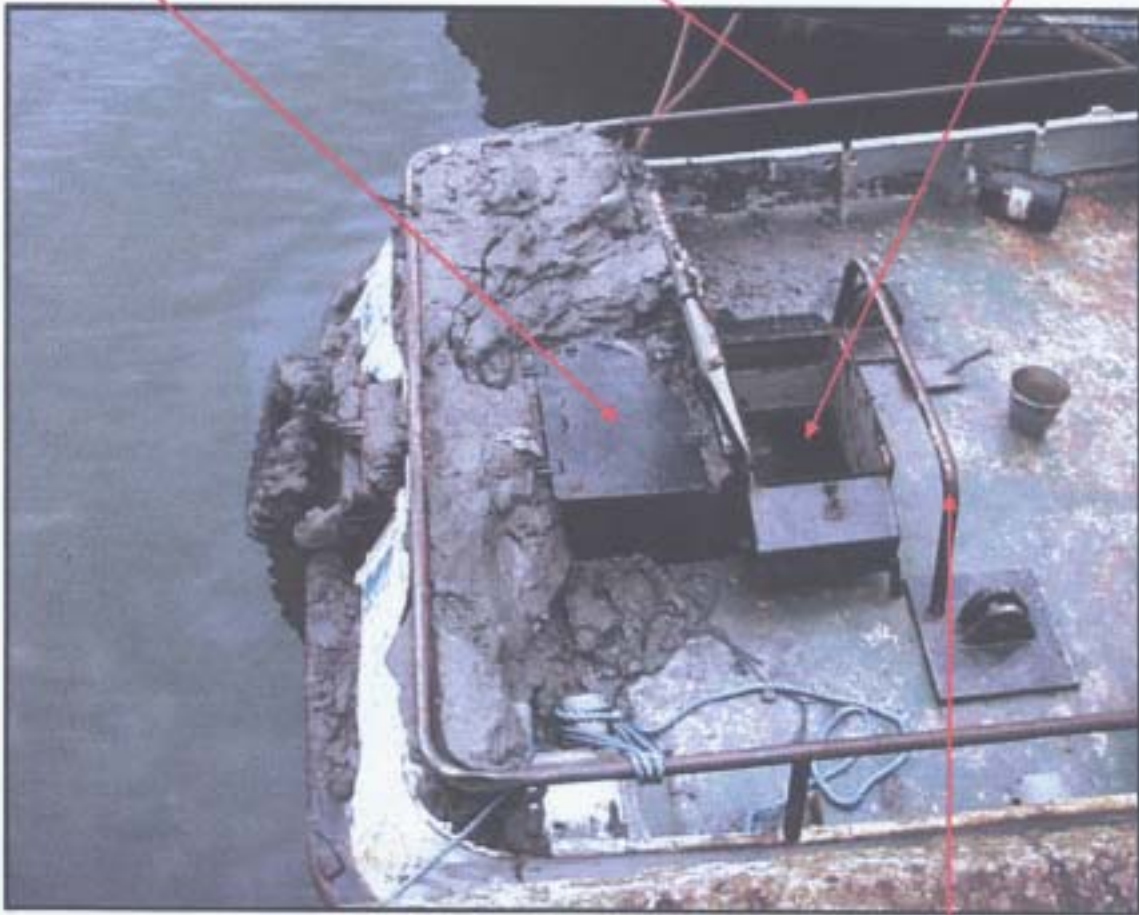


5. A general view of the after deck of *Trijnie*

Steering gear flat
access hatch

New guard rail

Engine room
access hatch



6. A closer view of the stern

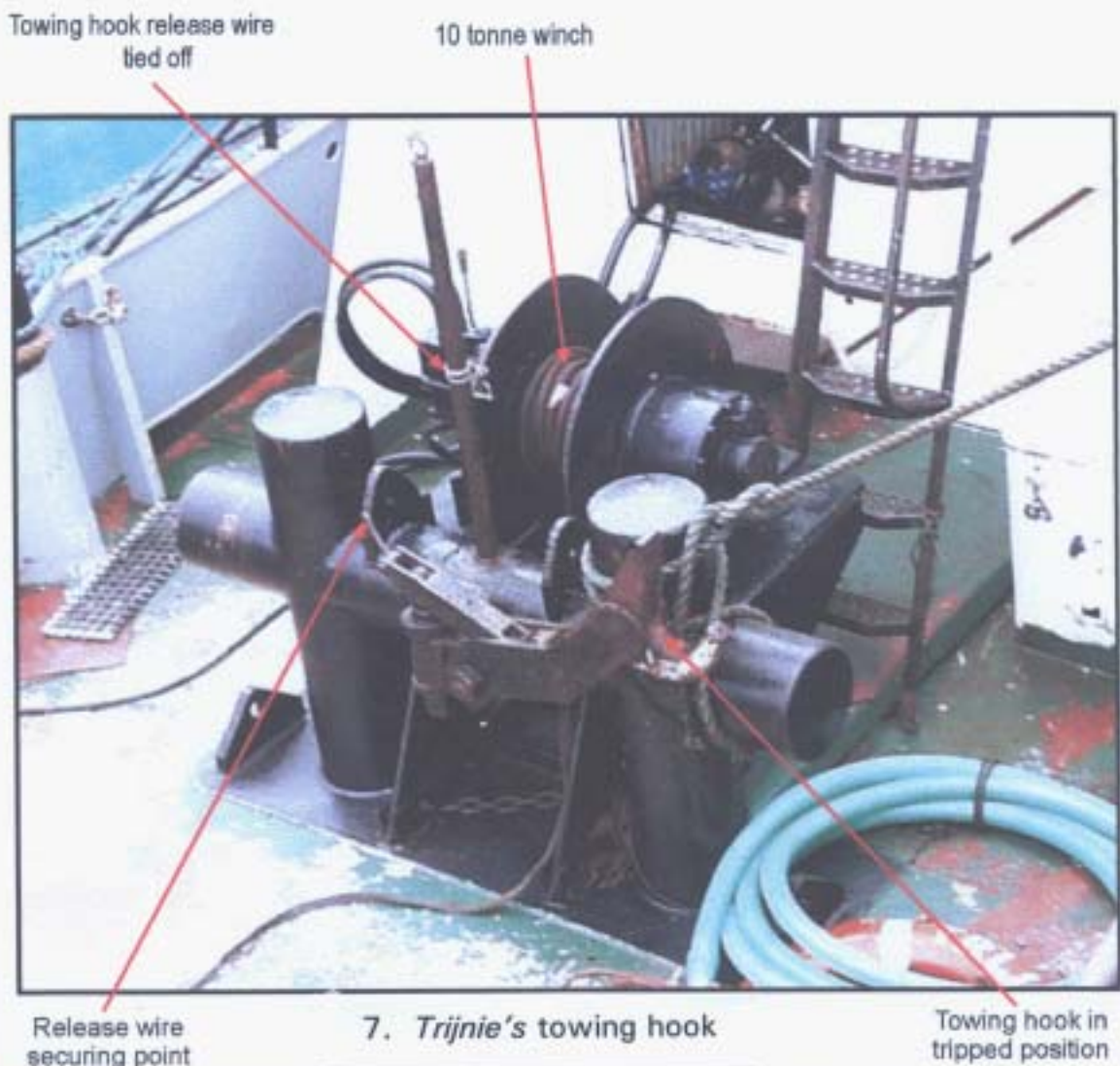
New 'U' shaped rail

1.3.3 Post accident inspection

When *Trijnie* was raised following the accident, it was found that the tow hook release wire **was** not secured to the hook but tied **off** on the vertical stanchion (**Photograph 7**). It was confirmed that none of the divers had touched the wire at any time. The investigation revealed that the wire had been tied **off** when working at the Texaco berths. The crews found heaving lines fell on the release wire when being thrown from ships and tripped the hook, which was inconvenient when running mooring lines.

After the accident, the release wire was untied from the stanchion and secured to the hook. In attempting to trip the hook from the helm position, the system would not work. However the hook was found to be have been displaced to about 30° above the horizontal, and probably occurred during the incident. During later tests, the hook was found to release satisfactorily when using the wire.

After *Trijnie* was salvaged, large quantities of mud were found at the stem and the engine room hatch was found open.



1.3.4 The crew

Trijnie's coxswain was 41 years old. He began his employment with Marine and Port Services as a general hand in the 1970s, working both ashore and on workboats and mooring boats. He left this employment in the early 1980s but rejoined the company in 1987 as a general hand and stand-in coxswain. In 1987 he passed the Boatman's Licence examination. In the early 1990s he became a full-time coxswain. All of his work was in Milford Haven, mostly at the Texaco and Elf refineries, and sometimes at Pembroke Dock. He was taken on by Delta Catalytic when the company took over from Marine and Port Services in November 1995.

The crewman was 60 years old. He had been employed by Marine and Port Services for a number of years in the 1970s. He was re-employed by the same company from January 1988 to December 1990 on a temporary basis, as a general hand/stand-in team leader, and then employed on a full-time basis. He was promoted to leading hand in 1993 and transferred to Delta Catalytic in November 1995 as a team leader. He had never taken charge of any of the mooring boats or *Trijnie*.

1.3.5 Crew training for *Trijnie*

As *Trijnie* was a different type of vessel carrying out new duties in Milford Haven, Delta Catalytic decided that a retired tug master, who had worked on larger local harbour tugs, should train the nine coxswains. He was told that *Trijnie's* duties would consist of rope running and assisting ships in berthing and unberthing by the push/pull method over the bow, or by direct towing from the hook over the stern when berthing or unberthing ships in adverse wind conditions.

From late December 1996 to January 1997, the coxswains were trained in pairs. They were instructed on general handling techniques, including cross tide conditions. They were shown how and when the towing hook should be tripped using the release wire.

Each training exercise lasted for about six hours.

None of the coxswains had been trained in the type of towing operations required for docking *Tillerman*. *Trijnie* had not been positioned as a stern tug with a ship making significant headway.

1.4 DELTA CATALYTIC (UK) Ltd

1.4.1 History

Delta Catalytic is owned by McDermott's - an American company involved in refinery maintenance and the offshore oil industry. The company has about 800 employees and operates in the Humber and elsewhere in Great Britain, including Milford Haven. Its UK headquarters is near Immingham and its main work is refinery maintenance.

In 1990 Delta Catalytic took over the maintenance contracts from Seaforth Holdings at the Lindsey oil refinery and from Port Services for the Immingham and Killingholme refineries - all situated in the Humber area. In 1993 it took over the maintenance contracts at the Texaco and Elf refineries at Milford Haven.

In 1995 the company won the contract from Marine and Port Services to serve the marine operations of the two terminals in Milford Haven. All Marine and Port Services staff were transferred to Delta Catalytic, as were four mooring boats which were leased on a bareboat charter.

1.4.2 The operations manager

The operations manager joined Marine and Port Services in 1968 as a general hand and coxswain, working in the Milford Haven area on mooring boats, barges and a tug. His work included mooring ships at the refineries and taking stores and bunker barges to ships. In 1978 he was promoted to operations controller based at Pembroke Dock. In 1991, he was offered the marine manager's post which he accepted but had to work for two years as a general hand/coxswain to refamiliarise himself with the work. He became full-time operations manager in December 1993 and transferred to Delta Catalytic in 1995.

The assignment of *Trijnie* was a one-off arrangement made between himself and the operator of *Seamaid*. He was not aware how *Trijnie* would be employed the next day, as this was the responsibility of the pilot on board *Tillerman*. The pilot was not assigned until the next morning.

1.4.3 Risk assessment

Delta Catalytic operates a corporate safety management system based on the *International Loss Control Institute Principles of Practical Loss Control* and has quality assurance accreditation.

The company had undertaken risk assessments, which included *Trijnie*. Under *Task Step: Berthing vessel, towing from long line to towing hook*.

the hazard was identified as *Towing line breaking under strain*.

the risk was identified as *Impact injuries to deckhand, knocked in water - drowning*.

effect rating - *high*

probability rating - *medium*

risk rating - *high*

to minimise the risk (deckhand) *stand in wheelhouse when tug towing. Wear full personal protective equipment and lifejacket when working on tug.*

residual risk - low

There were other identified areas of risk with regard to mooring and tug duties, from which the following assessment was made:

Operators of tug must be aware at all times as to the various hazards when working the tug especially in severe weather conditions. Always ensure that the towing hook is thoroughly checked before each and every task and that this can be tripped if required from inside the wheelhouse. Full personal protective equipment and lifejackets must be worn at all times.

The overall risk was given as low.

The risk assessment form was signed on 14 November 1997 by the operations manager.

No risk assessment had been made for the towing mode in which *Trijnje* was engaged on the day of the accident.

1.4.4 Instructions for working

Delta Catalytic documented the procedures to be followed when carrying out tug duties to assist berthings/unberthings of ships at the refinery terminals. Each operative was responsible for working in accordance with the instructions. It advised that if ways could be found to improve the process they were to be referred to management for assessment and any alterations thought appropriate.

The relevant working instructions in this case were:

- *check tug for fuel and lubrication levels;*
- *check operation of tow hook "QUICK RELEASE" before each and every task;*
- *ensure tug is on station no later than ordered time in agreed position and that the ship's pilot captain are aware of presence and position.*

For assistance to berth ships, the coxswain was to ensure that the following was carried out:

- *clear and precise instruction given both ways to ensure incident free berthing*
- *instruct the ship that the safety of the tug and its crew is paramount and the ship must reduce speed as soon as is reasonably possible*
- *instruct the ship that if a long tow is required, the speed must be kept below five knots*

- *in the event of the ships not being able to keep speed below five knots instruct the ship that you are releasing the quick release towing hook*
- *lifejackets to be worn by tug crew at all times*
- *radio communications will be established and maintained between tug and ship for the duration of the operation*

The risk assessment and instructions for working documents were on board *Trijnje*.

1.5 THE PILOT

1.5.1 Experience

The pilot was 59 years of age and had been working as a pilot in Milford Haven for 25 years. He had gained his sea-going experience in Blue Funnel Line in which he served for 11 years. For the next five years he was an assistant harbour master and pilot in Nigeria before being appointed as a pilot in Milford Haven. He had been a senior pilot for 18 years, and was permitted to pilot ships of any size arriving at, or leaving, the port.

The pilot had been on *Tillerman* many times before and was fully familiar with the ship's handling characteristics. On this occasion she was very light for dry-docking purposes. He had never piloted *Tillerman* into Milford Docks before.

1.5.2 Hours of working

Pilots at Milford Haven work a 24 hour watch period, in which they have an 8 hours stand-down period. On this occasion, the pilot began his watch at 0800 on 7 September 1998 and, because of the pattern of ship movements, his stand-down period began at 0800. He became available for duty at 1600. He piloted a ship to sea and then berthed *Tillerman* from sea to the Texaco oil terminal No3 berth, at which she was fast alongside at 2018.

The next morning he piloted a gas tanker from the anchorage to Texaco No5 berth at 0200. The next move was *Tillerman* from Texaco No3 berth to the dry-dock.

Between berthing operations the pilot went to his home, close to the pilot launch stage, to rest. He was called at home by Port Control when he was due at the launch stage. Once the 24 hour duty period ends, all pilots at Milford Haven have 48 hours off-duty. On average pilots work nine days a month.

1.5.3 Conduct of pilotage

The pilot had worked with *Trijnje* before when berthing ships at the refineries (mainly at Texaco). He recognised the coxswain's voice over the VHF radio but had never met him. He made *Trijnje* the stern tug because of her greater power. He was unaware that the coxswain had never operated in this towage mode before or that a gog rope was not in place on the tug.

The larger harbour tugs were not employed in this operation, because they were too large to manoeuvre in the confines of Milford Docks.

Before letting go from the berth, the pilot did not make his full operational intentions known to the coxswain. He knew that there was an easterly running tidal stream across the approach channel and that he would have to keep steerage way on dead slow ahead up to the two buoys, which were close to the entrance of the lock. As *Tillerman* approached the lock entrance, the pilot wanted *Trijnie* to tow on the port quarter to keep the stern of the ship up into tide and wind and slow her down as she entered the lock. He did not want the stern of the ship to fall off to the east and the bow to move to port, which could have wedged the ship across the lock.

The coxswain had assumed, rightly, that *Trijnie* would be employed to slow the ship down.

While moving from the berth to the approach channel, the pilot could not see *Trijnie* from the helm position where he was steering the ship. He knew that the tug would be keeping station somewhere astern and assumed that she was moving with the ship in a stern-to-stern position. This means that the tug would have been towed by the ship on the mooring line. From this position it would have been relatively easy for the tug to move from right astern to the port quarter.

1.6 ENVIRONMENTAL CONDITIONS

1.6.1 Weather

The wind was west force 5, the sea was slight in sheltered waters, and the visibility was clear.

1.6.2 Tide

High water was predicted to be at 0814 with a height of 7.4m - the rate of the easterly tidal stream in the approach channel would have been less than 1 knot at the time of the accident.

Low water was predicted to be at 1434 with a height of 0.3m.

1.7 TOWING INFORMATION

1.7.1 The use of gog ropes

A gog rope (or wire) is used on harbour, coastal and deep sea tugs to control the movement of the main tow line. The rope is also known as 'gob' or 'bridle'. The gog rope can be led from a winch or from two sets of bits, through a large steel eye or fairlead sited on the centreline and vertically over the rudder on the after deck. From the fairlead the rope is either looped over the main tow line or attached to it by a free-running shackle.

In certain circumstances when manoeuvring a tow, a gog rope can be used to hold the main tow line down at or near the stern of the tug. This effectively transfers the towing point from the towing hook (or towing winch), which is usually sited near amidships, to the point where the gog rope makes contact with the tow line. The towing point is defined as the point from where the tow line goes out in a straight line.

The flow of water around the hull form imposes a force on the tug, the centre of which is the lateral centre of pressure. The direction and magnitude of the force depends on the underwater shape, the direction in which the tug is moving, the underwater depth and the speed, the latter has the greatest influence. When a tug is beam-on to the flow of water, the centre of pressure normally moves to a point about one third of the length of the tug from aft. This point coincides with the towing hook on board *Trijnie*. With no gog rope in place, the horizontal turning moment is small and the tug's ability to steer is severely impaired.

Another effect is that a heeling moment is created by the vertical distance between the towing point and the point of resistance to movement on the tug's hull form, together with the magnitude of the opposing forces. This is known as girting and can cause a tug to capsize (**Figure 4**).

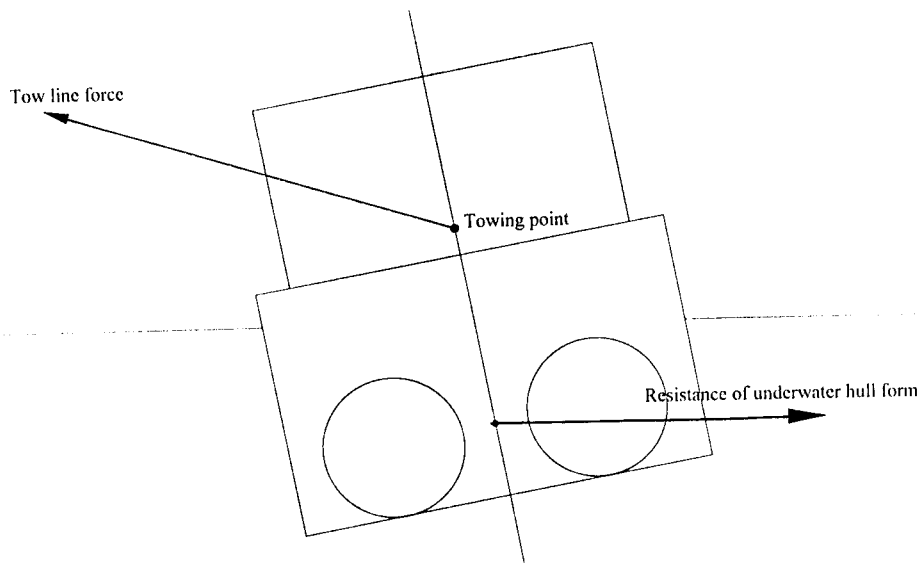
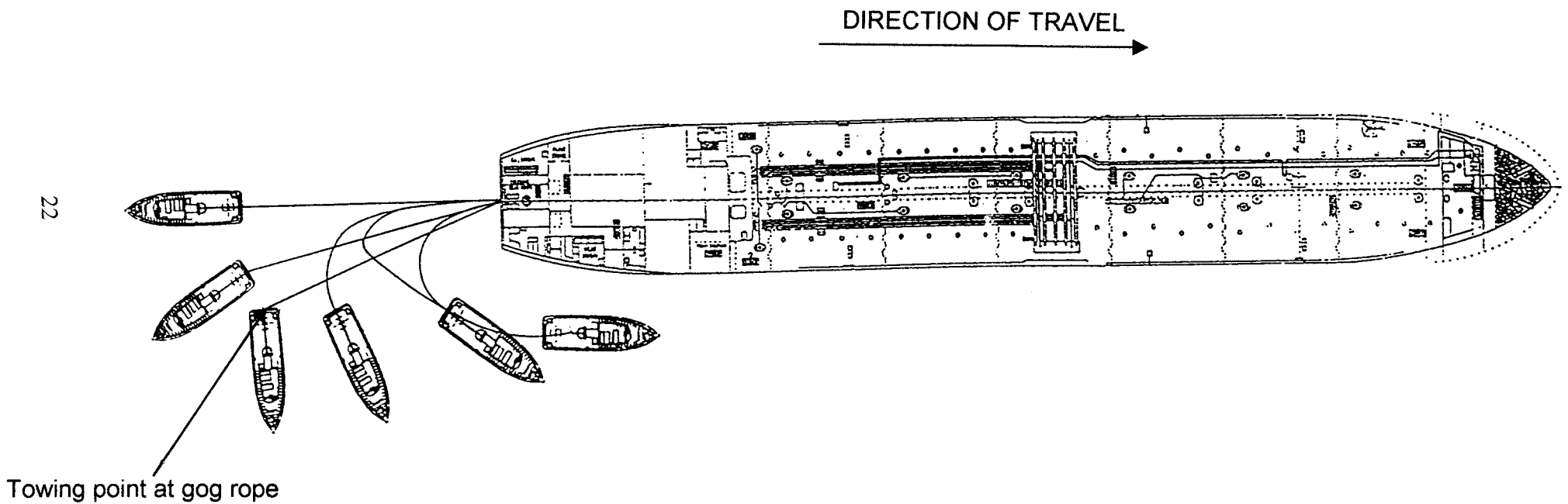


Figure 4 - A sketch showing the opposing forces on a tug in the girting position

By using a gog rope, the horizontal distance between the towing point and the centre of pressure is increased, which increases the horizontal turning moment. This enhances the tug's ability to steer. Being able to manoeuvre out of a beam-on situation means that the tow line can be brought into the fore and aft centreline of the tug and dangerous heeling moments can be prevented (**Figure 5**).



The peel-off manoeuvre using a gog rope
(Tug and ship to scale)

1.7.2 Towing hooks

When towing, the eye on the inboard end of the tow line is placed over the hook. There are many types of hooks but all are designed to be able to release the tow line effectively and quickly, even when heavily loaded. The ability to release a tow line quickly is particularly important when a tug is in danger of capsizing.

In the release mode, the hook is designed to open or swing down to allow the tow line to slip. The release mechanism can be hydraulic, pneumatic or a cable. Early hooks were released simply by striking a mechanism on the hook with a hammer. Modern tug release mechanisms are now remotely controlled as well, to give greater safety (**Photograph 8**).



8. A view of the interior of *Trijnie's* wheelhouse, looking forward from aft door

1.7.3 *Seamaid and Neptune*

Seamaid had a conventional single fixed propeller and was previously a Ministry of Defence “Girl” class tug. She was normally employed, together with *Neptune*, to assist ships in entering and leaving Milford Docks. The configuration of positioning and operating modes for the tugs depended on individual pilot’s preferences. Being a tractor tug with Voith Schneider propulsion, *Neptune* was more manoeuvrable than *Seamaid* but had less bollard pull. Her towing hook was close to the stern and she did not use a gog rope.

When *Seamaid* was tasked as a stern tug, the crew always used a gog rope and a special bracket had been fitted at the stern for this purpose (**Photograph 9**). The towing hook release mechanism was pneumatic.

1.7.4 **Watertight Integrity**

On making his engine room checks on the morning of the accident, the coxswain closed the after deck access hatch but did not batten it down (**Section 1.7.5**). Another hatch, to port of the helm position in the wheelhouse and giving access to the lower spaces, was closed and secured (**Photograph 10**).

1.7.5 **Relevant extracts on towing from *The Safety of Small Workboats and Pilot Boats - A Code of Practice***

This Code was published by the Marine Safety Agency (now the Maritime and Coastguard Agency) in 1998. The primary aim of the Code is to set standards of safety and protection for all on board. It applies to UK vessels of up to 24m loadline length (which are either vessels in commercial use at sea and which carry cargo and/or not more than 12 passengers or provide a service in which neither cargo nor passengers are carried), or are UK pilot boats.

Although the Code was not directly applicable to *Trijnie*, while working in Milford Haven, the following extracts are relevant.

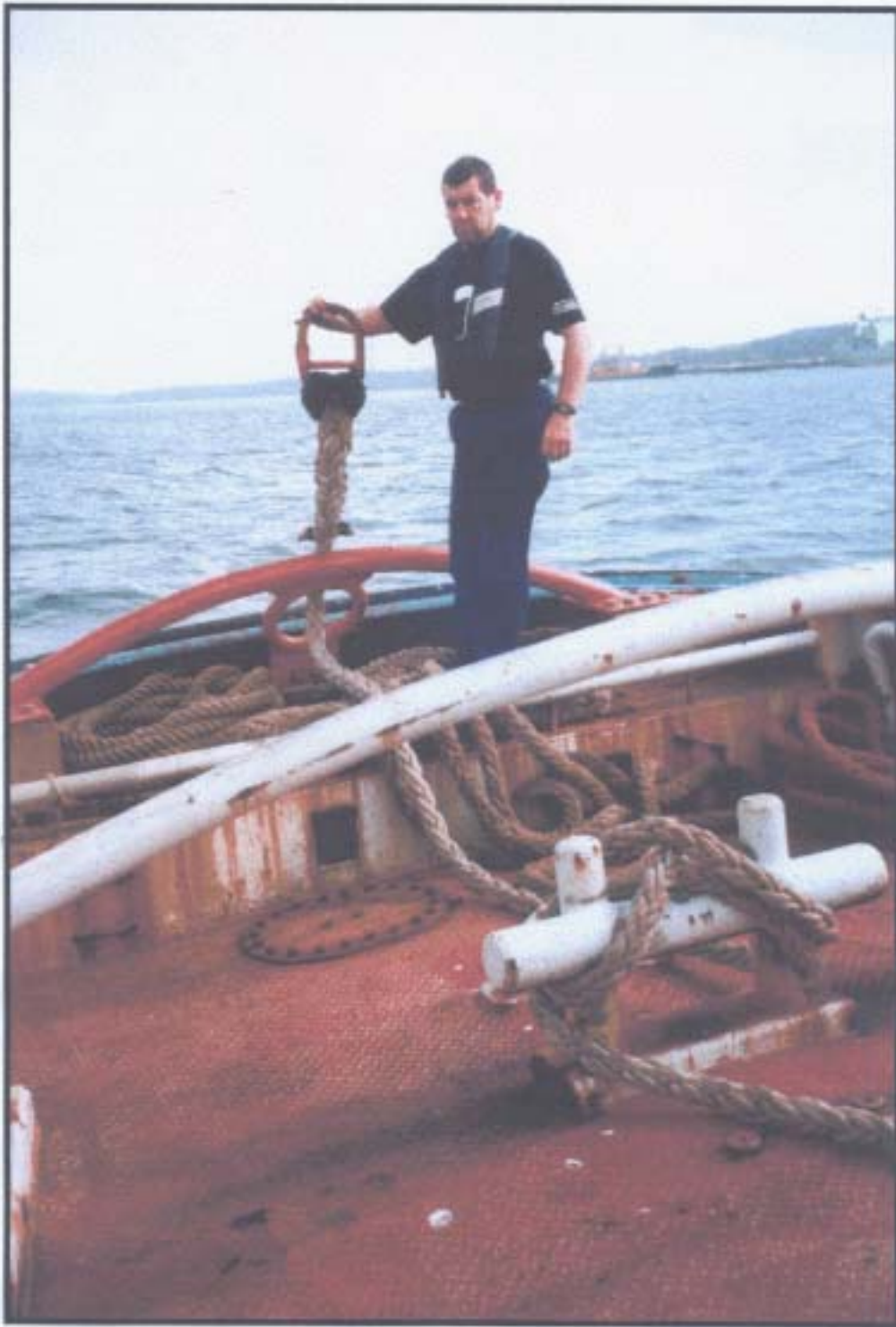
Under the section *Vessel Engaged in Towing*:

General

An existing vessel which is used for towing and has a proven history of safe operation should be considered on the basis of the safe history and conditions which have been applied to ensure the safety of the vessel and the persons on board.

Towing arrangements

The design of the towing gear should minimise the overturning moment due to the lead of the towline.



9. A crewman on *Seamaid* holding up the gog rope eye through which the tow line passed



10. This access hatch to the lower deck was closed during the incident

The towing hook or towline should have a positive means of release which can be relied upon to function correctly under all operating conditions.

In a new vessel the release mechanism should be controlled from the wheelhouse, at the aft control position (if provided) and any other coming position and at the hook itself. The local control at the hook should be of the direct mechanical type capable of independent operation. In an existing vessel the arrangements should be the same as required for a new vessel so far as practicable.

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

Watertight integrity

Doorways in superstructures, deckhouse and exposed machinery casings situated on the weather deck and which enclose accesses to spaces below deck should be provided with efficient weathertight doors. Weathertight doors should be secured in the closed position when the vessel is towing and the doors should be marked clearly to this effect.

Merchant Shipping Notice M1531 *Safety of Tugs While Towing* also draws attention to the importance of towing hook release mechanisms and the need to ensure that weathertight openings are secured at all times.

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 with the aim of preventing similar accidents occurring in the future.

2.2 PREPARATIONS

Any towing activity depends, to a large extent, on a high degree of understanding and trust between pilot and tugmaster. Such understanding and trust must however never be taken for granted.

The assignment of *Trijnie* to assist with the move of *Tillerman* to dry-dock on the morning of 8 September was unique. It was a one-off arrangement between the operator of the tug that was normally used to assist vessels into dry-dock, and the operations manager of Delta Catalytic who ran *Trijnie*. The arrangement was made on the day before the event because the usual tug, *Seamaid*, was committed to other work. The operations manager did not know the towing mode in which *Trijnie* would be employed as this depended very much on the individual pilot. No steps were taken to ensure the pilot was aware that a stand-in tug was to be used or that the coxswain had not carried out this towing mode before.

There was no procedure in force within the port to ensure that a tug allocated to a particular duty was capable of carrying out the task. There was no readily available means of knowing whether *Trijnie* was capable of this particular operation, whether she was equipped to do it or whether the coxswain was sufficiently experienced or competent. No risk assessment had ever been carried out for the type of towing mode for which *Trijnie* was now being tasked.

The first that *Trijnie*'s coxswain knew of his assignment was at 0700 when he started his shift. He did not know how he was to be employed until he arrived at the ship and was given instructions by the pilot over the radio. He did not tell anyone that he had never been coxswain of a stern tug assisting a ship that would be making significant headway.

The pilot assigned to the movement was unaware that the tug and coxswain allocated had never carried out this particular type of operation before. He had never met the coxswain. He did not discuss fully his intentions with the tug coxswain and the coxswain never sought them. The plan should have been discussed and agreed between them before the movement commenced. No matter how routine or commonplace any movement involving a ship within a port, all key players should be aware of the plan. Had the pilot discussed fully his intentions with both ship's officers and the tug coxswain, the outcome to subsequent events could have been different.

2.3 CONDUCT OF PILOTAGE

As *Trijnje* secured aft, nobody on board *Tillerman* was aware of her coxswain's inexperience in the operation that was to follow. The pilot assumed he would understand what was required without further instructions. If the third officer in charge of the aft mooring station saw how the tow line was being rigged on *Trijnje* without a gog rope, or was in any way concerned, he did not inform those on the bridge.

From the moment *Tillerman* let go from her berth at the Texaco oil terminal, the pilot was preoccupied with the safe pilotage of the ship into the approach channel to the lock. Only two people were on the bridge, master and pilot. There was no helmsman, an arrangement accepted by the pilot as he took the helm himself. He assumed, after many years experience, that the stern tug was doing what he expected of her. He never checked. No ship's officer informed him of the tug's relative position and obviously saw no need to do so.

Trijnje was not doing what the pilot had assumed. She was following *Tillerman* on her starboard quarter and not, as the pilot assumed and expected, following stern-to-stern.

Because he was steering, he was never in a position to look aft to observe the tug.

2.4 PILOT/TUG COMMUNICATIONS

The pilot communicated with the coxswain by VHF radio on channel 8. This was not being recorded so it has not been possible to obtain a transcript and there are some discrepancies in the accounts of what was actually said.

On entering the approach channel, the pilot warned the coxswain that *Trijnje* would need to go to the port quarter. This warning was given on an assumption that the tug was directly astern. The new position was required to help take the way off the vessel as she approached the lock and so she could hold the stern steady against any cross tidal stream and wind. Because of the lack of any form of recording, it is not clear what passed between pilot and coxswain. The coxswain nevertheless interpreted the warning as a requirement to push on the port quarter, a mode he was familiar with when berthing ships at the Texaco oil terminal. An experienced coxswain would have realised that the westerly wind and the east setting tidal stream would have pushed the ship to starboard and that the tug would have been required to counteract these effects rather than contribute to them by pushing.

The coxswain did not question the pilot's warning, but did, nevertheless, realise that to change from running alongside the starboard quarter to take station on the port quarter would be very difficult with the tow line on the hook. He therefore told the pilot that he was still attached to the ship. The purpose of this report was to convey to the pilot that he would require the tow line to be let go before he could carry out the required manoeuvre.

The pilot, unaware of the relative position of *Trijnie*, and still believing her to be stern-to-stern, did not understand the implications of the coxswain's message and simply repeated the original warning.

As a result of this exchange and the repeated warning to go to the port quarter, the coxswain thought he was expected to carry out the manoeuvre with the tow line still made fast. He therefore made the decision to turn to starboard and away from *Tillerman*.

2.5 **TRIJNIE'S ATTEMPTED TURN TO STARBOARD**

The coxswain did not realise how dangerous it was to turn without a gog rope holding the tow line down at the stern.

A gog rope should have been in place throughout the entire towing operation. The Code of Practice and the M Notice referred to in section 1.7.5 give appropriate advice in this respect. *Trijnie* was sometimes employed to tow ships off the Texaco berths in adverse weather conditions using the towing hook. This type of operation used a straight tow with the ships involved moving far more slowly than was being experienced on this occasion. Such straight tow operations had been foreseen and were covered in Delta Catalytic's risk assessment. It would seem this established practice in very different circumstances provided the coxswain with an assurance that a gog rope would not have to be used on this occasion.

From the moment the distance between tug and ship began to open, the slack on the tow line would have been taken up. As soon as the tug came beam-on to the direction of travel of the ship, any further turn to starboard was impossible. The tow line leading out on her beam would, once tight, have acted in opposition to the forces acting on the hull, forcing her to heel to port. As the heeling moments continued and water started to pour on board, capsize was inevitable. The phenomena is known as girting.

It is recognised that a gog rope, when used, could fail and place a tug in this unsafe position inadvertently. To allow for such an eventuality, tugs are fitted with an emergency towing hook release mechanism which can either be operated locally or remotely. *Trijnie* was so fitted, and a release mechanism handle was situated by the coxswain's helm position. It was not operated, and in any case, when *Trijnie* was inspected after the accident it was found that the towing hook release wire was not connected to the hook. It was not connected at 0700 when both coxswain and crewman reported on board that morning and had not featured as a shortcoming in their checks.

2.6 **THE FOUNDERING**

Once *Trijnie* had capsized, she sank rapidly by the stern. Although the two crew members were both in the wheelhouse at the time she started to heel to port, only one managed to survive. It is not known why the crewman failed to escape and it is possible he was prevented from leaving the wheelhouse by the inrush of water.

Delta Catalytic's risk assessment for towing operations had identified that there were some risks in *Trijnie* when handling tows. A means of minimising them had been identified with an instruction for the deckhand to wear full personal protective equipment and lifejacket when working on the tug. On this occasion the crewman was not wearing a lifejacket on the day he died. Although it can never be proved that had he done so he might have survived, his lifejacket would have provided buoyancy once in the water.

After the salvage a large quantity of mud was found at the stern. When the tug capsized, she quickly took on a bows-up attitude which suggests there was residual buoyancy forward and that the stern was resting on the seabed. As she capsized, the engine room hatch probably swung open to allow water to pour in. This expedited the foundering. Had the hatch been properly secured in accordance with section 1.7.5, it is probable that *Trijnie* would have remained afloat longer than she did.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

1. *Trijnje* capsized and sank in Milford Haven at 0836 on 8 September 1998 while assisting the petroleum products tanker *Tillerman* to enter a lock prior to dry-docking. [1.2.1]
2. One crewman from the tug lost his life when he failed to survive the sinking. [1.2.2]
3. The coxswain of the tug survived the sinking. [1.2.2]
4. The tug normally used to assist vessels entering the lock at Milford Haven, *Seamaid*, was committed to other work on the morning of 8 September. [1.2.1]
5. The decision by the operations manager of Delta Catalytic to allocate *Trijnje* to this task was made without being in a position to establish precisely what was required of her. [1.4.2]
6. *Trijnje* was allocated to a task for which she was ill-fitted, had never done before and without consideration at any time as to whether she was capable of undertaking it. [2.2]
7. No risk assessment had been made for *Trijnje* to undertake stern tug operations with a vessel under way as on 8 September. Risk assessment for normal operation in *Trijnje* had been carried out and the relevant documentation was on board. [1.4.3,1.4.4]
8. The first the coxswain knew of his tasking for 8 September was after reporting for his shift at 0700. [2.2]
9. The coxswain had no experience of the type of operation he attempted to undertake. [2.2]
10. The pilot was unaware of *Trijnje*'s coxswain's lack of experience. [2.2]
11. There was inadequate briefing prior to *Tillerman* leaving her berth at the Texaco oil terminal. [2.2]
12. There were two people on *Tillerman*'s bridge during the manoeuvre, the master and the pilot. There was no dedicated helmsman. [2.3]
13. The steering was done by the pilot. [2.3]
14. The pilot was unable to see *Trijnje* from where he stood on the bridge. [2.3]
15. The pilot assumed *Trijnje* was following stern-to-stern. [2.3]

16. The pilot did not understand the implications of the coxswain's message that he was still attached to the ship. [2,4]
17. *Trijnje* did not have a gog rope in place. [2.5]
18. The coxswain decided to execute a peel-off manoeuvre with the tow line still attached. [2.5]
19. Delta Catalytic's risk assessment for towing from long line to towing hook sought to minimise the risk by requiring the deckhand to stand in the wheelhouse when towing, and that he should wear full protective equipment and a lifejacket. [1.4.3]
20. Neither the coxswain nor the crewman was wearing a lifejacket. [2.6]
21. *Trijnje* girted and capsized once the tow line had tightened on the port beam. [2.5]
22. The emergency towing hook release was not operated. [2.5]
23. The towing hook release wire was not connected to the hook. [2.5]
24. The engine room hatch was not secured. [2.6]
25. *The Safety of Small Workboats and Pilot Boats - A Code of Practice* and Merchant Shipping Notice M.1531 provide appropriate advice for towing operations. [2.5]
26. VHF channel 8 was not recorded. [2.4]
27. *Tillerman* was neither required to carry a voyage data recorder nor was fitted with one. Had one been fitted and was functioning correctly at the time, it would have contributed to a better understanding of what actually occurred on her bridge during this incident. [2.4]

3.2 CAUSES

The immediate cause

The accident was caused by *Trijnje*'s turn to starboard when trying to change her position from *Tillerman*'s starboard quarter to her port quarter. The turn caused her to girt, capsize and sink. [2.5]

Contributory causes

1. From the moment that *Trijnje* was allocated to assist *Tillerman*, nobody ashore or afloat sought to enquire whether she was suitable for the task or draw attention to her limitations. [2.2]
2. The pilot had not been informed that a stand-in tug had been allocated for the move. [2.2]

3. *Trijnje*'s coxswain did not inform the pilot that he lacked experience in acting as a stern tug for a vessel making significant headway. [2.2]
4. The pre-movement briefing or discussion was inadequate. [2.2]
5. The coxswain of *Trijnje* lacked experience of the type of operation he attempted to undertake. [2.5]
6. There was a lack of understanding between pilot and coxswain in the exchange on VHF leading to *Trijnje* taking up a position on *Tillerman*'s port quarter. [2.4]
7. There was no gog rope in place. [2.5]
8. *Trijnje* had not been used before in Milford Haven as a stern tug with a ship making significant headway. [2.2]
9. No alert was raised by the coxswain with reference to no risk assessment being in place on this type of stern tug operation. [2.2]
10. The towing hook release wire was not connected. [2.5]
11. An unsafe practice had developed when running ships' mooring ropes. [1.3.3]
12. There was a lack of monitoring by the operations manager to identify unsafe practices. [2.2]
13. A peel-off manoeuvre was undertaken with the tow line attached. [2.5]
14. No risk assessment was in place for this type of stern tug operation. [2.2]
15. The pilot assumed that *Trijnje* was following the ship in a stern-to-stern position.
16. After making fast, there was no visual monitoring of the tug by the pilot. [2.3]
17. The coxswain decided to proceed with the peel-off manoeuvre while still attached based upon a perceived expectation. [2.4]

3.3 OTHER FINDINGS

1. The engine room hatch was not secured properly, and the probability that it opened during the capsize provided a means for rapid flooding to take place and expedite the sinking. [2.6]
2. Lifejackets were not worn but this made no difference to the outcome. [2.6]

3. It is uncertain whether the crewman would have survived if *Trijnie* had remained in the capsized position. [2.6]
4. No single person was in a position to identify and evaluate all of the circumstances and hazards before the accident. [2.2, 2.3]

SECTION 4 - RECOMMENDATIONS

Milford Haven Port Authority is recommended to:

1. Direct the port's Safety Liaison Committee to review and identify the different marine operators' respective needs and to harmonise procedures through improved communications.

Delta Catalytic (UK) Ltd is recommended to:

1. Introduce policy for its staff to raise issues that are not covered by risk assessment procedures.
2. To enhance its monitoring of procedures to identify any unsafe practices that may develop.

Marine Accident Investigation Branch

July 1999