Report on the investigation of

the collision between

Thorngarth and Stolt Aspiration

River Mersey, Liverpool

13 April 2005

Marine Accident Investigation Branch
Carlton House
Carlton Place
Southampton
United Kingdom
SO15 2DZ

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Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purpose is to attribute or apportion liability or blame.

CONTENTS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ARPA	-	Automatic Radar Plotting Aid
BTA	-	British Tugowners Association
CHA	-	Competent Harbour Authority
CPD	-	Continuing Professional Development
GMDSS	-	Global maritime distress and safety system
gt	-	Gross Tonnage
IALA	-	International Association of Lighthouse Authorities
IMO	-	International Maritime Organization
m	-	Metre
MATS	-	Marine Apprenticeship Training Scheme
MCA	-	Maritime and Coastguard Agency
MRSC	-	Maritime Rescue Co-ordination Sub-centre
NVQ	-	National Vocational Qualification
PEC	-	Pilotage Exemption Certificate
PMSC	-	Port Marine Safety Code
RT	-	Radio telephony
STCW95	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended in 1995.
t	-	Tonne
TASD	-	Twin Azimuthing Stern Drive
VDR	-	Voyage Data Recorder
VHF	-	Very High Frequency
VLCC	-	Very Large Crude Carrier
VTS	-	Vessel Traffic Service

SYNOPSIS

(All times are UTC +1)

At about 0210 on 13 April 2005, the UK registered tug *Thorngarth* was assisting the Liberian registered chemical tanker *Stolt Aspiration* and acting as bow tug. The two vessels collided when *Thorngarth* was attempting to recover her position ahead of *Stolt Aspiration*.

As a consequence of the impact, *Thorngarth* was holed below the waterline and sustained significant structural damage. The tug's engineer also suffered a broken arm. *Stolt Aspiration* suffered only minor damage to its bow. There were no other injuries or pollution.

Stolt Aspiration was approaching Alfred Lock, the entrance to the Birkenhead Docks on the River Mersey. To assist in passing through the locks, the services of two tugs were utilised, and a pilot was on board the tanker. The tug *Thorngarth* was to act as the bow tug, with the tug *Ashgarth* assisting aft. The weather was overcast with rain showers, but at the time of the accident, visibility was moderate, with light winds. It was still dark.

Both tugs were designed to tow over the bow, and the standard approach for the bow tug is to meet the ship 'bow-to-bow'. The tug passes her gear up to the ship's forecastle, and then quickly reverses away from the bow of the ship to take the weight of the towing gear. It thus tows stern-first. This is not an unusual manoeuvre and is performed by many tugs around the world.

While carrying out this manoeuvre, *Thorngarth* initially correctly positioned herself right ahead of *Stolt Aspiration*, and passed her messenger line up to the forward mooring party. The tug then started to move away from the ship, but began to turn slightly to one side. The turning effect was countered and the tug closed the port bow of the ship. Position ahead of the ship was regained by increasing engine power. Once ahead of the ship again, the tug started to turn once more. This again was countered, but this time the tug approached the starboard bow of the ship. In recovering from this position and move ahead of the ship, the tug ended up across the bow of *Stolt Aspiration*, which then struck *Thorngarth* on its starboard side.

Thorngarth crossed the Mersey to berth at the Princes Landing Stage to assess the damage and land the engineer to an ambulance. Having taken advice from the VTS operators, and in consultation with the company managers, they berthed at the Kings Dock River Wall in order to dry out the vessel as the tide dropped, inspect the damage and carry out temporary repairs.

Stolt Aspiration continued to enter Birkenhead Docks, with the assistance of only one tug, without further incident. External and internal inspections were made of the tanker's bow spaces, and only minor damage was found.

The accident was caused by the tug master's lack of familiarity with the tug, and the lack of training in the particular manoeuvre he was required to perform. This was one of a number of similar incidents involving tugs in a period of 4 months. All were attributable to the lack of training and familiarisation of the tug master with the tug, and the particular task required of him. This prompted the MAIB to issue Safety Bulletin 02/2005 **(Annex A)**, highlighting the need for an assessment of the "tug to task" allocation before each towing operation, and ensuring that tug masters are fully trained.

A recommendation has been made to major tug operators, the British Tugowners Association (BTA), and the PMSC (Port Marine Safety Code) steering group. The recommendation is aimed at encouraging discussion between all parties when deciding the optimum allocation of tugs for all manoeuvres within a port, and the level of crew experience required for each task. A further recommendation has been made to the BTA to encourage its members to ensure that the movement of personnel between tugs is closely monitored, and that training and expertise of tugs' crews is matched, and is consistent with the type of tug and its expected task requirement.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *THORNGARTH*, *STOLT ASPIRATION* AND THE ACCIDENT

Vessel details	:	***Thorngarth* (ex *Tenzen*) (Figure 1)**
Registered owner	:	Svitzer Marine Limited
Manager(s)	:	Svitzer Mersey
Port of registry	:	Milford Haven
Flag	:	UK
Type	:	Harbour Tug
Built	:	1983 Hawazaki Co, Yokosuka Japan
Classification society	:	Lloyd's Register
Construction	:	Steel
Length overall	:	36.28m
Gross tonnage	:	365
Engine power and/or type	:	2 x Niigata 28BXE driving twin stern azimuthing units
Bollard Pull	:	45 tonne
Service speed	:	14.0 knots
Persons on board	:	4
Injuries/fatalities	:	Engineer sustained a broken arm
Damage	:	Holes in starboard side above and below waterline, extensive buckling and displacement of shell plating and internal support structure, and damage to internal fittings.

Vessel details	:	***Stolt Aspiration*** **(ex *Golden Angel*) (Figure 2)**
Registered owner	:	NYK Stolt Tankers SA
Manager(s)	:	Stolt Nielsen Transportation
Port of registry	:	Monrovia
Flag	:	Liberian
Type	:	Chemical/oil carrier
Built	:	1987 Japan as *Golden Angel*
Classification society	:	Nippon Kaiji Kyokai
Construction	:	Steel
Length overall	:	128.91m
Gross tonnage	:	7901.00
Engine power and/or type	:	Oil engine driving 1 CP propeller 5075kW (6900 hp)
Service speed	:	14.0 knots
Other relevant info	:	Bow thrusters
Persons on board	:	23
Injuries/fatalities	:	Nil
Damage	:	Oval dent to bulbous bow, approximately 600mm long by 300mm wide.

Accident details

Time and date	:	0210 on Wednesday 13 April 2005
Location of incident	:	53°24.'2N 003°00.'5W Approaches to Alfred Lock, Birkenhead
Sunrise	:	0617

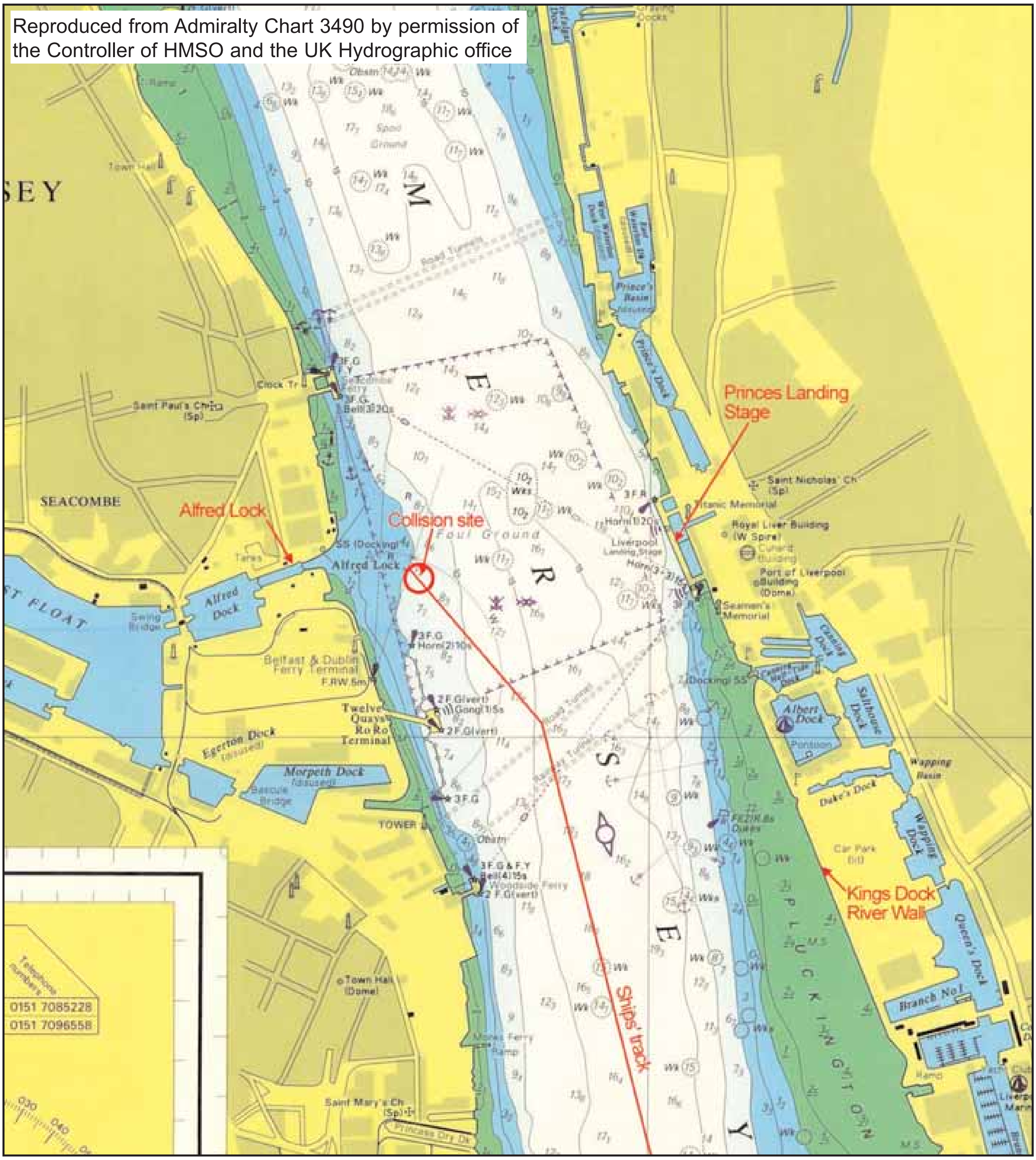
Figure 1

Thorngarth

Figure 2

Stolt Aspiration

Figure 3



Area of the collision

1.2 BACKGROUND

Svitzer Marine, the tug owners, had operated *Thorngarth* in Milford Haven since 1992. She was transferred to the Mersey in October 2004, 6 months before the accident. She was the third tug in the Liverpool fleet with twin azimuthing stern drive (TASD) propulsion.

1.3 NARRATIVE (Figure 3)

Stolt Aspiration, a 7901gt Liberian registered chemical tanker, left QEII lock at Eastham shortly after 0100 on 13 April 2005, bound for East Lewis Quay, Birkenhead. Entrance to the Birkenhead Docks is through the Alfred Lock, and the pilot on board *Stolt Aspiration* had confirmed with Mersey Radio that there was one other ship due to lock in at the same time. Meanwhile, the pilot received an update on the traffic situation in the river. There was little river traffic, with one other vessel inbound from sea. The master and pilot had discussed the passage plan, and the pilot had signed the ship's information sheet.

Thorngarth, a TASD tug of 45t bollard pull, had been tasked with assisting *Stolt Aspiration* into Alfred Lock and berthing at East Lewis Quay, along with the tug *Ashgarth*. The tugs were moored in the Bramley Moore Dock and it was necessary for them to lock out through Langton Lock into the river. The crew therefore arrived on board at 2300, and the tugs were stationed in the river off Alfred Lock awaiting *Stolt Aspiration*'s arrival by 0030. Both *Thorngarth* and *Ashgarth* were TASD tugs and towed over the bow. Unusually, *Thorngarth* carried a crew of four, which included a trainee, and *Ashgarth* a crew of three. Since the extra personnel carried would make the task of connecting the towline to *Stolt Aspiration* easier, the two tug masters agreed that *Thorngarth* would act as the bow tug during the planned operation.

Neither tug had any mechanical defects.

As *Stolt Aspiration* approached Alfred Lock, the pilot began reducing speed steadily from 10 knots. The ship had a controllable pitch propeller and, to maintain steerage way, steady reductions in speed were required. The master of *Thorngarth* requested that *Stolt Aspiration* proceed at slow speed to allow the connection of the forward towline and, as this was normal practice, the pilot agreed. The pilot contacted the tugs at 0147 and agreed to use VHF channel 8 for the operation. The VTS station, Mersey radio, only monitors and records VHF channel 12, and was therefore unable to listen in on any further conversations between the two tugs and the pilots on board *Stolt Aspiration*.

As *Stolt Aspiration* passed the 12 Quays South Terminal, the pilot noted his speed through the water as 6.5 knots and slowing. *Ashgarth* reported that his line was being made fast and that he was happy with the speed. *Thorngarth* then began to make his approach. Because *Thorngarth* is designed to pass its towline from its bow, the tug had to approach *Stolt Aspiration* bow-to-bow, then manoeuvre stern-first to maintain the correct station off the larger vessel. The pilot was unhappy with the speed of *Thorngarth'*s approach, and warned the tug master. The tug slowed and the approach continued. Thereafter, *Stolt Aspiration* maintained a steady course, with the speed continuing to slowly reduce.

Having received a heaving line from *Stolt Aspiration*, and having positioned close under the ship's bow, *Thorngarth* backed away from her. The tug's stern began to move to port, and this was corrected to maintain its position right ahead of the ship. However, the tug's stern began to move to port again, which caused *Thorngarth* to move quickly across to the starboard side of *Stolt Aspiration'*s bow which, at this stage, was approximately 6 metres away from the tug. The tug master again attempted to position *Thorngarth* directly ahead of *Stolt Aspiration*'s bow, but this time, the corrective action caused the tug to move directly into the path of the vessel's bulbous bow. *Stolt Aspiration* struck *Thorngarth* on its starboard side, causing the tug to heel heavily to port while being bodily displaced to port by the impact.

When *Thorngarth* came back upright, her mate left the bridge to check on the other crew members. Passing through the cross-alleyway, he came across the engineer, lying on the deck with his arm at an unusual angle. The engineer appeared to be in no imminent danger, so the mate went out on deck to confirm that the deckhand was unhurt. He then shouted to the master that the engineer had been injured. The deckhand and the mate then went to the engine room to assess the damage. They could see water coming in through a crack in the ship's side and from damage to the starboard main engine jacket water cooler **(Figure 4)**.

On *Stolt Aspiration*, the pilot, noting the movement of *Thorngarth*'s masthead light, immediately ordered full astern, and used the bow thruster to counter the transverse thrust of the propellers and to maintain the vessel's heading. *Ashgarth* also began to pull directly astern at full power to slow the ship. *Thorngarth* managed to pull clear, and contacted the pilot to tell him that they were damaged and that the engineer had broken his arm. *Thorngarth* could no longer assist the ship, so was released to go to the Princes Landing Stage to assess the damage and land the engineer to an ambulance. It was quickly assessed that any damage caused to *Stolt Aspiration* during the collision had not penetrated her hull, and she resumed the berthing operation without further incident.

When *Thorngarth* approached the Princes Landing Stage, two other tugs, *Svitzer Bootle* and *Oakgarth* were already moored there. The tug master brought *Thorngarth* alongside *Svitzer Bootle* and made fast. The crews from all three tugs then attempted to stem the flow of water into *Thorngarth*. To achieve this, the engineer from *Svitzer Bootle* stopped *Thorngarth*'s starboard engine

Figure 4

Damage to the starboard main engine jacket water cooling heat exchanger and ships side

and isolated its jacket water cooler. This action stopped much of the water ingress, and the tugs' crews attempted to stem the remaining water flow into the vessel by blocking the holes in the ship's side using *Thorngarth*'s damage control equipment.

With *Stolt Aspiration* continuing her approach to the Alfred Lock, and *Thorngarth* alongside the Princes Landing Stage, the VTS operators were still unaware that there had been a collision on the river. Shortly after *Thorngarth* berthed at Princes Landing Stage, the VTS operators received a telephone call from the lock operator at Langton Lock asking about the requirement for an emergency lock in for *Thorngarth.* This was the first indication that the VTS operators had received to indicate a problem. The VTS operators then initiated their emergency procedures for dealing with a collision. This included contacting the duty harbourmaster.

In consultation with the port authority and the tug company duty manager, it was decided to beach *Thorngarth.* An area along the Kings Dock River Wall was chosen, as the nature of the riverbed was known and it was suitable for beaching since it was flat and would dry out. At about 0310, the tug berthed at the wall, and the tug company local managers arrived on board. They assessed

Figure 5

Thorngarth beached at Kings Dock River Wall

Figure 6

Weld repair to split in the hull

the damage and noted that all preparations for drying out had been made. They then sent the personnel from the other tugs back to their vessels and sent the crew of *Thorngarth* home. The tug dried out at about 0535 **(Figure 5)**.

The damage to *Thorngarth* was mainly confined to the engine room, but included buckling of the vessel's fuel oil double bottom tanks. There was therefore a concern that there could be a risk of pollution as the tug dried out. Accordingly, the levels in the fuel oil tanks were carefully monitored during the drying out operation. Additionally, as the rate of water flowing into the vessel reduced, all overboard pumps were stopped to obviate the risk of pumping residual oil from the tug's bilges into the river.

Following an inspection of the external hull, the area of damage was temporarily repaired before *Thorngarth* refloated at 1330. Permanent repairs were later effected in dry dock. **(Figure 6)**

1.4 CREW

1.4.1 *Thorngarth*

Thorngarth was manned by a crew of four: the master, mate, engineer and a trainee. All crew members worked a week-on/week-off rota, which began on a Thursday. The crew were required to remain on board the tug each Thursday when essential maintenance work was carried out. At other times the crew were allowed to be away from the tug, however they were contactable at all times using a pager system. Most of the operational tasks performed by *Thorngarth* occurred around the period of high water.

The mate had been a member of the delivery crew when *Thorngarth* was moved from Milford Haven to Liverpool about 6 months prior to this accident. The master, who held a STCW 95 certificate of competency for tug master inshore, had been appointed to the tug 10 days before the accident. He had completed 5 months of a 6 month probationary period as a newly appointed master. He had never carried out this manoeuvre on this tug, although as mate he had seen it done on tugs of similar configuration. Before joining *Thorngarth*, the tug on which he previously worked had been a twin unit omni-directional tractor tug, which towed from the stern. The tug master was not fully familiar with the manoeuvring characteristics of *Thorngarth*. At the time of the accident, the master and the mate were in the wheelhouse, the trainee was on deck and the engineer was returning to the deck after acknowledging an alarm in the engine room.

1.4.2 *Stolt Aspiration*

Stolt Aspiration had a single nationality crew of 23. At the time of the accident, the bridge team consisted of the master, third officer, helmsman and a pilot. The chief officer was stationed on the forecastle with a mooring party of four, which included the bosun. The vessel was a regular caller at Liverpool, and had last visited the port 6 weeks earlier with the same master in command. The master held a class 1 certificate of competency and had sailed on *Stolt Aspiration* on a previous tour of duty.

1.5 ENVIRONMENTAL CONDITIONS

Although it had been raining heavily, at the time of the accident there was a drizzle with moderate visibility. The wind was light and the river calm. High water was predicted for 0236 at a height of 8.9m. This would have given a 1 - 1.5 knots of flood tide in the river off the Albert Lock entrance 30 minutes before high water.

1.6 RECORDED DATA

Neither vessel was fitted with a Voyage Data Recorder, nor were they required to be. Recorded data was available from the port's VTS station. Only those radar targets that had been tagged on the system were recorded, and it was only the data from the tag that was available. The position, course and speed were therefore the position course and speed of the tag, and not necessarily the vessel.

Tugs were not tagged, so the only data available concerned the position, course and speed of the tag on *Stolt Aspiration*. One channel of VHF radio was recorded, and this was the channel in use by the VTS operators. In this case, it was channel 12, the working channel for the port. Once the pilot and tugs transferred to channel 8 for berthing, their conversations were no longer recorded, nor monitored by the VTS operators. The next contact made on VHF channel 12, between *Stolt Aspiration* and the VTS station, was the ship reporting that they were all fast in Alfred Lock. No mention was made of any incident on the river, and VTS were unaware of the incident for a further 15 minutes.

The VTS radar record does show that the radar tag associated with *Stolt Aspiration* shifted to the tug at 0212, 2 minutes after the collision. The tag changed direction by approximately 120º and made for the Princes Landing Stage, where it stopped. The radar return of *Stolt Aspiration* could then be seen continuing towards the Alfred Locks, without a tag.

1.7 ACTIONS BY *STOLT ASPIRATION*

In the lead up to the collision, *Stolt Aspiration* maintained a steady course, with the speed reducing. The speed through the water was still quite high, but this was necessary to maintain progress over the ground. Expecting the tug to approach bow-to-bow, there was no indication of anything unusual happening until the tug turned beam on to the ship.

After the collision, the pilot ordered the engines full astern, and the after tug to pull full. The bow thrust was used to counter the effect of transverse thrust and maintain the ship's heading. There were no further actions which could be taken by the ship, apart from informing the port authority that the incident had occurred.

1.8 PORT MARINE SAFETY CODE

The Port Marine Safety Code was developed by the Department for Transport in consultation with wide ranging industry bodies, and was published in March 2000, for implementation by December 2001. The Code introduced the principle of a national standard for every aspect of port marine safety, and although the Code was not mandatory, the Department for Transport expected every CHA to comply with its requirements. These included the completion of formal risk assessments of marine operations in their harbours and approaches, and the management of the risks identified through a safety management system. Among the principal aims of the Code, was the establishment of a system in each UK port covering all marine operations to ensure that all risks were both tolerable and as low as reasonably practical.

1.8.1 Risk assessment

Mersey Docks and Harbour Company had carried out risk assessments, as required by the Port Marine Safety Code and these incorporated assessments for both Towage and Pilotage. Risk reduction was achieved by the following means: directions, tug registration, bona fide tug operators only, commercial agreements, compulsory pilotage, Tranmere Oil Terminal procedures and the Liverpool Special Safety Scheme (which related to the movement of nuclear powered vessels).

1.9 TUG USE IN LIVERPOOL

The use of tugs for berthing within the port is a matter for the ship's master, in consultation with the pilot where embarked. It is the wishes of the master and the professional judgment of the pilot that will set the level of tug provision. This provision may be changed in circumstances directed by the harbourmaster.

Towage within the port is organised on a commercial basis. The vessels' owners contract towage companies to assist their passage in and out of port. The request for assistance would require tugs of a particular bollard pull. The decision on which tugs to assign to the job would be taken by the tug operator's port management team, based on their extensive knowledge of operations in the port. Considerations would include tug availability, size, crew working hours, defects etc, but would rarely consider the tug type. It was accepted that each tug in the port could carry out all the possible tasks required of a tug of that bollard pull.

The number of crew on board would influence the decision about which of the two tugs assigned to the task would act as the bow tug. Unusually, *Thorngarth* carried a trainee, and this gave her a crew of four, compared to *Ashgarth*'s three. The extra person therefore made the operation of passing the towline up to the bow of the ship easier. Having decided between themselves that *Thorngarth* would act as the bow tug, and *Ashgarth* as the stern tug, they informed the pilot of this, and the pilot acknowledged this arrangement.

1.10 TRAINING OF TUG CREWS

1.10.1 Old system

By tradition in Liverpool, tug masters have been trained on the job. The turnover of personnel is low, and a young school leaver joining the Liverpool tug industry could expect to be a deckhand for a number of years before a position as mate became available. Thereafter, he or she could expect to remain in that rank for a substantial number of years before being offered promotion to master.

The duties of tug's mate include understudying the master, occasionally taking over at the controls for progressively more complicated manoeuvres. A mate would move between a variety of tugs to ensure that experience was gained on all the different types which operated in the port. After a period of time, he/she would then start to work as a relief master, before finally being given a job as permanent master of a specific tug. In this way, the prospective tug master would gain a substantial amount of experience of tug operations in the port, and of the handling characteristics of the different tugs. The progression from deckhand to master often took 20 years or more. The precise experience that the prospective tug master had assimilated during his/her career was never recorded, but it was assumed that, in the time it took for a candidate to progress to a position where he/she was being considered for promotion, the prospective tug master would have had experience of all of the tasks he/she was likely to encounter in the port of Liverpool. The suitability of the candidate for promotion was informally assessed by each master he sailed with. Final promotion to master was preceded by a 6 month probation period to ensure that the candidate had the right aptitude for command.

1.10.2 New system

Originally there were no certificates of competency for tug masters, or any national requirements for training and qualification. However, this changed with the introduction of STCW95, and a new certificate regime was introduced in April 2000. The regime applies to personnel serving aboard inshore tugs of less than 500gt, operating no more than 30 miles from a safe haven. Tug masters must, as a minimum, hold this qualification.

New entrants to the tug industry are enrolled on a National Vocational Qualification (NVQ) in tug operations. This starts at level 2, which is the qualification for deckhands, and progresses to level 3 for watchkeepers either on the bridge or in the engine room, and finally to level 4 - the qualification as inshore Tug – Master. The lead body for the NVQ is the British Tugowners Association.

1.11 PORT USER MEETINGS

Liverpool port authority holds meetings with other port users on a regular basis to discuss matters of mutual concern. Meetings are held as follows:

- Pilots - the harbourmaster and pilotage manager meet a representative of the Liverpool Pilotage Service Ltd on a monthly basis.
- Agents - the harbourmaster and pilotage manager meet approximately 4 times a year with the pilotage sub-committee of the Institute of Chartered Shipbrokers.
- Tug Operators - the harbourmaster and an assistant harbourmaster meet approximately twice a year with the two main tug operators in the port.
- Ship Owners - the harbourmaster and the pilotage manager meet with the operators of the oil terminals in the port approximately twice a year and, when necessary, with the management company of the major ferry operator.
- Berth Operators - the harbourmaster and assistant harbourmasters meet berth operators on a daily basis as operations require.

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

The crew of *Thorngarth* had been at home for some 8 hours before reporting for work the evening before the accident. Although none had slept, they had not been involved in any strenuous physical or mental activity, so were not considered to have been fatigued at the time of the accident.

The crew of *Stolt Aspiration* had maintained their work/rest periods within the IMO guidelines, so were not considered fatigued. The pilot was not considered fatigued either.

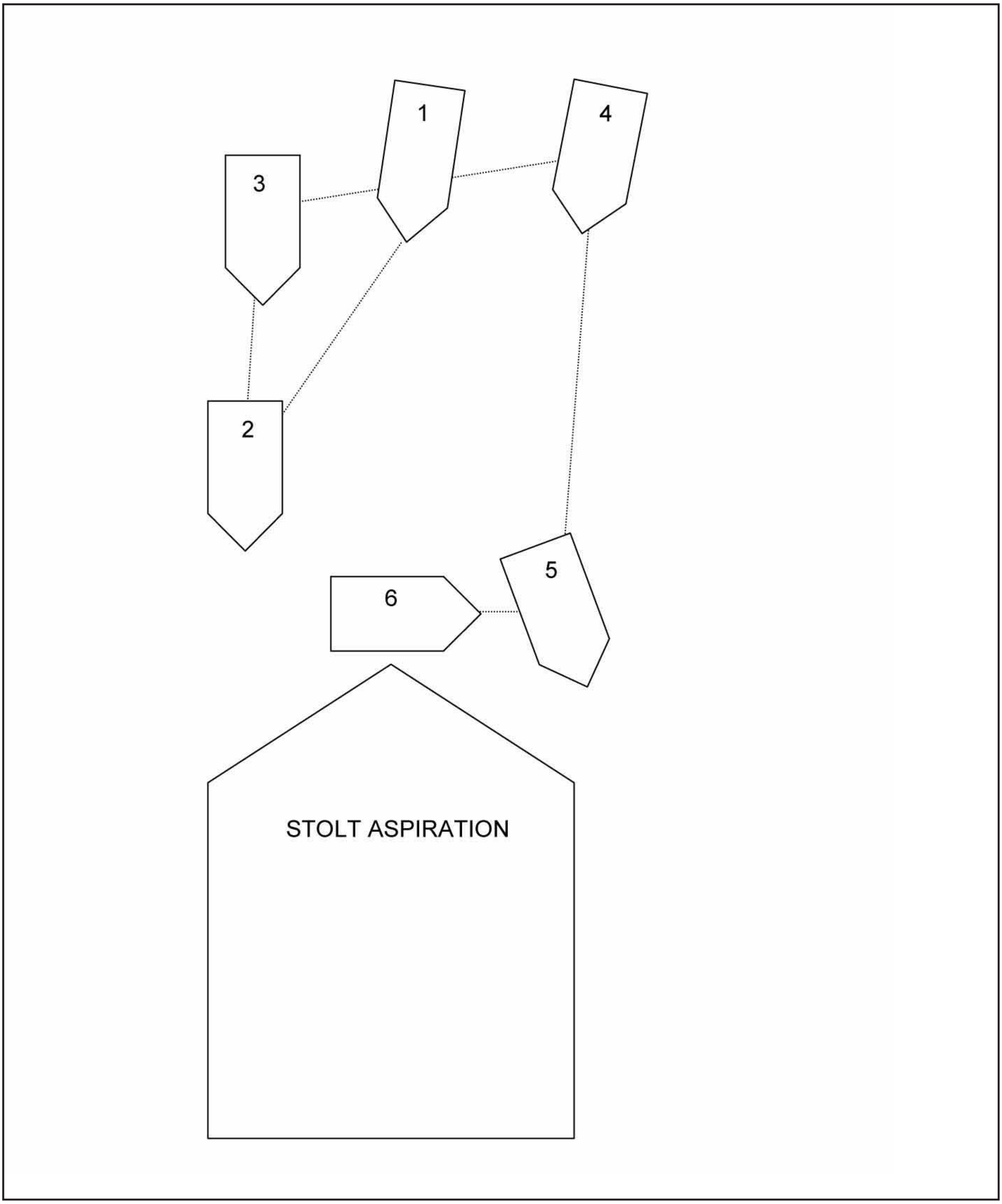
2.3 THE COLLISION

There were no mechanical failures on either vessel that could have led to the collision. The collision occurred when the tug master was re-positioning his tug ahead of the ship **(Diagram 1)**. In backing away from the ship's bow, the stern of the tug began to move to port **(position 1)**. To correct this, he pushed the port ahead-astern handle forward, which swung the stern back to starboard. However, this slowed the tug and it closed the ship **(position 2)**. Engine speed was increased to regain position ahead of the ship **(position 3)**. Once ahead of the ship, the stern again moved to port **(position 4)**, and again the port ahead-astern control handle was pushed forward to correct the swing. Because *Thorngarth* was now to starboard of *Stolt Aspiration*'s bow, as speed reduced due to the change in astern power, she ended up on the starboard bow of *Stolt Aspiration* **(position 5)**. In attempting to recover from this position, the tug master caused *Thorngarth* to move across the closing bow of *Stolt Aspiration* where he was hit on the starboard side **(position 6)**. The tug master was unfamiliar with *Thorngarth*'s manoeuvring characteristics and the manoeuvre he was required to undertake. Due to the necessary close range at which the pickup of the tow occurred, there was no time for *Stolt Aspiration*'s bridge team to take any action to avoid the collision.

2.4 *STOLT ASPIRATION*

With the after tug made fast, and the approach to Alfred Lock proceeding as planned, the next concern for the pilot and master was the connection of the bow tug. There was nothing to indicate anything was going wrong with this operation until the tug turned across the bows of the ship. This alteration across the bows of the ship was noted by the changing aspect of the tug. The quick

Diagram 1



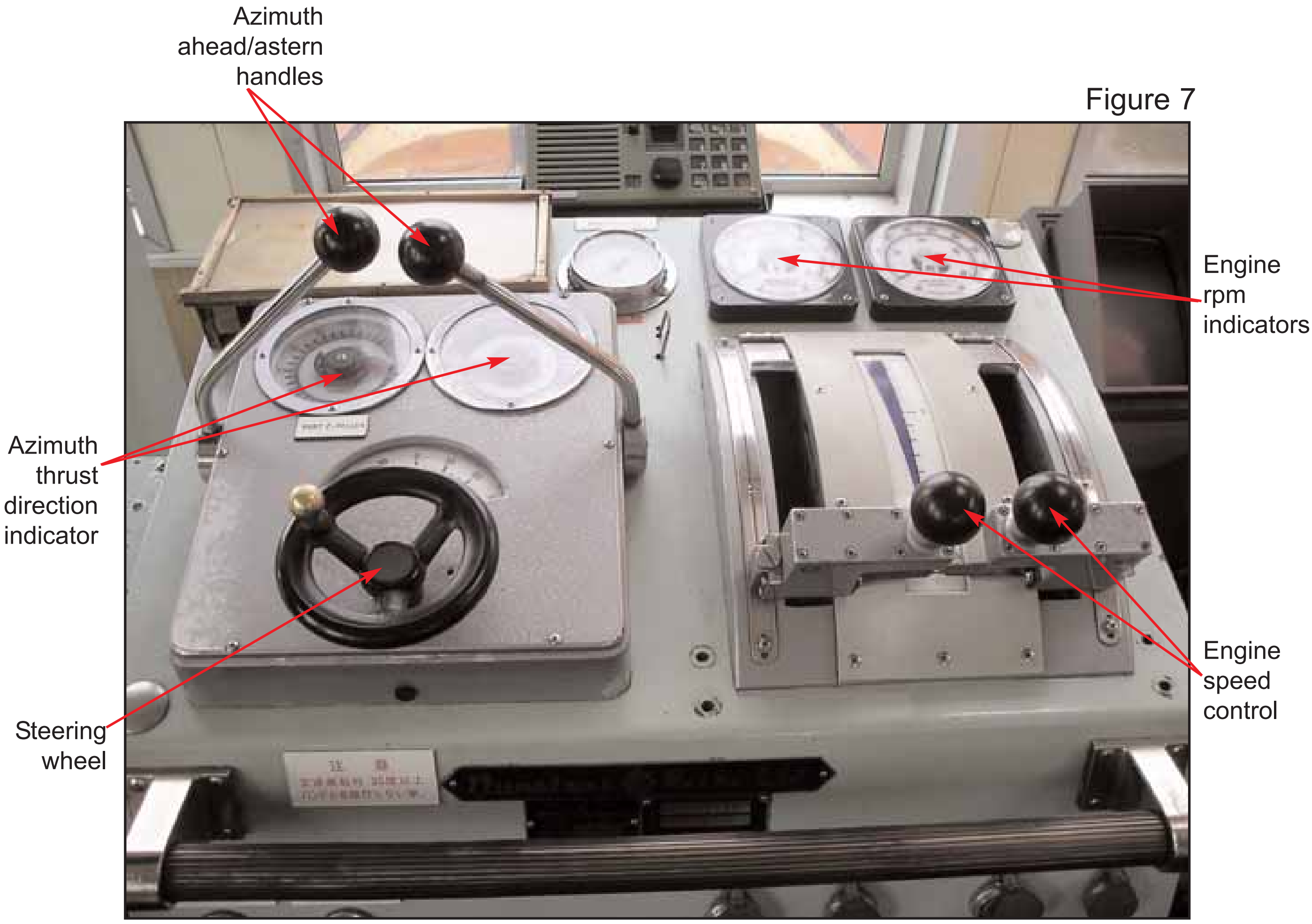
Movement of *Thorngarth* ahead of *Stolt Aspiration* (not to scale) reactions of the bridge team, in applying reverse pitch and ordering the after tug to pull astern, ensured that the ship was rapidly slowed. This would have stopped the tug being pushed over any further, and possibly prevented *Thorngarth* from suffering more extensive damage or capsize.

There was little *Stolt Aspiration*'s crew could have done to avoid the collision. They were expecting the tug to be close under the bow, and the first indication that there was a problem was just before the two vessels collided. The options available to the bridge team consisted solely of reducing the effects of the impact; this they did.

2.5 TUG MANOEUVRING CONTROLS

Tug manoeuvring controls and their propulsion systems cover a wide spectrum and, even among tugs of the same type, the speed of reaction of the propulsion gear to a control input will vary. As a consequence, any tug master will need to spend time familiarising himself with the controls of a new tug, even if he is familiar with the propulsion type and control system. Control of *Thorngarth* was effected by the use of three controls: the steering wheel, the ahead-astern handles and the speed control handles **(Figure 7)**.

Figure 7



Thorngarth propulsion controls

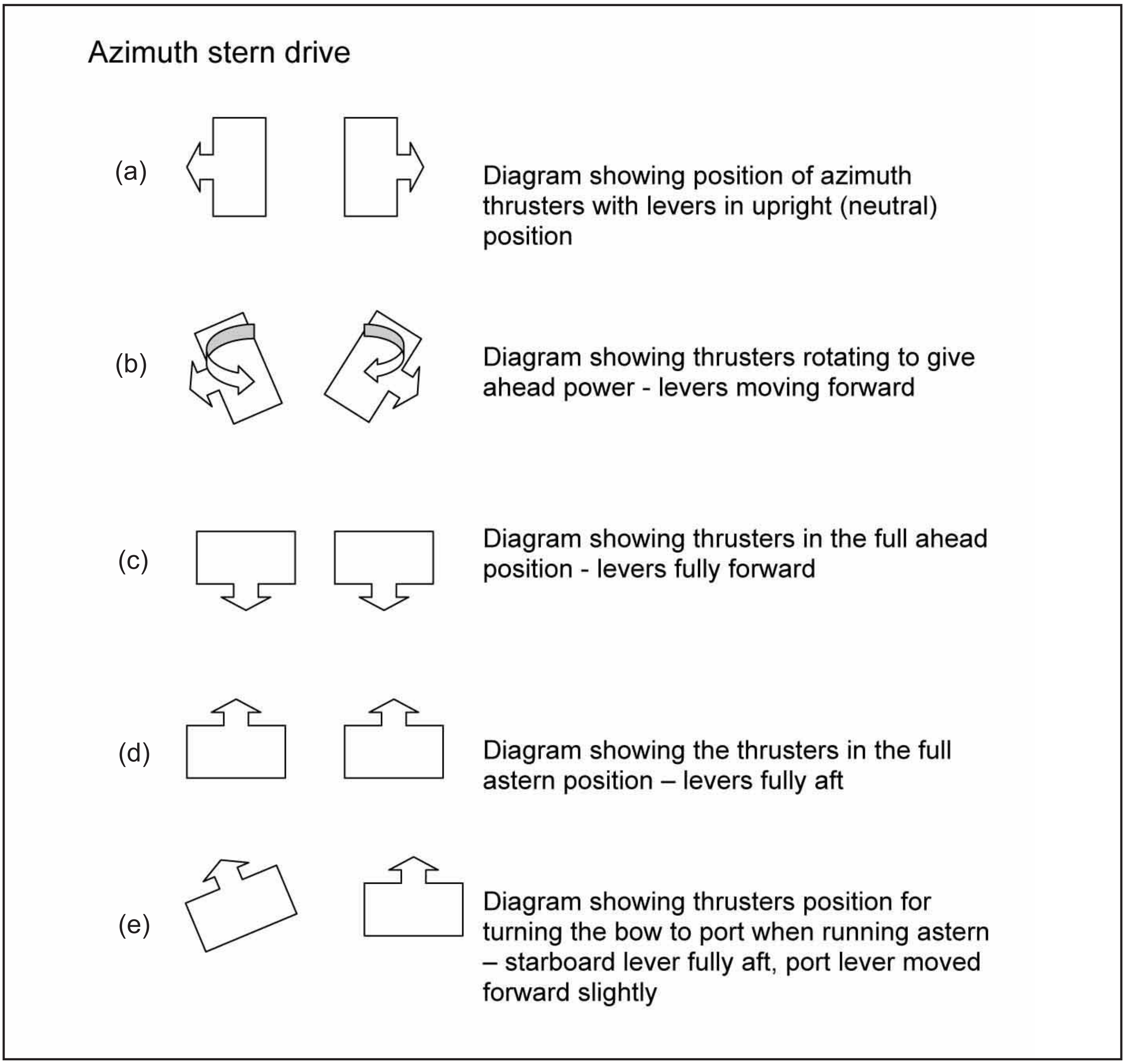
The speed control handles adjusted the speed of the engine. With the lever towards the operator, the engine would be clutched out, at tick-over. Pushing the handle away from the operator, the handle would first reach the clutch-in position, and then, with further movement away from the operator, the engine speed increased.

Directional control was achieved by a combination of the remaining two controls. The steering wheel turned both azimuth propellers in the same rotational direction, i.e. both clockwise or both anti-clockwise. This control would be used for steering when transiting from one towage operation to another. The ahead-astern handles control the direction in which the azimuth propellers are pointing. With the handles mid-way in the vertical position, the starboard propeller is pointing abeam to starboard, and the port one is pointing abeam to port. This is the neutral position **(Figure 8a)**. Pushing the handles forward moves the starboard propeller clockwise to point aft, and the port propeller anti-clockwise to point aft **(Figure 8b)**. The propellers are therefore turned through 90º to move from a neutral position where they are pushing against each other in the athwartships direction, to a position where both are pushing the vessel ahead **(Figure 8c)**. The wheel can now be used to steer in the normal fashion, since it will move both propellers together, turning the tug either to port or to starboard. By pulling both ahead-astern handles aft, the starboard propeller will rotate anti-clockwise, and the port propeller clockwise, to a position where both propellers are pushing the tug aft **(Figure 8d)**. Using the wheel now will work in the opposite sense, since turning the wheel to starboard will move the bow to port. To then move the stern to starboard requires the port handle to move forward, rotating the port azimuth propeller anti-clockwise **(Figure 8e)**. The further the handle is moved forwards, the more the azimuth propeller will rotate. This will reduce the amount of thrust astern, which will slow the vessel. Increasing the engine speed will increase the speed of the vessel, but will also increase the amount of side thrust, increasing the turning moment.

A further complication is that if an operator is used to conventional tug operation (ie twin screw propulsion with rudders), when going astern to turn the stern to starboard, an increase in speed on the port engine is required. This is usually achieved by moving the port engine control lever aft. Moving the starboard lever forward would also move the stern to starboard. The required control movement is therefore opposite to the actions required on a TASD tug. For more details about the controls of a TASD tug see **Annex B**.

Although the change of personnel between different types of tug is a necessary part of the flexible operation of a tug fleet, doing so without extensive initial or ongoing familiarisation training, where the complexities and nuances of control of different tug types can be properly understood and practised by the personnel concerned, will inevitably increase the risk of mistakes being made during operational situations.

Figure 8



2.6 TUG APPROACH

The collision happened during a bow-to-bow towing operation at a speed of about 6 knots. During this operation, the tug master was at the controls, with the mate also on the bridge operating the winch. The engineer would normally have been handling the towing gear on deck, but he had gone to the engine room to cancel an alarm. The one remaining crew member was therefore handling the towing gear on his own.

For a tug which tows over the bow, there are two possible approaches to a ship when acting as the forward tug.

2.6.1 Approach from alongside

In this approach, the assisting tug will follow alongside the shoulder of the ship, and pass towing gear from this position. The tug can then be used for pushing on or pulling off once the vessel's forward speed has reduced. This method is known as "breasting" and will generally be used when a ship requires the services of a tug to control the bow in the athwartships direction, such as when berthing. To rotate the tug so that it is perpendicular to the ship's side in order to push on, or pull off, requires the forward speed of the ship to be as low as possible. The tug's power is split between the push/pull force required to assist the ship, and the directional force required to maintain position on the ship. The lower the forward speed, the more power the tug has available to push or pull, as less power will be required to maintain its position perpendicular to the hull of the ship.

2.6.2 Approach from ahead

The second method of approach is for the tug to position itself ahead of the vessel, then approach bow-to-bow, to pass the towing gear, and then reposition itself ahead of the vessel. This method is usually used when a tow directly ahead of the vessel is required, especially when negotiating locks. Again, the lower the speed, the easier it will be for the tug to pass the towing gear, since the effects of interaction between the two vessels' hulls will be reduced. The tug will navigate stern-first, guiding the bow in the direction indicated by the pilot. The best practice for the approach is to approach bow-to-bow. Any other method would involve the tug overtaking the ship stern-first, or turning around in front of the ship, both of which are more dangerous.

Both of the above methods are conducted many times a day by tugs throughout the world. The method chosen for use in Liverpool was the approach from ahead, bow-to-bow. This was as a result of a series of trials with TASD tugs when they were first used in the port. Other methods of approach proved unsatisfactory, especially if the vessels concerned were proceeding at anything other than minimum speed. The high rate of tidal flow in the port often meant that a ship had to maintain a higher speed through the water to make progress over the ground. It is speed through the water that influences the effect of interaction, and due to the higher speeds through the water, the safer option was to approach bow-to-bow.

2.7 RISK ASSESSMENT

The Mersey Docks and Harbour Company had carried out a Formal Safety Assessment as required by the Port Marine Safety Code. This consisted of risk assessments covering 17 aspects of operations within the port, and included pilotage and towage. The risk assessments follow the 5 key steps given in the Management of Health and Safety at Work Regulations 1999, which are:

- Look for and identify the hazards
- Decide who or what might be harmed
- Evaluate the risks arising from the hazards and decide whether the existing precautions are adequate, or whether more should be done
- Record the significant findings
- Review the assessment if there is a significant change, or evidence that the original assessment was inadequate.

2.7.1 Pilotage risk assessment

This risk assessment detailed the measures taken to reduce the risk from a lack of local knowledge of the river and its approaches. One of the measures is the requirement for compulsory pilotage for vessels of 82m length and over, and all vessels carrying hazardous cargoes. *Stolt Aspiration* was over 82m and was carrying hazardous cargo. She therefore had to carry a pilot. The risk from a lack of knowledge of the river was thus reduced.

The level of tug assistance assigned to a particular job was decided by the master and the pilot. Despite being one of the pilot's tasks, the work was not covered by this risk assessment, but by the towage risk assessment.

2.7.2 Towage risk assessment

The risk assessment did not specifically cover each different type of towing evolution that may be experienced within the port of Liverpool, and it would be unreasonable to expect it to do so. It did, however, give the rationale for tug provision within the port.

The risk assessment is in two parts. Firstly, it looks at the number of tugs available in the port, and secondly it looks at the number and size of tugs required for each task. The number of tugs available in the port is left to the tug operating company's judgment, considering the number of contracts it is likely to have to service. However, if the number of tugs available is too low for the effective management of the risk within the harbour, then the harbourmaster can determine other methods of controlling the risk, such as contracting in other tugs, or imposing restrictions on harbour operations.

The second part of the risk assessment examines the number of tugs to use for a particular contract. This is normally determined by the vessel's master, in consultation with the pilot, although the harbourmaster has the powers of direction to insist on the specific number of tugs to be used. In practice, the number of tugs employed on a task will be determined by the bollard pull of the available tugs, and does not necessarily make allowance for the type of propulsion and towing arrangement of each tug, or the limitations which different propulsion systems might impose on the task.

Special directions are also given for high risk operations, such as the berthing of VLCCs and standby and escort duties for tankers, as well as the berthing of nuclear-powered submarines. The special directions and guidelines make allowance for the risks associated with these more hazardous operations, and include the number of tugs to be available for each move.

The decision taken on how many tugs to use was based on the bollard pull required for a particular operation. The limitations imposed on the task by the different propulsion systems of the tugs in the port was, therefore, a matter for the pilot to contend with. No formal guidance was given to the pilots concerning the capabilities and limitations of the tugs available in the port.

2.8 TRAINING AND QUALIFICATION OF TUG CREWS

The training and qualification schemes for inshore tug operators had changed twice in the 5 years before the accident. The first change introduced qualifications for tug operators, and the second introduced the NVQ scheme for new entrants to the industry, leading to the tug master inshore qualification.

2.8.1 The old scheme

Staff turnover in the inshore tug industry is low, with many employees joining as school leavers and continuing to retirement. Traditionally, promotion was based on "dead man's shoes", and the next available promotion was offered to the next man in line. Since each candidate for promotion would have served a considerable period of time as mate on a tug, it is likely that he would have seen every task the tug was required to carry out, and would have performed them all under the watchful eye of the tug master, especially as his turn for command approached. As staff changed over, and new tugs were bought into the fleet, the mate would gain experience on all the different tugs in the fleet in that port, before eventually being given command. However, no records were maintained of either the tugs served on or the type of jobs undertaken. It was assumed that all the necessary familiarisation and training would have been achieved before promotion to master.

In April 2000, the MCA introduced a new scheme to enable uncertificated personnel, previously not required to hold a STCW95 certificate, to obtain a qualification prior to the full implementation of the STCW95 convention on 1 February 2002. This involved being able to prove service in tugs in an appropriate capacity, produce evidence of attendance at ancillary courses and pass an oral examination.

The master and mate of *Thorngarth* had taken advantage of this route to qualification, both obtaining their qualifications in 2001.

These fast-track training arrangements were available until 31 January 2002, with no further examinations available after 31 December 2002.

During the transition phase, a number of tug crew members held STCW78 certificates of competency, certificates of service or boatmasters' licences. They were permitted to use the new scheme to obtain an STCW95 certificate of competency. Alternatively, if close to retirement age, they were allowed to continue under the existing arrangements until 31 January 2005, but, only if they informed the MCA that this was their intention.

2.8.2 The current training scheme

The introduction of a formal qualification for inshore tug operators meant that there was now a national standard for tug masters, and it could be expected that the standard of tug operation would be the same in each port in the UK. The additional requirement for ancillary training improved the safety of operation of the tugs, and the safety of the personnel operating them.

A new trainee is required to complete a training portfolio in order to achieve his qualifications as Inshore Tug – Tughand at VQ level 2, and then Inshore Tug – Bridge Watchkeeper at VQ level 3. The portfolio provides the means for the trainee to collect the necessary evidence of proficiency needed for the qualification. The portfolio requires the trainee to complete tasks and assignments related to his work, and to demonstrate an appropriate level of knowledge and understanding of selected subjects. There are two routes to complete this scheme. The first is to follow the BTA Marine Apprentice Training Scheme (MATS), in full, and the second is to complete the appropriate BTA portfolio. Both routes then require the completion of ancillary training, and proof of service on tugs, before finally sitting the MCA oral examination. Ancillary training for deckhands consists of the following courses:

- Personal Survival Techniques
- Fire Prevention and Fire-Fighting
- Elementary First-Aid
- Personal Safety and Social Responsibility.

To gain the Bridge Watchkeeper qualification, additional ancillary courses required are:

- Proficiency in Survival Craft and Rescue Boats
- Training in Advanced Fire-Fighting
- Proficiency in Medical First-Aid
- GMDSS Restricted Operators Certificate.

The further qualification as Inshore Tug – Master at VQ level 4, is not covered by the Apprenticeship scheme.

For Svitzer's in Liverpool, the training is assessed by an independent team of assessors, and validated by a nautical college. This means that the new trainee will have carried out all the tasks required by the industry lead body, and these will have been independently assessed before the trainee takes his oral examinations leading to MCA certification.

This system is intended to enable tug personnel employed in the inshore tug industry to obtain an STCW95 certificate of competency. By employing the services of external assessors, the company ensures that the assessment of their trainees is unbiased, and to a common standard.

Although the crew of *Thorngarth* held the appropriate qualifications, these had been gained under the old scheme. It was assumed that by the time an individual qualified as master, he would have experienced every type of tug manoeuvre, and that this experience would have been overseen by at least one other experienced master. No records were kept to monitor the training and experience gained. The master of *Thorngarth* had witnessed the bow-to-bow approach, which he was required to use when passing the towline to *Stolt Aspiration*, but it was the first time he had conducted the manoeuvre in charge of the tug.

2.9 CHOICE OF TUG FOR THE TASK

In the port of Liverpool, the allocation of tugs for a particular task is the responsibility of the towage company port managers. This is generally based on a commercial contract for tug(s) of specified bollard pull. Allocation of a designated tug to a task is dependent on a number of factors including the workload within the port and the hours worked by specific crews. This means that the pilot and master of a ship would not know which type of tug had been allocated to the vessel until just before the planned operation. However, they could be confident that the tug would meet the bollard pull requirement and would be capable of carrying out the designated task, despite not necessarily being the optimum choice of tug for the task.

Once nominated for a task, the tug masters concerned will discuss and agree the disposition of each tug. Agreement for the arrangement is then obtained from the relevant pilot and master.

The allocation of the most appropriate number and/or type of tugs for each task, could be enhanced if there was formal dialogue established between the tug operators, pilots and the port authority. These meetings could also be used to establish the required experience level for tug crews when performing specific tasks (see section 2.10).

2.10 COMMUNICATIONS IN THE PORT

The series of meetings that were routinely carried out in the port of Liverpool, as identified in section 1.11, were designed to ensure that the providers of the port infrastructure shared a common vision, and that the port users received the services they required. The benefits of these meetings were twofold: the port provided its services as safely and efficiently as possible, and the customers' requirements were met.

However, when looking in more detail at the meetings that were arranged, the port authority met the pilots, and met the towage companies, but not at the same time. There was no forum for the towage companies and the pilots to raise matters of mutual concern with the port authority and vice versa. This had implications on safety, since tug use was being conducted under the control of the pilot whose only opportunity to speak with the tug masters was when undertaking a towage operation. This provided no opportunity to review the way in which pilots and tug masters interact, or review and/or improve the methods employed to achieve specific tasks.

A regular meeting of the port authority, tug masters and pilots would be of benefit in ensuring that the people undertaking the towage tasks are aware of each other's capabilities and limitations, with particular emphasis on the operating characteristics of the different types of tug.

2.11 RADIO COMMUNICATION

A Vessel Traffic Service was provided in the port, and this operated on VHF channel 12. Vessels of more than 50gt, navigating in the port of Liverpool, were required to be equipped with VHF/RT communications, and were also required to establish contact with the Control Centre, call sign Mersey Radio. They were then required to maintain a listening watch on VHF channel 12 when underway or at anchor within the port. VHF channels 08 and 10 were intended for use within the port for towage communication from 3 hours before high water, to 3 hours after high water.

Both *Thorngarth* and *Stolt Aspiration* were keeping a listening watch on VHF channel 12 while using the working channel, channel 08, to conduct the towage operation.

As the co-ordinator for the operation of vessel movements in the Mersey, it is vital for the safe and efficient operation of the port that the VTS station is kept informed of any incident which may affect operations. An incident involving damage to a tug would be one such incident, and it is surprising that the first the VTS operators knew of the problems experienced by *Thorngarth* and *Stolt Aspiration* was a telephone call from the lock operators, at about 0245, asking for more information about a possible emergency lock-in for *Thorngarth*. Although not required in this case, the deployment of rescue services would have been expedited had either the tug master of *Thorngarth* or the master/pilot on board *Stolt Aspiration* informed the VTS of the incident. The VTS operators could then have co-ordinated the rescue, leaving those on board to concentrate on the best efforts to save the vessel. The tug master of *Thorngarth*'s use of a mobile telephone, to call for an ambulance, was quick and direct. However, it did not alert other users of the port to the tug's problems.

The MRSC at Liverpool was not informed of the accident until 0400, and then by Port Operations, not by either of the vessels involved.

By not keeping the VTS operators or the MRSC informed of the accident, and the actions being taken, the VTS and MRSC operators were unable to offer advice or co-ordinate assistance.

2.12 OTHER INCIDENTS

Two similar accidents occurred elsewhere within the UK, within 4 months of the collision between *Thorngarth* and *Stolt Aspiration*. In the first, a tug was operating as the stern tug in moving a ship astern. After being asked to pull the ship's stern to one side, the tug found it could not regain its original position, and collided with the ship's stern. The second incident occurred when a tug, acting as the bow tug in a berthing operation, was manoeuvring to pass its towline to the ship. Once the line had been passed to the ship, the tug intended to move ahead of the ship, but collided with her bulbous bow. In neither case were there any injuries or pollution caused.

In both cases, the tug masters had a wealth of experience in tug operations within their respective ports. However, both were operating tugs with unfamiliar propulsion systems and manoeuvring controls, and attempting manoeuvres with which they were not entirely familiar.

The three accidents, sharing similar causes and occurring during a short period of time, prompted the MAIB to issue Safety Bulletin 2/2005 **(see Annex A)**.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

The following are the safety issues which have been identified as a result of the MAIB's investigation. They are not listed in order of priority, but in the order in which they appear in Section 2.

1. Fatigue was not an issue in this accident. [2.2]

2. There were no mechanical failures on either vessel that could have led to the collision. [2.3]

3. The accident occurred when the tug master of *Thorngarth* was adjusting his position ahead of the ship and, due to his unfamiliarity with the tug, misjudged the amount of control movement required. [2.3]

4. There was little that *Stolt Aspiration*'s crew could have done to prevent the collision. [2.4]

5. Although the change of personnel from tug type to tug type is a necessary part of the flexible operation of a tug fleet, doing so without extensive initial or ongoing familiarisation training, where the complexities and nuances of control of different tug types can be properly understood and practised by the personnel concerned, will inevitably increase the risk of mistakes being made during operational situations. [2.5]

6. The bow-to-bow approach is conducted many times a day by tugs throughout the world. [2.6]

7. No formal guidance was given to pilots concerning the capabilities and limitations of tugs in the port. [2.7]

8. The introduction of new qualifications for Inshore Tug Operators has standardised the training requirements. The previous system was not satisfactory in that it relied on personnel gaining the relevant experience over time but no records of experience gained were maintained. [2.8]

9. The pilot and master of a ship would not know which type of tug has been allocated to the vessel until just before the planned operation. However, they could be confident that the tug would make the bollard pull requirement and would be capable of carrying out the designated task, despite not necessarily being the optimum choice of tug for the task. [2.9]

10. There was no forum for the tug operators, pilots and port authority to raise matters of mutual concern. [2.10]

11. By not informing the VTS operators or the MRSC of the accident, the VTS and MRSC operators were unable to co-ordinate the response from the rescue services. [2.11]

12. Two other accidents occurred elsewhere in the UK in a short period of time, both also caused when tug masters were operating tugs with unfamiliar propulsion systems and manoeuvring controls, and attempting manoeuvres with which they were not entirely familiar. [2.12]

SECTION 4 - ACTION TAKEN

Since the accident, the following actions have been taken:

1. The Mersey Docks and Harbour Company

   Have published a pamphlet giving the capabilities and limitations of all the tugs available on the Mersey, and will distribute this to all pilots and other interested parties.

2. Svitzer Marine Limited

   Has taken the following actions:

   - Undertaken a UK-wide skills assessment of all masters, relief masters and mates to assess both their experience and capabilities on a number of tug moves on different tug types. This will form the starting point for an individual training and experience log that is being developed.
   - A course has been established at a UK simulation centre, initially for Liverpool tug crews. The course will include leadership skills, incident management, bridge management and will include a simulated incident. Eventually, this will apply to all the company's UK crews, and will be in addition to escort tug training already undertaken.
   - It has begun a consultation process with its crews regarding the introduction of a Continuing Professional Development (CPD) programme. This is to be introduced with the individual training and experience logs.
   - Masters of new tugs being introduced to the UK will undertake a pre-joining simulator course before taking command.
   - The probationary period for the master of *Thorngarth* has been extended, and his confirmation in post is dependent on meeting new criteria introduced by the company as being compulsory for all new masters.
   - An internal accident report has been issued to all ports, and is to be discussed at the Health and Safety committee meetings in individual ports.
   - It has undertaken a review of all training procedures.
   - A Group Safety Seminar has taken place to discuss bow-to-bow operations. As a result of the seminar, Group Safety Memorandum number 7/2005 was issued on 30 September 2005.

SECTION 5 - RECOMMENDATIONS

The British Tugowners Association is recommended to:

2005/211 Encourage its members to ensure that the movement of personnel between tugs is closely monitored, and that training and expertise of tugs' crews are matched, and are consistent with the type of tug and its expected task requirement.

Major Tug Operators, the British Tugowners Association, and the PMSC Steering Group are jointly recommended to:

2005/212 Encourage regular formal discussion between port authorities, pilots and tug operators. All parties should be involved in the decision-making process, which will decide the optimum allocation of tugs for all manoeuvres within a port, and the level of crew experience required for each task.

Marine Accident Investigation Branch
November 2005

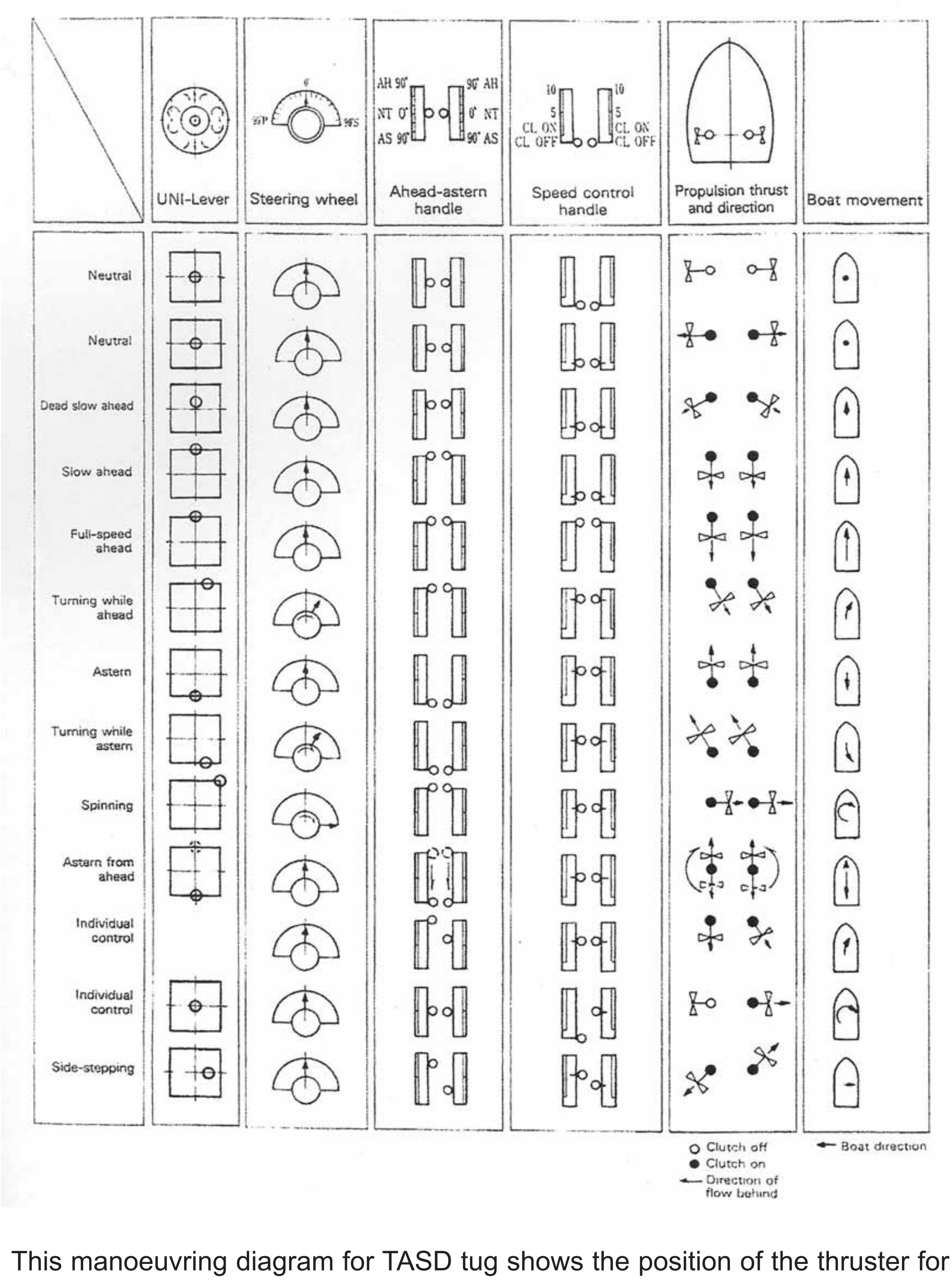
Safety recommendations shall in no case create a presumption of blame or liability

ANNEX A

Safety Bulletin 2/2005

ANNEX B

Manoeuvring diagram for TASD tug



This manoeuvring diagram for TASD tug shows the position of the thruster for different control positions, and the effect that this will have on the movement of the tug.