Report on the investigation of

the grounding of

***Stolt Tern***

Holyhead, Wales

1 December 2004

Marine Accident Investigation Branch
Carlton House
Carlton Place
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United Kingdom
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**Report No 18/2005**
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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.

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## GLOSSARY OF ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| BA | - | British Admiralty |
| BPA | - | British Ports Association |
| CHA | - | Competent Harbour Authority |
| CPP | - | Controllable Pitch Propeller |
| GP | - | General Purpose |
| GPS | - | Global Positioning System |
| Grt | - | Gross registered tonnage |
| HW | - | High Water |
| IMO | - | International Maritime Organization |
| ISM Code | - | International Management Code for the Safe Operation of Ships and for Pollution Prevention |
| Ltd | - | Limited |
| NTM | - | Notice to Mariners |
| OOW | - | Officer of the Watch |
| PEC | - | Pilotage Exemption Certificate |
| QCA | - | Qualifications and Curriculum Authority |
| SMC | - | Safety Management Certificate |
| TSS | - | Traffic Separation Scheme |
| UK | - | United Kingdom |
| UKC | - | Under Keel Clearance |
| UKHO | - | United Kingdom Hydrographic Office |
| UKMPG | - | United Kingdom Major Ports Group |
| UTC | - | Universal Co-ordinated Time |
| VTS | - | Vessel Traffic Services |

## SYNOPSIS

At 0940(UTC) on 1 December 2004, the Cayman Islands registered product tanker *Stolt Tern* ran aground off the south eastern end of the breakwater in Holyhead, following passage from Immingham. The vessel was re-floated the same morning and proceeded to an alongside berth. The ship was carrying 4000 tonnes of gas oil. However, despite damage to the vessel, including a split to her hull, there was no pollution.

The grounding occurred when the ship was entering Holyhead with a harbour pilot embarked. As the ship approached the harbour's breakwater, speed was reduced, and helm was applied to adjust the ship's course by 10° to starboard. The bow thruster was applied to starboard at the same time. As the ship passed the intended heading, efforts to check the swing included the application of maximum port rudder and the use of the bow thruster to port, but these had no perceivable effect. The master was unable to regain control of the movement of the ship, which grounded in shoal water to the south of the breakwater.

The investigation identified several contributory factors, including:

- The ship's turn to starboard could not be checked because of her manoeuvring characteristics when speed was reduced quickly, the differential effects of the tidal stream in the vicinity of the breakwater, and the initial use of the bow thruster and helm.
- Inadequate communication and teamwork between the bridge personnel meant the pilot was unaware that *Stolt Tern*'s speed had been reduced to below the level he had requested, or that the bow thruster had been used.
- In an attempt to prevent the collision with the breakwater, the master took evasive action which ignored the advice given by the pilot to put the ship's action astern. Additionally, this action was taken when *Stolt Tern* was too close to the breakwater for it to be successful.
- The ship manager's safety management system had not identified a number of departures from bridge procedures, or material deficiencies affecting the ship's safe navigation, particularly in pilotage waters.
- The precaution of allowing greater passing distance from the breakwater was not considered during the port's risk assessment. This was because the approach to the port was perceived to be relatively straightforward, there had been no history of accidents or incidents to raise concerns and the port management had a high regard for the ability and experience of the pilot.
- It was difficult for the harbour authority to effectively monitor the pilot's performance in all aspects of his work.

Action has been taken by Stena Line Ports UK Ltd to:

- Introduce a one cable exclusion zone around the breakwater head at Holyhead.
- Refine the process for the review of its risk assessments.
- Review the information contained in the Admiralty Sailing Directions regarding Holyhead Port.

Recommendations have been made to the Maritime and Coastguard Agency, the British Ports Association, the United Kingdom Major Ports Group, the ship manager of *Stolt Tern*, and the Competent Harbour Authority of Holyhead, with the purpose of:

- Improving and developing the ship manager's safety management system.
- Ensuring action is taken to establish national occupational standards for marine pilots as prerequisites for their recruitment and authorisation.
- Highlighting the need to ensure that risks are reduced to as low as reasonably practical, and that the control measures implemented to reduce risk are regularly reviewed.
- Encouraging the information exchange between pilots and masters to be meaningful and cover all relevant aspects of the bridge organisation, rather than just a paperwork exercise.

# SECTION 1 - FACTUAL INFORMATION

## 1.1 PARTICULARS OF *STOLT TERN* AND ACCIDENT

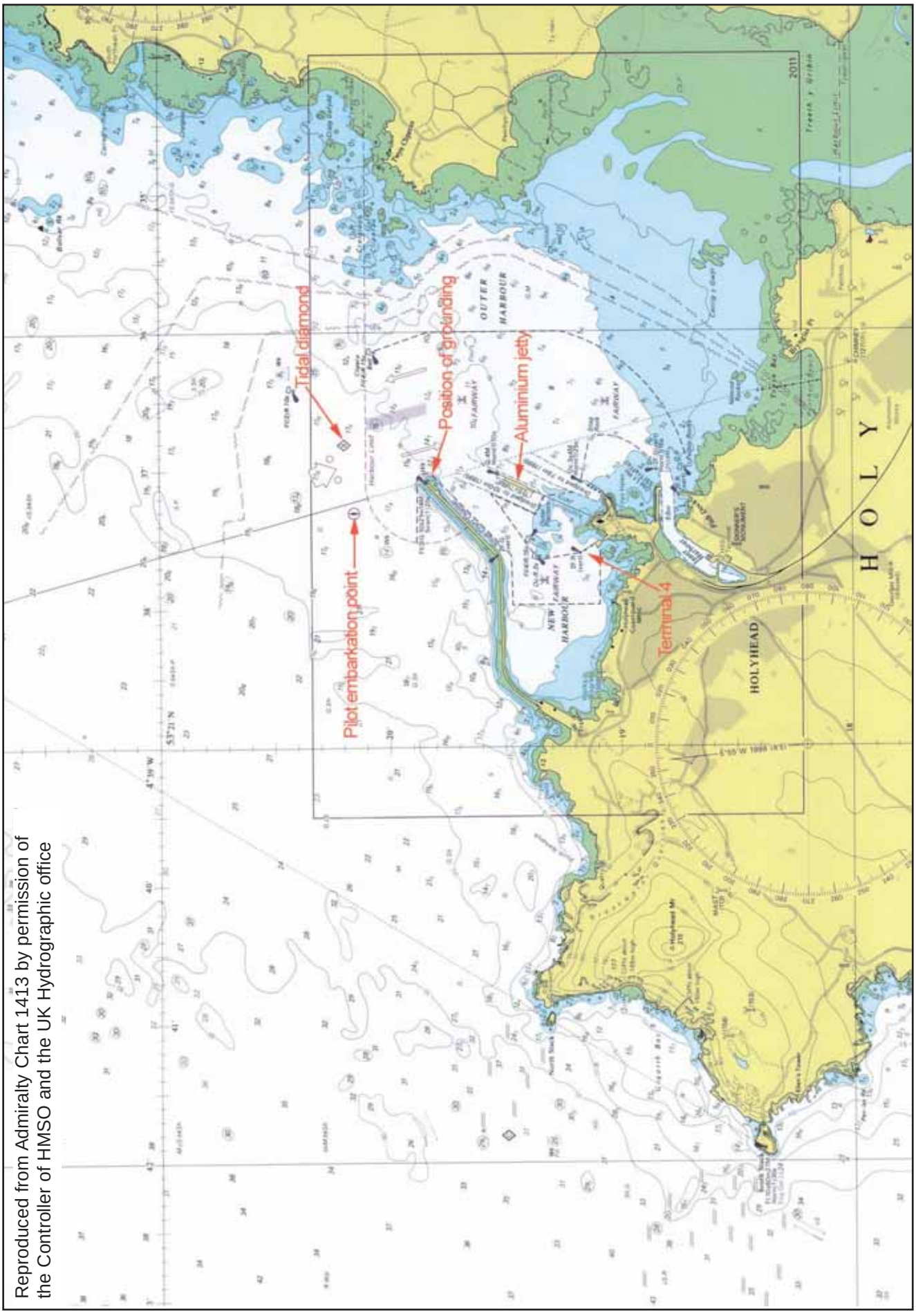
### Vessel details

| | | |
|---|---|---|
| Registered owner | : | Stolt Tern B.V. |
| Manager(s) | : | Stolt-Nielsen Transportation Group B.V. |
| Port of registry | : | George Town |
| Flag | : | Cayman Islands |
| Type | : | Product tanker |
| Built | : | 1991- Aarhus Flydedok A/S-Aarhus, Denmark |
| Classification society | : | Lloyd's Register |
| Construction | : | Steel |
| Length overall | : | 96.35m |
| Gross tonnage | : | 3206 |
| Engine power and/or type | : | 2999Kw |
| Service speed | : | 14.25 knots |
| Other relevant info | : | Right handed CPP, Becker rudder, 450BHP bow thrusters |

### Accident details

| | | |
|---|---|---|
| Time and date | : | 0940 UTC on 1 December 2004 |
| Location of incident | : | South east end of Holyhead breakwater. 53°19'8N, 004°37'1W |
| Persons on board | : | 14 (13 crew and one harbour pilot) |
| Injuries/fatalities | : | Nil |
| Damage | : | Damage to underwater area extending 15m from bow, including indentations and a 2.3m split. |

Figure 1




Reproduced from Admiralty Chart 1413 by permission of the Controller of HMSO and the UK Hydrographic office

## 1.2 NARRATIVE (all times are UTC, and all courses are true)

At 0915 on 1 December 2004, *Stolt Tern* approached the pilot embarkation position off Holyhead **(Figure 1)**, with a cargo of 4000t of gas oil from Immingham. She was on an easterly course and was at slow ahead. When the pilot boat was sighted, the master took the bridge watch from the third officer, and started the bow thruster. The pilot embarked at 0925.

On arrival on the bridge, information was exchanged between the master and the pilot. The pilot was given the ship's pilot information card and supplementary information regarding her Becker rudder **(Annex A)**. The advice on these cards, that reductions in speed should be made gradually and not when changing heading, was emphasised to the pilot verbally. In return, the pilot gave the master the port passage plan and master/pilot information exchange pro-forma **(Annex B)**. He also described the intended route to Terminal 4 **(Figure 1)**, the intended berth, which was visible over the breakwater. During the exchange of information, the pilot advised the master to alter course to starboard to 140°, which put the breakwater light fine on the starboard bow. He also advised him to increase speed to full ahead. The master complied with this advice. Manual steering was selected at about this time. The pilot was aware that there were no other vessels in the vicinity.

As the ship approached the harbour entrance, the master and third officer stood behind the control console sited in the centre of the bridge **(Figure 2)**. The pilot stood in front of this console. The master controlled the pitch control lever, and the third officer was on the helm, except when relieved by the master to allow him to plot fixes on the paper chart at 0930 and 0935.

Figure 2

Photograph showing bridge layout

After remaining at full ahead for between 4 and 5 minutes, speed was reduced to half ahead on the advice of the pilot. It was further reduced to slow ahead when about 5 cables from the breakwater. Soon after, the pilot advised a 10° alteration to starboard to aim towards a prominent chimney. As a consequence, the third officer applied 5° of starboard helm. The master also gave a short burst of the bow thruster to starboard, and reduced to dead slow ahead, in accordance with advice he thought the pilot had given.

The ship started to swing quickly to starboard. The pilot commented that the stern was being influenced by the tidal stream and ordered ‘midships’ followed by ‘steady’. As the third officer applied 20° of port helm, the pilot advised ‘hard to port’. Although 35° of port helm was applied, and the bow thruster was thrust to port, the ship continued to swing quickly to starboard. Disturbed water from the bow thruster was observed on the starboard side.

Realising that the ship was swinging towards the breakwater, the pilot advised the master to ‘stop’ followed by ‘full astern’. The third officer responded by stating in Filipino that this action would accelerate the swing towards the breakwater end. Accordingly, the master increased to half ahead, and in view of the ship’s slow speed, he removed the limit to the becker rudder and increased the port helm to 65°. Moments later, at 0940, the ship grounded on a patch of shoal water to the south of the eastern end of the breakwater **(Figure 3)**. Estimates of the speed of grounding range from 2 to 6 knots.

Figure 3

Photograph of *Stolt Tern* aground

## 1.3 ACTION TAKEN FOLLOWING THE COLLISION AND DAMAGE

After the grounding, the master tried unsuccessfully to manoeuvre the vessel clear of the breakwater using astern power and bow thrust. The chief officer, who had arrived on the bridge shortly before the grounding, immediately went below to check the cargo tanks, while the third officer checked their contents using the cargo monitoring computer system sited on the bridge. The general alarm was not sounded because the master forgot to do so. Water ingress was detected in the fore peak hold at 0955, but all other compartments were reported to be dry. *Stolt Tern* was re-floated with the assistance of the tug *Afon Braint* at 1120, and was secured alongside Terminal 4 at 1215. There was no pollution.

An underwater survey conducted at Terminal 4, showed that the ship had sustained a 2.3m x 50mm split on the starboard side of the hull forward of the bow thruster, together with several indentations.

Following a temporary repair, the vessel sailed during the evening of 2 December 2004. Permanent repair was conducted in Rotterdam between 7 and 19 December 2004.

## 1.4 ENVIRONMENTAL CONDITIONS

The wind was south-east force 1-2, and the sea was calm. Low water at Holyhead was 0624 and high water was at 1239. It was 46% spring tides. The predicted mean rate of the tidal stream in the position of tidal diamond 'B' shown at **Figure 1** was 102° at 0.5 knot. This information was based on data collection by a Royal Navy survey in 1976.

With respect to tidal streams immediately to the north of the breakwater at Holyhead, the Admiralty Sailing Directions states:

| *Interval from HW Holyhead* | *Direction* |
|---|---|
| *-0240* | *W (runs for 9 hours)* |

*No perceptible E-going stream [Sic]*

Revisions to the Sailing Directions were last received by the UKHO from the port in November 2001, but these did not include any changes to the tidal stream information.

## 1.5 RECORDED INFORMATION

A copy of the ship's course recorder for the period covering the interval between 0740 and 1210 is at **Annex C**. The recorder was checked by MAIB inspectors on 2 December and was found to be reading 10 minutes slow, and 10° low. The ship was fitted with a propeller pitch recorder, but this was not working during the entry into Holyhead. The port's radar was operating at the time of the accident, but did not have a recording capability.

## 1.6 NAVIGATIONAL PUBLICATIONS AND PASSAGE PLANS

The ship's passage plan **(Annex D)** was prepared by the second officer, and did not contain any tidal information. The ship had not held tide tables on board since 1 January 2004. The chart in use for entry into the port was BA 2011, the largest scale chart available. The last small correction applied to the chart was Notice to Mariners 1165. Two further corrections issued in weeks 25 and 46 (2836 and 5158) had not been applied.

The port passage plan **(Annex B)** was compiled by the harbourmaster in consultation with the pilot. The plan does not show the intended routes to the port's berths, including Terminal 4, and the intended distance at which ships should pass the breakwater was not discussed.

## 1.7 MANNING

### 1.7.1 Minimum safe manning and language

The ship's minimum safe manning document was issued by the Cayman Islands Administration on 7 January 2003, and required a total crew of 11. This comprised the master, chief officer, chief engineer, two OOWs, second engineer, four deck ratings and a cook. *Stolt Tern* had a crew of 13, all Filipino, with a GP trainee and a fitter being carried in excess of the requirements of the safe manning document. The common language among the crew was Filipino (Tagalog), but the working language was English.

### 1.7.2 Bridge manning

The level of bridge manning required for different situations was detailed in the ship's bridge procedures manual. In restricted waters, the procedures required that the master be accompanied by an OOW and a helmsman. The master considered that it was good experience for the chief officer to witness the ship being handled in confined waters, and insisted that the chief officer be on the bridge when arriving at, or leaving from, alongside berths. Accordingly, it had become usual practice for the chief officer to go to the bridge as soon as forward and aft mooring stations were called. This allowed the OOW to proceed to his mooring station. The ship's previous master had not required any of the crew to accompany him on the bridge when a pilot was embarked. Deck ratings were not normally required on the bridge unless requested by a pilot, or when conducting long river passages in hand steering.

### 1.7.3 The master

The master was Filipino and first went to sea in 1968. He qualified as a master in 1983, and joined Stolt-Nielsen in 1988 as a second officer. The master has worked primarily in the company's Asian fleet based in Singapore, and was promoted to master in 1992. He joined *Stolt Tern* on 14 October 2004 in Le Havre, France, and spent one month on board the vessel before assuming

command on 15 November. The master spoke and understood English, but this was his first contract in the company's European fleet, and the first time he had been to Holyhead. The master did not hold a PEC for any European ports and had taken a pilot in every port visited since joining *Stolt Tern*. He did not keep bridge watches.

1.7.4 The third officer

The third officer was employed by Stolt-Nielsen as a cadet in 1997. Following 2 years at college and a period serving in the company's Asian fleet, he joined *Stolt Tern* in March 2004 on a 9 month contract. During his 8 months on board, he had served with three masters. At sea, deck officers worked 4 hour watches on the bridge with the third officer being on the bridge from 0800 to 1200, and 2000 to 2400. The third officer's spoken English was very good.

## 1.8 THE PILOT

1.8.1 Experience and fitness

The pilot was 65 years old and was raised in Holyhead. He had served on board deep-sea ships, and had been qualified as a master since 1966. From 1970, he worked onboard ferries operating out of Holyhead, where he held a PEC, and was promoted to master in 1980. The pilot served continuously as master and then as senior master on board several Holyhead based passenger ferries until 1993. After ceasing to be a ferry master, he remained employed in the port overseeing dredging operations, and as a standby pilot. He became the port's principal pilot in 1999 on a self-employed basis, and was paid a fixed monthly retainer.

The pilot was used on board all vessels less than 10000 tons using the Aluminium jetty **(Figure 1)**. He was also employed about 12-15 times per year on board passenger cruise ships, some of which proceeded alongside, and others anchored. On average, he conducted between 150 and 200 pilotage acts each year. On ships of varying size, the pilot had not experienced any accidents or near accidents during his time in Holyhead, and the Port Authority had not received any adverse comments from third parties regarding his performance. He was well respected for his knowledge and shiphandling ability by the port's senior management, and maintained a keen interest in the operations of the port. He had been instrumental in the upgrading of the light at the end of the breakwater, and in 2002 had also suggested that a permanent navigation mark be placed to mark the shoal water to the south of the breakwater end. In addition to his pilotage duties, the pilot had also voluntarily assisted the harbourmaster in the oral examination of over one hundred PEC candidates.

The pilot kept physically fit via a daily training regime and underwent a medical test annually. He was well rested when he arrived on board *Stolt Tern*.

### 1.8.2 Intentions

The pilot expected the ship to be set to the east by the tidal stream as she proceeded towards the harbour entrance. He estimated that the rate would be a maximum of between 2 and 3 knots, and anticipated this would cause the ship to pass between 1.5 and 2 cables off the breakwater end. The pilot was aware the ship might experience a turning moment to starboard when crossing the 15m contour line, where the effects of the tidal stream quickly reduced. He anticipated that, for a brief period, the stern would continue to be influenced by the tidal stream, whereas the bow would not, and had identified a need to ensure that the ship was on a steady course during this period. It was his usual practice to aim towards a prominent chimney during this phase of the passage. Once clear of the tide line, the next alteration of course was to be between 210° and 220°.

### 1.8.3 Recollections

The pilot stated that he never advised 'dead slow ahead', or for the bow thruster to be used when initially altering course to starboard. After port helm was applied to steady the ship on the chimney, the pilot remembers the ship being steady on course for about 2 minutes, and that it was not until the breakwater head was on the starboard beam, at a distance of between 1.5 and 2 cables - that the sheer to starboard developed. From where the pilot was standing, he could not see the CPP control lever, or ship speed indications, but could see rudder angle and propeller pitch repeaters. He was conscious of the master making adjustments to controls on the console and was aware that the master and third officer were interchanging on the helm.

## 1.9 TERMINAL 4

Terminal 4 was built in the 1980s to accommodate the occasional deep-sea ship, but was later used for a daily freighter service to and from Ireland. In 1992, the terminal was modified for use by the ferry *Stena Cambria*, of which the pilot was master at the time. To enable the port to receive marine fuel by sea, rather than by road, the terminal was re-furbished in 2003, and holding tanks installed.

Before the berth became operational, several accident scenarios, together with the port's oil spill procedures, were discussed at senior management level. The advice of the local fire brigade was also sought regarding the procedures required in the event of a fire. With respect to marine aspects of the terminal, the harbourmaster arranged for *Stolt Kittiwake* to visit on 29 July 2003 to validate the positions of the mooring arrangements available. The pilot was on board throughout the trial. In consultation with the pilot, the harbourmaster decided that ships should not berth at the terminal when wind strength exceeded 25 knots from the north-west, because a wind strength of 25 knots was considered to be the limit at which bow thrusters would remain effective.

Since April 2004, Stolt-Nielsen ships had delivered marine fuel to Holyhead and used Terminal 4 nine times, with wind conditions delaying berthing on one occasion.

The pilot had conducted the pilotage without incident on all of these occasions, one of which was on board *Stolt Tern*, and four others were on board ships of the same class.

## 1.10 HOLYHEAD PORT MANAGEMENT

### 1.10.1 General

The CHA for Holyhead is Stena Line Ports Ltd (UK), which is also the CHA for the ports of Fishguard and Stranraer. The company had adopted the principles of the Port Marine Safety Code introduced at the end of 2001.

### 1.10.2 The harbourmaster

The harbourmaster had been employed by Stena Line Ltd since 1985, and had been master of ferries operating from Holyhead before taking over as harbourmaster in 1997. He was accountable to the company, through the ship operations and port manager, for the safety of operations in the harbour. His specific responsibilities included:

> *Ensuring safe passage for all vessels entering, leaving or manoeuvring within the Harbour Limits [sic].*
>
> *Ensuring compliance with all current legislation for harbours.*
>
> *The examination, authorisation and control of Authorised Pilots and Pilotage Exemption Certificate holders.*

### 1.10.3 The ship operations and port manager

The ship operations and port manager had served as a master of high speed craft after serving 13 years on board VLCC, ULCC and coastal tankers.

He was responsible for the fabric of the port and its day to day operations, including the development of sound auditing procedures of operations where the ships and port interfaced.

### 1.10.4 The safety manager

The safety manager was an experienced mariner having served as master and senior master on ferries, deep sea vessels, and high speed craft. He was responsible for the safety assurance on board Stena Line's twelve ships, its operations in the ports of Holyhead, Fishguard and Stranraer, and several other sites such as call centres. The safety manager was the designated person ashore as required by the ISM Code, and the designated person required by the

Port Marine Safety Code. He had no operational responsibilities, but provided regulatory advice to the company's technical and operations departments, and audited their operation to ensure compliance with the company's safety management system. The safety manager produced a monthly report for the company's board of directors, detailing all accidents and incidents occurring on board the company's ships and ports, and commenting on any safety and quality assurance audits undertaken.

1.10.5 Risk assessment

A marine superintendent, employed by Stena Line, initially conducted the formal risk assessments for the marine aspects of the port in October 2001. The assessments were discussed with the harbourmaster before being approved by the safety manager. The harbourmaster reviewed the risk assessments annually, with the last review being conducted in May 2004. The pilot had not sighted the assessment for grounding or collision.

The harbourmaster had completed several courses, which included risk assessment in their syllabi. Both Stena Line and the harbourmaster considered the training provided in risk assessment was sufficient. The harbourmaster had considered the implications of the use of Terminal 4 by product tankers, but this had not identified a need to amend the risk assessment for grounding.

A copy of the risk assessment for grounding is at **Annex E**, which also shows the hazard-risk and likelihood of occurrence criteria used.

1.10.6 Audit

In accordance with company procedures, the internal audit of the port's operations was organised annually by the safety manager. The last annual company safety and quality audit of Holyhead port was conducted by the port's safety superintendent (lead auditor), assisted by the safety manager, during 30 November and 1 December 2004. Although the audit made several observations regarding the risk assessment in several areas of the port's operations, none concerned the assessments for which the harbourmaster was responsible. In preparation for the company's 3 yearly review of its safety management system, as required by the Port Marine Safety Code, the safety manager had arranged a bespoke course covering the requirements of the Code for key personnel, including the harbourmaster. During this course, which was conducted in November 2004, the port's safety management system, including its risk assessments, was reviewed by a harbourmaster from a port unconnected with the company.

## 1.11 PILOTS AND NAVIGATION SAFETY

When the pilot was retained as the port's principal pilot in 1999, there was no formal process for the authorisation of pilots in place. His PEC was transferred to a pilot authorisation without an examination being conducted. During the pilot's time in post, although the harbourmaster had accompanied him on the occasional act of pilotage, and had witnessed numerous mooring operations conducted by him, no formal checks had been made on his performance.

The port used the services of a standby pilot when the principal pilot was unavailable. The standby pilot was a serving master employed by Stena Line on its ferries. He had understudied the principal pilot during a number of pilotage acts, and had received a verbal examination from the harbourmaster before being authorised as a pilot. The port's pilotage directions, which detail the requirements for pilotage and requirements for PECs, are at **Annex F**.

The pilot was not employed on board ships over 10000grt using the Aluminium jetty. Mersey pilots were employed on these ships because of their need for tug assistance, and the harbour authority considered that its own pilots had insufficient experience in this respect. As Holyhead does not operate its own tugs, these are also usually brought in from the Mersey. Before being allowed to act as a pilot in Holyhead, Mersey pilots must complete ten port entries and exits, of which half should be conducted during darkness, and they must pass a verbal exam given by the harbourmaster. Production of their pilot's authorisation for the Mersey is taken as proof of their ship and tug handling ability.

The permanent provision of tugs in the harbour had been discussed by the port's senior management, but had been discounted on the grounds of cost. The pilot stated that it was usual practice for the pilot boat to escort ships on which he was on board, but had not done so on this occasion because of the calm conditions. The pilot boat has the ability to 'push' if required.

A traffic separation scheme (TSS) at the harbour entrance **(Figure 1)** was initiated in 1995 to separate inbound and outbound traffic. The port's standing orders require that the passage plans for all vessels include the correct use of the TSS, but make provision for vessels not to comply with the requirements of the TSS on the grounds of safety, providing that the permission of the port control has been obtained.

The port's pilotage committee was chaired by the harbourmaster and comprised the port's major users, including the pilot, and other interested bodies. The committee's agenda typically included all aspects of the safety of navigation, and pilotage within the port.

## 1.12 THE SHIP MANAGERS

Stolt-Nielsen Transportation Group Ltd manages 73 ships worldwide. *Stolt Tern* was one of 12 ships within its European coastal tanker fleet, all of which are registered with the Cayman Islands, and classed with Lloyd's Register. The assistant manager of marine services, based in Rotterdam, is responsible for the quality assurance of all the vessels the company manages. He arranges for internal audits of the fleet to be conducted around the world by representatives based in Singapore and Houston however, he conducts his own internal audits on Stolt Nielsen ships which trade in Europe. The last internal audit of *Stolt Tern* was conducted on 15 October 2004. The non-conformances regarding bridge procedures recorded during this audit were:

1. *No evidence found that Annual Summary of NTM have been kept updated* [sic].
2. *UKC wrongly calculated not taking into account squat* [sic]
3. *Very seldom GPS positions are compared to the land mark fixes as required by Company Procedures.* [sic]

In addition to the internal audits, masters are required to review their ships' management every 6 months. The last review conducted on *Stolt Tern* was in August 2004. The checklist applicable to her bridge procedures completed during this review is at **Annex G**. The ship's last ISM SMC audit was conducted in October 2002, during which no observations or non-conformities were made regarding bridge procedures.

The company's general manager is the company's Designated Person Ashore for all of its ships. He does not routinely visit the fleet. The company relies on its fleet managers and superintendents to provide the lines of communication for the successful operation of its safety management system. It also employs an 'ombudsman' to settle grievances and disputes. A safety manager is employed for the investigation of accidents. During 2004, two other ships of the company's European coastal fleet had accidents with pilots onboard in Rotterdam. In both cases, reduction in speed and the overriding of the Becker rudder limit switch were considered to be contributory factors. In response to these accidents, the company revised its bridge procedures, relevant extracts of which are at **Annex H**.

The company employs three masters to act as mentors for masters who have not been promoted from within the company, but have joined from external sources. The mentors spend between 4 and 5 weeks on board selected ships at a time. The company had experienced some difficulty in identifying which of its ships would benefit most from this initiative, and to date this had been largely determined as a result of commercial, operational and technical complaints. The

company stated that it was looking into ways it could improve the system and to place reports resulting from such visits onto a common database, accessible to the different management areas. The reports are currently only passed to the applicable fleet manager.

All of the masters employed by Stolt-Nielsen in its deep-sea vessels had completed bridge resource management training during 2004, and the company had extended this training to the masters in its European coastal fleet, but not all had yet attended. The company also held master and senior officer conferences, which it estimated its masters were able to attend every 2 years. The next conference is planned for June 2005.

## 1.13 PORT MARINE SAFETY CODE

### 1.13.1 Implementation and aims

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 are both tolerable and as low as reasonably practical, together with the creation of occupational standards for key port personnel, including harbourmasters, pilots, and VTS operators.

### 1.13.2 National Occupational Standards

In its review of the Port Marine Safety Code titled *'Port Marine Safety Code, Sea Change for Port Safety*, published in November 2004, the Department for Transport concluded, that although the main issues had been addressed in relation to national occupational standards for VTS operators, the work undertaken on standards for pilots and harbourmasters had progressed to varying degrees. The review stated:

*MCA should continue to engage with the industry on occupational standards until it is generally established that these underpin the recruitment and statutory authorisation of those key positions – this needs to include the promotion of formal training in assessment.*

National occupational standards for pilots, extracts of which are at **Annex I**, have been agreed and accredited with the QCA. However, the assessment criteria for their implementation have yet to be agreed.

## 1.14 IMO RESOLUTION A.960 – PILOT TRAINING

The recently revised IMO Resolution A.960(xxiii) contains recommendations on the training and authorisation of pilots, and recommends that harbour authorities, as the "guiding authority" should satisfy themselves that pilots continue to possess up to date knowledge (at intervals not exceeding 5 years) of local navigational issues, current regulations and any other specifically related local issues. It suggests that this might be proven by the keeping of personnel service records, the completion of continuing professional development training, or by examination. It also states:

*Every pilot should be trained in bridge resource management with an emphasis on the exchange of information that is essential to a safe transit. This training should include a requirement for the pilot to assess particular situations and to conduct an exchange of information with the master and/or officer in charge of the navigational watch. Maintaining an effective working relationship between the pilot and the bridge team in both routine and emergency conditions should be covered in training. Emergency conditions should include loss of steering, loss of propulsion, and failures of radar, vital systems and automation, in a narrow channel or fairway.*

The harbourmaster of Holyhead was unaware of the content of Resolution A.960(xxiii).

## 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

There is no evidence to indicate that fatigue affected the decision-making or actions of the master or the pilot with regard to this accident. The pilot was well rested, and the master did not keep bridge watches at sea.

### 2.3 LOSS OF CONTROL AND GROUNDING

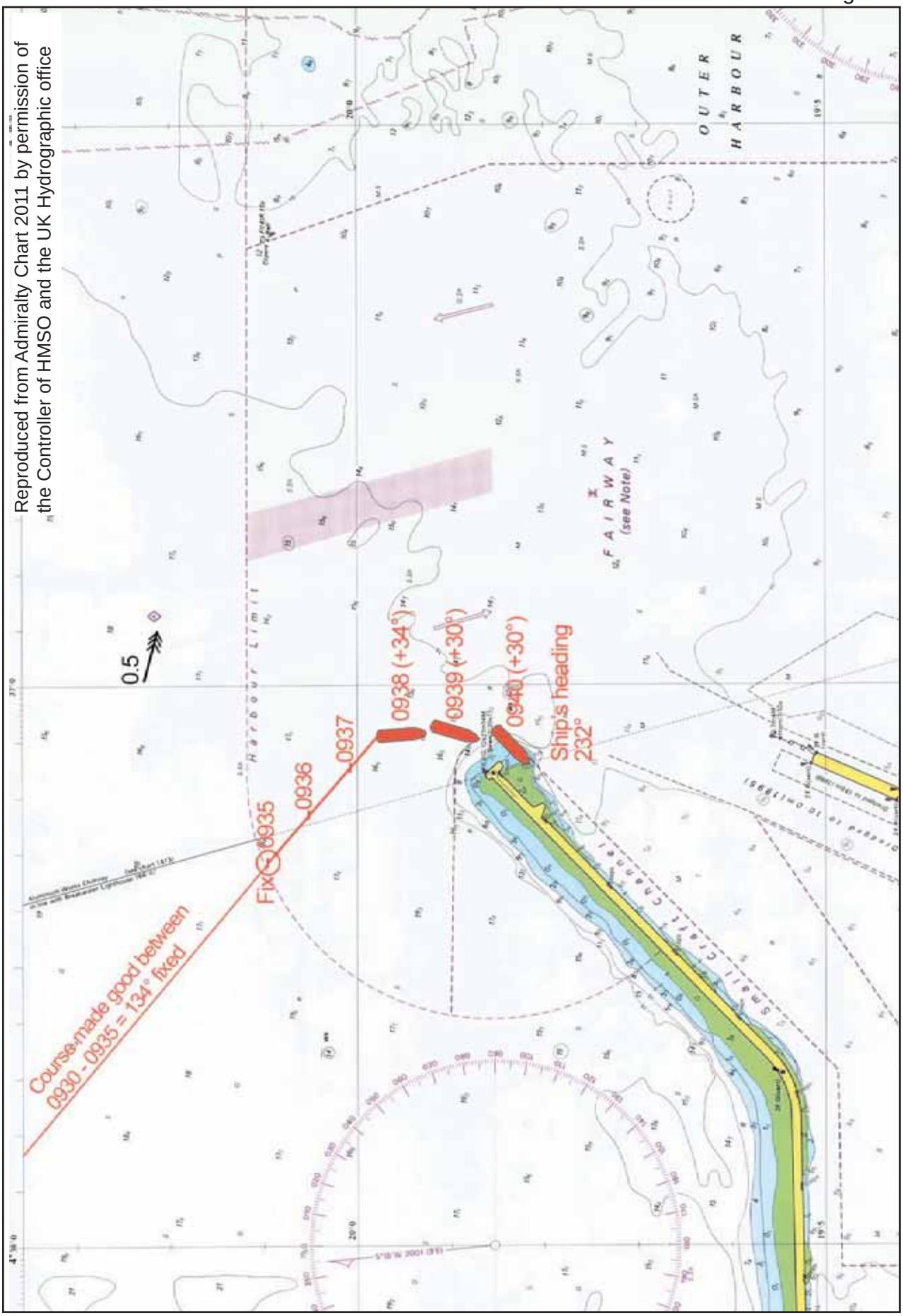
After the pilot embarked in *Stolt Tern*, the initial passage towards the breakwater proceeded as planned. There were no problems experienced with the ship's manoeuvrability. However, as a small alteration of course to starboard was made to the north of the breakwater, the turn could not be checked. **Annex C** shows that the ship started to turn from a course of 139° at 0937, and grounded at 0940 on a heading of 232°. The rate of turn during this period appears to be reasonably constant. Using this data, together with the ground track derived from the positions recorded on the ship's chart at 0930 and 0935, and the position of grounding, an estimation of the ship's ground track during the turn has been made at **Figure 4**. Based on the position plotted at 0935 and the time of grounding, it is estimated that the ship's mean ground speed during this period was between 3 and 4 knots. In the absence of any indication of a machinery malfunction or failure, the loss of control was probably due to one, or a combination, of several factors.

First, the time interval between the engine movements from half ahead to dead slow was short, and the resulting reduction in speed would have been quite rapid. Given that the ship was known to be extremely right-handed **(Annex A)**, and that the pilot information card warned against reducing speed and changing heading at the same time, a sheer to starboard was a likely outcome.

Second, as *Stolt Tern* passed the end of the breakwater, her bow would have entered the still waters to the south, while her stern would have been set to the east by the tidal stream to the north of the breakwater. This would have exacerbated the ship's turning moment, and her slow speed would have prolonged her exposure to this effect.

Third, although the time the bow thruster was used at the start of the turn was stated by the master to have lasted only a few seconds, its use is likely to have had an influence given the ship's slow speed. In conjunction with the 5° of starboard rudder, which according to the information in the pilot card equated to about 15° of conventional rudder, this could have induced a high rate of turn unless quickly checked.

Figure 4




Estimation of ship's ground track

It is impossible to determine if the grounding would have been avoided had the master followed the advice of the pilot and put the engines astern. The master's decision to ignore this advice, and to increase speed and rudder, was based on his knowledge and experience of the ship's manoeuvring characteristics. It is correctly the prerogative of the master to take such action, whenever he considers appropriate.

## 2.4 BRIDGE MANAGEMENT AND COMMUNICATION

Before entering Holyhead, relevant information had been passed between the pilot and the master. Importantly, both were aware of the manoeuvring characteristics of the ship and the route to the intended berth. Language did not appear to be a problem.

However during the execution of the passage plan the pilot was not integrated into the bridge team. The master's rapid reduction of speed, and his use of the bow thruster, resulted from poor communication between the master and the pilot. The master either misunderstood the advice of the pilot, or acted on his own initiative. The pilot was not aware of the action taken because the master did not inform him. He was concentrating on conning the ship and did not monitor the master's actions.

The pilot estimated the ship's position and movement by eye. He did not ask for any of the additional information available to the bridge team, such as ranges by radar or speed over the ground, nor was any of this information offered. Although uncertain of the roles of the master and third officer, following their interchanges on the helm, the pilot did not seek clarification, and he was isolated from the decision-making process during the discussions between the master and third officer, in Filipino, immediately before the grounding.

The integration of pilots into a bridge team is essential if passages in pilotage waters are to be conducted safely. On this occasion, it is not certain why the master reduced speed to dead slow. He was operating the CPP controls, and was aware of the ship's handling characteristics. However, better teamwork and a more effective working relationship between the master and third officer, and the pilot, might have helped to recognise what was going wrong with the plan in sufficient time for corrective action to be taken. It is not certain to what extent, if any, cultural differences influenced the interaction between the pilot and master on this occasion.

It is understood that some of the larger ports arrange for their pilots to attend tailored bridge simulator courses as part of their ongoing professional development. Such training would probably be of benefit to all pilots. Guidance on pilot integration and support is worthy of inclusion in the bridge team management training the ship manager is providing for the masters of its European coastal fleet, and in its conferences for masters and senior officers.

## 2.5 PASSAGE PLANNING

The intended passing distance off the breakwater allowed insufficient sea room and time for corrective action to be taken. A similar accident could easily have occurred had the ship suffered a mechanical failure, or had to manoeuvre to avoid a small craft unexpectedly leaving the small craft channel, south of the breakwater.

There was no reason why a greater clearance could not have been planned. There were no other movements in the harbour, and the ports standing orders allowed ships not to comply with the requirements of the TSS, providing permission was obtained beforehand. However, the pilot had followed the intended route and passed the breakwater many times without incident, and it had become custom and practice.

Since joining *Stolt Tern*, the master had taken a pilot in every port requiring compulsory pilotage. Although the bridge team had produced a pilotage plan for entry into the port, the lack of tide tables indicates that the master was reliant on the services of the pilot for this information.

## 2.6 PORT SAFETY MANAGEMENT

In keeping with the Port Marine Safety Code, the port of Holyhead was operated under a safety management system. Assessments had been made of all identified risks related to marine activities, and these had been periodically reviewed by the harbourmaster, and audited annually by the safety manager.

Relevant control measures to reduce the risk were indicated in each assessment, including the provision of a competent pilot in the assessment of the risk of grounding. In this respect, the harbourmaster had identified limitations in the experience of the port's pilots, and had made provision for pilots experienced in controlling tugs to be used when handling ships over 10000grt bound to and from the Aluminium jetty.

Before Stolt Ships began the delivery of marine fuel to the port the harbour authority had taken several precautions, including the review of its oil spill and fire response procedures, and consideration of a number of accident scenarios. The harbourmaster had also arranged for the visit of *Stolt Kittiwake* before the delivery service commenced. However, although the harbourmaster's consideration of the risks identified with the fuel delivery operation at Terminal 4 prompted the imposition of a wind limit for berthing, amendment of the assessment for the risk of grounding was not considered necessary. The harbourmaster assessed that the use of the port by product tankers had not changed the hazard or the likelihood of occurrence criteria.

The simple and cost free precaution of allowing a larger safety margin when passing the breakwater end was not identified. This was particularly relevant to the ships on passage from the pilot station to Terminal 4, which needed to make

a large turn around the breakwater end. The precaution was probably not identified due to the fact that the entry to the port is relatively straightforward, there was no experience of previous accidents in this area, and the port's management, which was very experienced in ship and port operations in Holyhead, was highly respectful of the pilot's ability and experience.

Risk assessment is a very useful tool to quantify and reduce risk through the identification and implementation of suitable control measures. However, unless the control measures themselves are regularly reviewed to ensure that the risks are being kept as low as reasonably practical, the effectiveness of the risk assessment process is diluted. Liaison with the persons providing the control measures is essential to achieve this.

## 2.7 PILOT AUTHORISATION AND PERFORMANCE MONITORING

Since the pilot had been in post, the port had improved and formalised its procedures for the authorisation of pilots. This was demonstrated by the authorisation procedure followed for the standby pilot, and the pilots employed from the Mersey. The requirements for PECs were also clearly defined. The authorisation of the pilot on board *Stolt Tern* pre-dated these procedures, and he had never undergone any formal assessment in his role.

This situation is likely to be common in smaller ports, operated by a limited number of people. Even had the IMO recommendation (Resolution 960(XXIII), that harbour authorities should verify a pilot's knowledge and performance at least every 5 years, been a requirement, its effective implementation would have been problematic. Examination of the pilot's local navigational knowledge would have been difficult as he was seen to be the expert in this area and was highly respected. The pilot was also self-employed, and although the pilot/master information exchanges signed by the masters were retained, no other service records such as performance appraisals were raised. However, the harbourmaster had monitored the pilot's performance by accompanying him on the occasional act of pilotage, and by witnessing his shiphandling from ashore.

Local navigational knowledge and shiphandling are obviously pivotal to a pilot's performance, but there are other areas in which a pilot must also be proficient. It has already been highlighted that although the pilot was very experienced and had the full respect of the port's management, he was not integrated into the bridge team on board *Stolt Tern,* and could have planned a greater safety margin when passing the breakwater. It is difficult for harbour authorities to effectively monitor performance in all aspects of a pilot's work, but a requirement for all pilots to have a qualification based on national occupational standards would at least provide a reliable base from which to start.

## 2.8 ONBOARD PROCEDURES AND SAFETY MANAGEMENT

A number of departures from the company's procedures and material deficiencies, with respect to navigation and bridge management, were evident on board *Stolt Tern*. These included: the lack of tide tables; the chart in use not being corrected up to date; the lack of a helmsman on the bridge; the lack of a bridge team brief prior to entering the port; the lack of assistance provided to the pilot in terms of his familiarisation with the bridge equipment and general support; the interchanging of the master and third officer on the helm; the use of Filipino rather than English just before the grounding; the misalignment of the course recorder; and the non-functioning of the propeller pitch recorder.

Other than the incorrect calculation of under keel clearance, which was related to passage planning, none of these departures or deficiencies were identified during either the internal audit in October 2004, or the master's review in August 2004 **(Annex G)**. The internal audit was based on a sampling process, and therefore was not guaranteed to identify these deficiencies. However, the master's review was quite specific, and to indicate that the ship's passage planning was in accordance with the standards required, even though tide tables, which are a fundamental component of any passage plan, were not carried, was incorrect and strongly suggests this review was of little value.

It was disappointing to note that three masters commanded the ship in European waters, affected by strong tidal streams and large tidal ranges, without being able to refer to tide tables on board. The masters failed to obtain copies of tide tables, or to report this deficiency through their fleet manager or superintendents, or at the time of the August review. Along with the other departures from procedures and deficiencies highlighted, this calls into question the effectiveness of the company's safety management system.

## 2.9 HYDROGRAPHIC INFORMATION

The tidal stream predictions for tidal diamond 'B' shown at **Figure 1** are based on a relatively recent survey, and are therefore considered to be accurate. However, it is anticipated that the breakwater would cause the rate of an east flowing tidal stream to accelerate, as described by the pilot. If this is the case, the information contained in the Sailing Directions, which describes the tidal stream close to the north of the breakwater as 'negligible', is misleading. As the tidal streams in this area affect all ships entering and leaving the harbour, clarification of the rates likely to be experienced is required, and, if necessary, amendment to the Sailing Directions initiated.

## SECTION 3 - CONCLUSIONS

### 3.1 SAFETY ISSUES

1. The ship's turn to starboard could not be checked because of her manoeuvring characteristics when speed was reduced quickly, the differential effects of the tidal stream in the vicinity of the breakwater, and the initial use of the bow thruster and helm. [2.3]

2. It is not certain why the master reduced speed to dead slow. He was operating the CPP controls, and was aware of the ship's handling characteristics. [2.4]

3. The pilot was not aware of the master's reduction in speed or his use of the bow thruster because of inadequate communication and bridge teamwork. [2.4]

4. The master ignored the pilot's advice to put the engine astern, and the distance off the breakwater was insufficient to allow the master's corrective action to be successful. [2.3, 2.5]

5. There was no reason why a greater clearance off the breakwater could not have been planned, but the pilot had followed the intended route many times without incident, and it had become custom and practice. [2.5]

6. The lack of tide tables indicates that the master was reliant on the services of a pilot for this information. [2.5]

7. The port's management had conducted a risk assessment in the port and had introduced additional control measures in relation to the use of Terminal 4. However, the precaution of allowing a larger safety margin, when passing the breakwater end, was probably not identified because of the straightforward entry to the port, the lack of experience of previous accidents in the area, and the management's respect of the pilot's ability and experience. [2.6]

8. The authorisation of the pilot on board *Stolt Tern* pre-dated the port's current procedures for the authorisation of pilotage and, although the pilot's performance was monitored by the harbourmaster, he had never undergone any formal assessment in his role. [2.7]

9. It was difficult for the harbour authority to effectively monitor the pilot's performance in all aspects of his work. A requirement for all pilots to have a qualification based on national occupational standards would at least provide a reliable base from which to start. [2.7]

10. The ship manager's safety management system did not identify a number of departures from procedures and material deficiencies affecting the ship's safe navigation, particularly in pilotage waters. [2.8]

11. The information contained in the Sailing Directions regarding the tidal stream to the north of the breakwater, is potentially misleading, and requires clarification. [2.9]

## SECTION 4 - ACTION TAKEN

### Stena Line Ports UK Ltd

Following the harbourmaster's investigation of the grounding, the following action has been taken:

- *Measures have been initiated to introduce a one cable exclusion zone around the end of the breakwater head. It is intended that the exclusion zone will be shown on the relevant navigational charts.*

- *The company has commenced a review of the Holyhead Port entry contained in the Admiralty Sailing Directions, which will include a check of the tidal streams in the vicinity of the breakwater.*

- *The company has changed the way it reviews its risk assessments. Reviews are now conducted by the company's designated person, together with relevant harbourmasters and port safety superintendents. It is intended that all such risk assessments will be verified by an external marine auditor.*

- *The provision of radar recording equipment has been arranged.*

### Stolt-Nielsen Transportation B.V.

Following the ship manager's investigation of the grounding, the following action was taken:

- *The incident was discussed with various masters of the fleet during ship's visits. This action is ongoing.*

- *The company has invited a representative from the Rotterdam Pilot Association to attend its conference of masters and senior officers in June 2005.*

## SECTION 5 - RECOMMENDATIONS

**The BPA/UKMPG marine and pilotage group** is recommended to:

2005/184 Highlight to members of the BPA and UKMPG the importance of reducing the level of risk identified to as low as reasonably practical when conducting risk assessments, and the importance of ensuring that the effectiveness of any resulting control measures is reviewed regularly.

2005/185 Reinforce to the members of the BPA and UKMPG the need to ensure a meaningful exchange of information between pilots and masters rather than merely the completion of a checklist. Such exchanges should cover all relevant areas such as the vessel characteristics, bridge team organisation and duties.

**The MCA** is recommended to:

2005/186 Expedite and resource, through the national occupational standards working group of the Port Marine Safety Code steering committee, the requirement for national occupational standards for pilots to be a prerequisite for their recruitment and statutory authorisation.

**Stolt-Nielsen Transportation B.V.** is recommended to:

2005/187 Review its safety management and auditing processes with a view to improving the safety culture among its ships' crews, and encouraging a more open reporting regime.

2005/188 Expedite its programme of bridge resource management training for its masters within its European coastal fleet, and ensure that pilot integration is included in the course syllabus.

**Marine Accident Investigation Branch**
**September 2005**