Report on the investigation of

the grounding of

the Liberian-registered container ship

P&O Nedlloyd Magellan

in the Western Approach Channel to Southampton Water

on 20 February 2001

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Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999

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

CONTENTS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ABP	-	Associated British Ports
ARCS	-	Admiralty Raster Chart Service
CHA	-	Competent Harbour Authority
EBL	-	Electronic bearing line
ETA	-	Estimated time of arrival
IMO	-	International Maritime Organization
kW	-	kilowatt
LOA	-	Length overall
OOW	-	Officer of the watch
teu	-	twenty-foot equivalent unit
UTC	-	Universal co-ordinated time
VHF	-	Very high frequency
VLCC	-	Very large crude carrier
VTS	-	Vessel traffic services

SYNOPSIS

At about 0700 (UTC) on 20 February 2001, the Liberian-registered container ship *P&O Nedlloyd Magellan* ran aground in the Western Approach Channel to Southampton Water. There was no damage to the ship, no pollution and no injuries to persons. Associated British Ports Southampton reported the accident to the MAIB that day.

P&O Nedlloyd Magellan was inbound from Rotterdam to berth 207 at Southampton Container Terminal. At 0530 the pilot boarded the ship at the Nab Tower pilot station. The pilot's and the master's passage plans were exchanged and the ship's pilot card was given to the pilot. The passage continued along the East Solent, during which time there were various VHF radio conversations between vessels and Southampton Vessel Traffic Services (VTS), about restricted visibility.

The VTS officer gave the pilot a countdown from 5 to 2 cables to the Gurnard buoy. This was given so that the pilot could judge the timing of the wheel-over manoeuvre for the 141° turn into the narrow Thorn Channel. The wheel-over occurred at about 0652 and the ship began to turn. At this time, the W Bramble and NE Gurnard buoys, which are at the entrance to Thorn Channel, could not be seen because of restricted visibility. Various helm and engine movements were made during the turn. However, when W Bramble and NE Gurnard buoys appeared, the pilot realised that the ship was in the wrong position for the heading she was on. Despite further helm and engine orders, the vessel grounded soon after, at 0700. It was not until about 0710 that the escort harbour launch informed VTS of the grounding.

With the assistance of two tugs, the ship was refloated near the time of high water, and she safely berthed at 1232.

The cause of the grounding was an error of judgment by the pilot during the execution of the turn into Thorn Channel. Contributing factors include restricted visibility, lack of full monitoring of the pilot by the bridge team, no warning of reduced visibility in the area of the turn, and the pilot erroneously reading the electronic bearing line on the radar.

Recommendations have been made to:

- Associated British Ports Southampton, with regard to monitoring areas of restricted visibility, implementing a dedicated VTS service for the turn, and modifying port passage guidance procedures;

- The ship's management company, regarding monitoring the standard of passage plans and navigational procedures on its ships and producing turning data for various conditions; and

- The United Kingdom Hydrographic Office, regarding radar reference lines.

Photograph courtesy of FotoFlite

P&O Nedlloyd Magellan

SECTION 1 - FACTUAL INFORMATION

All times are UTC. All courses are true.

1.1 PARTICULARS OF *P&O NEDLLOYD MAGELLAN* AND ACCIDENT

Vessel details

Registered owner	:	Fourth Tiger Shipping
Manager	:	E R Schiffahrt
Port of registry	:	Monrovia
Flag	:	Liberia
Type	:	Single screw container ship
Built	:	2000 in Koje, Japan
Classification society	:	Germanischer Lloyd
Construction	:	Steel
Length overall	:	277. 26m
Gross tonnage	:	66,289
Breadth	:	40m
Engine power	:	46,671kW
Service speed	:	26.1 knots
Bow thruster	:	2,000kW – controllable pitch

Accident details

Time and date	:	0700 on 20 February 2001
Location of incident	:	Latitude 50° 47. 384' N, Longitude 001° 18.989' W, which is 1.37 miles north of Egypt Point, Isle of Wight
Persons on board	:	25 (including the pilot)
Injuries/fatalities	:	None
Damage	:	None

1.2 ENVIRONMENTAL CONDITIONS ON 20 FEBRUARY 2001

The wind was light and variable; the visibility was moderate to poor.

Nautical twilight began at 0555; civil twilight began at 0630 and sunrise was at 0705.

Predicted low water at Cowes was at 0241 with a height of 1.5m; high water was predicted at 0938 with a height of 3.7m and the tides were between neaps and springs.

1.3 NARRATIVE

P&O Nedlloyd Magellan left Rotterdam at 1812 on 19 February 2001 for berth 207 at Southampton Container Terminal. The master remained on the bridge with the third officer until 2300 (2400 ship's time). He was called at 0430 and was again on the bridge at 0445. The ship was due at the Nab Tower pilot station **(chart extract No 1)** at 0600 but, the ETA had been brought forward to 0530 to allow *P&O Nedlloyd Magellan* to transit the East Solent ahead of a tanker which was arriving at a similar time.

The pilot boarded the ship at 0530 and went to the bridge, escorted by the chief officer who was the OOW. The pilot met the master, who confirmed the ship's draught as 13.25 metres and that the designated berth had not been changed. A helmsman was on the wheel. The master also told the pilot the course and the engine control settings, which were on manoeuvring speed. The pilot said there would be two tugs for the berthing operations; he would give the master half an hour's notice to call the crew to stations and there was no other traffic, giving them a clear run to the berth. They clarified that the ship's time was on UTC + 1. The pilot was given the pilot card. The engine was in the bridge control mode.

The pilot sat in the chair on the port side of the console with a radar screen in front of him. The master sat in the starboard chair and had the second radar screen and an electronic chart system in front of him**.** The radars were ground stabilised, on a 3-mile range scale, and the passage plan waypoints and tracks were imposed on the starboard screen. The pilot moved the origin closer to the centre of the radar screen he was using.

The speed was increased to half ahead for the transit through the deep-water channel. Once past the Dean Tail wrecks, the speed was increased to full ahead.

At about 0610, just before the ship passed between No Man's Land and Horse Sand forts, the pilot overheard a VHF radio conversation between another ship and her attending tugs, that there was a problem with restricted visibility in the Southampton port area. Because tugs do not operate in visibility less than 2

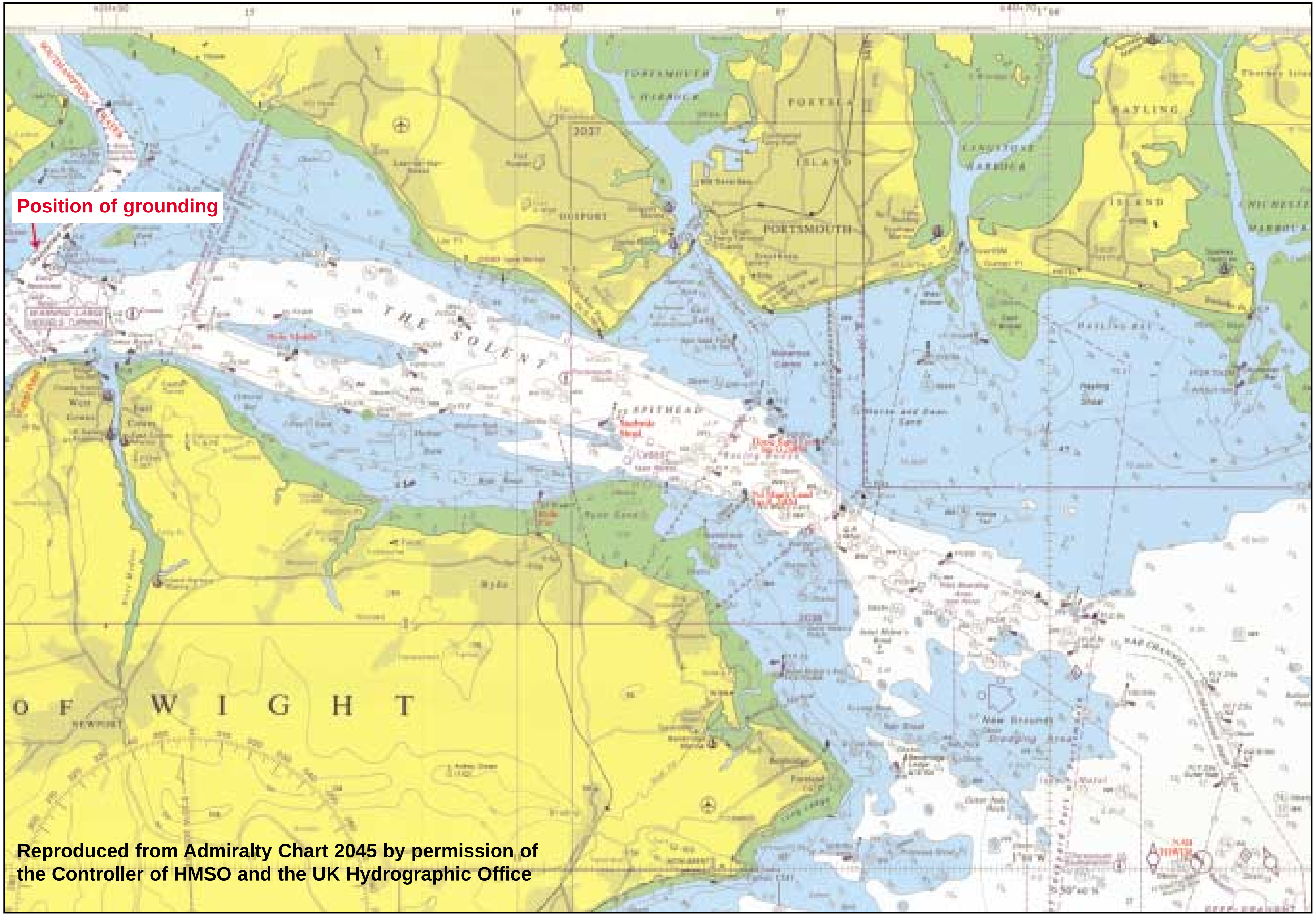


Chart Extract 1

cables, the pilot had to consider an abort plan. However, after switching the VHF radio over to the tug working frequency, he heard that the visibility was improving. He called the tugs and they agreed an ETA of 0745 at the rendezvous point at the NW Netley buoy.

After passing Ryde Pier, the range of visibility reduced to between 1.5 and 2 miles. When the ship had passed south of the S Ryde Middle buoy, the pilot shaped a course north of the radar reference, in preparation for making the large turn into the Thorn Channel, north of Cowes **(chart extract No 2)**. Earlier, the pilot had passed a requirement for the VTS officer to give him, on VHF radio channel 20, a countdown to the wheel-over position from 5 to 2 cables to the Gurnard buoy **(Section 2.2. and Annex 1)**.

At about 0646, when passing the W Ryde Middle buoy, the pilot reduced speed to half ahead. At about 0648, the pilot ordered an alteration of course to port from 290° to 260°. *P&O Nedlloyd Magellan* was joined by a harbour launch, which proceeded ahead of the ship to clear away any vessel which might have impeded her passage through the Thorn Channel. At this time the pilot could not see Fawley oil terminal. As the ship passed close to the Prince Consort buoy, the pilot observed that the tidal stream around the buoy seemed to confirm the predictions in his passage plan. The VTS officer gave the countdown to the pilot. The turn to starboard began at about 0653 with the pilot giving direct helm orders. At this time he could see neither the NE Gurnard nor the W Bramble buoys visually, but he saw their echoes on the radar, which was now on the 1.5 mile range scale, and with the origin offset to give a longer view of the Thorn Channel. During the course of the alteration to starboard, the pilot noted that the rate of turn indicator showed 30° per minute. He placed the EBL on 040°, the approximate intended heading through Thorn Channel, as means of monitoring the later stages of the turn.

During the turn, the pilot ordered various helm and engine orders **(see Annexes 2 and 3)**. However, when W Bramble and NE Gurnard buoys were sighted, the pilot realised that the ship was in the wrong position for the heading she was on, which was about 020°. Despite further helm and engine orders, the ship ran aground at about 0700 on the edge of the channel. The pilot tried to refloat her by going astern, and by using the bow thruster full to starboard.

At about 0710, the harbour launch noticed that *P&O Nedlloyd Magellan* was stationary on the limits of Thorn Channel, and notified the VTS of the situation. Visibility was about 2 cables at the scene but 5 cables at Southampton Dock Head, where the VTS is situated. The launch returned to the ship and began to take soundings around her, recording 12m at the bow, 11.5m along the port side and 14m aft. At this time, the Calshot tidal height gauge was reading 2.67m.

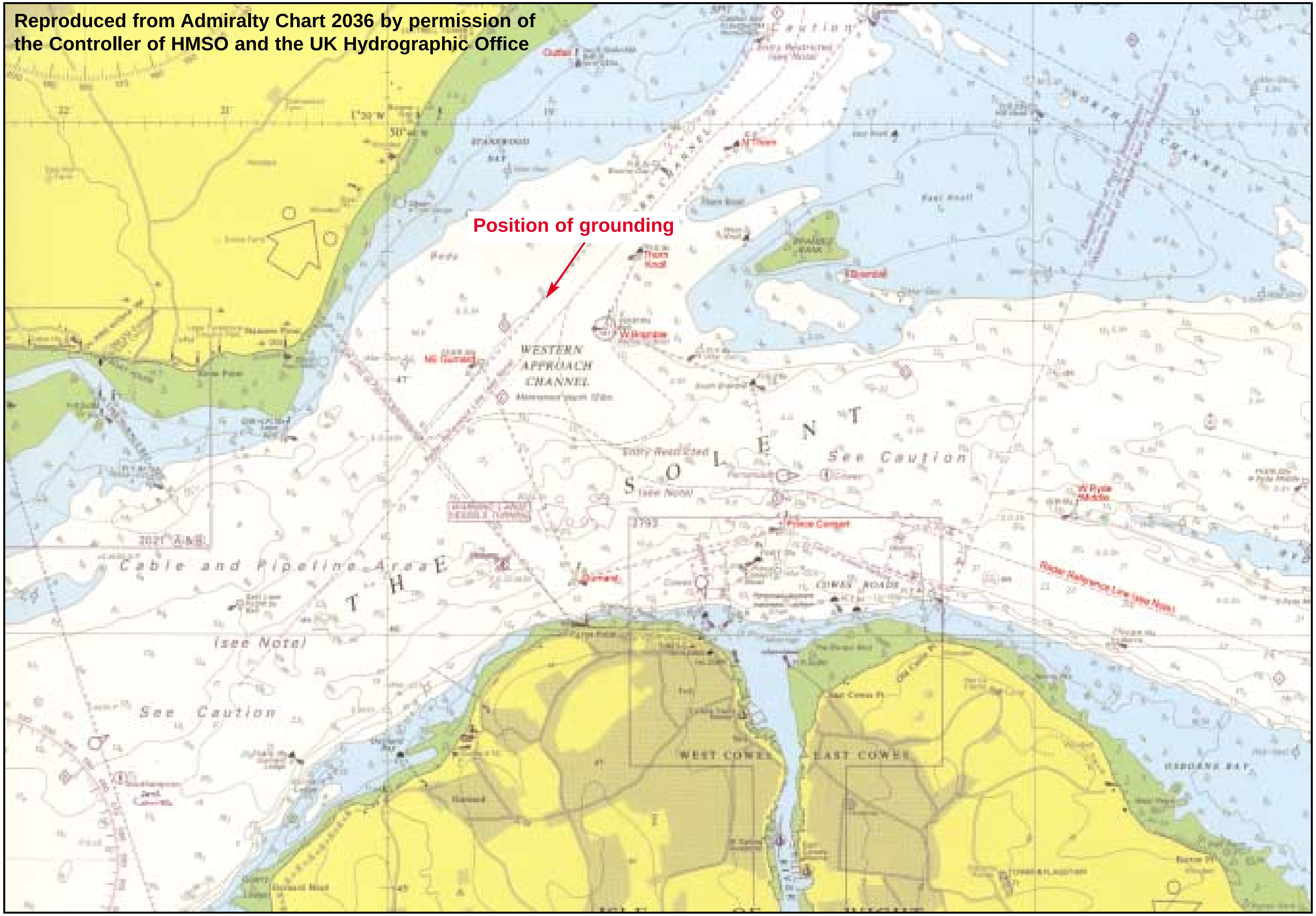


Chart Extract 2

Solfire A[1] was declared at 0740 when the harbourmaster was informed of the grounding. Shortly afterwards, harbour tugs *Hamtun* and *Lyndhurst* were dispatched to the scene. The pilot reported that the ship was de-ballasting forward. At 0805, the harbour launch reported to the VTS that the tug *Thrax*, from Fawley oil terminal, was on scene. By this time, the VLCC *Front Driver*, inward bound for Fawley, had aborted her passage at the Prince Consort buoy.

At 0840, the two harbour tugs were on scene and made fast. At 0943, the pilot reported that the ship was moving into deeper water. The Calshot tidal gauge was showing 3.73m. At 0955, *Solfire A* was cancelled and, at 1232, *P&O Nedlloyd Magellan* was all fast alongside berth 207 in Southampton.

Divers were tasked to survey any damage to the underwater hull, but found only the removal of paint from the first 150m from the bow.

1.4 *P&O NEDLLOYD MAGELLAN*

1.4.1 The ship

P&O Nedlloyd Magellan was a relatively new conventional container ship, with two hatches aft and six holds forward of the accommodation superstructure. Her container capacity was 5642 teu. She had a maximum draught of 14.0m. Although she was launched as *E R Amsterdam* she had been chartered to P&O Containers Ltd and given her new name.

1.4.2 The crew

There were 24 crew members on board, consisting of a German master and second officer, a British chief officer, a Polish second engineer and electrician, a Croatian chief engineer and two cadets, and a Filipino third officer, third and fourth engineers, refrigerator electrician, bosun, three able seamen, two ordinary seamen, fitter, motorman, three oilers and cook.

<u>The master</u> was 47 years old and held German and Liberian master's licences. He began his career at sea as an apprentice in 1969 on foreign-going general cargo ships. After his apprenticeship he went to nautical college in Rostock for three and a half years, which he completed in 1977. After having served as third, second and chief officer, he was promoted to master in 1997, in which position he had served ever since on large container ships. He had been with E R Schiffahrt since the summer of 2000. Before joining *P&O Nedlloyd Magellan* on 16 February, which was 4 days before the accident, he had sailed on her sister ship for 5 months.

[1] (Note: *The Solent and Southampton Water Marine Emergency Plan* defines Class A Solfire as – *A non-routine marine incident that can be dealt with by the Initiating Authority using resources readily available and with little or no impact on land based authorities.* The Initiating Authorities are the harbourmaster of Southampton, Queen's harbourmaster of Portsmouth and HM Coastguard, depending in which designated area the incident occurs.)

1.4.3 Navigational equipment and practices

The ship was furnished with the following navigational equipment:

Atlas radar 9000 with an Atlas NACOS Navigation and Command System;

Atlas Chartplot 9320;

C. Plath gyro;

Raytheon-Anschütz rate of turn gyro;

C. Plath magnetic compass;

Atlas Dolog 23 doppler log;

DEBEG electromagnetic log;

DEBEG echo sounder; and

Loran-C receiver

At sea, the three deck officers carried out the conventional 4 hours on, 8 hours off navigational watches. In port, the second and third officers carried out 4 hours on, 6 hours off cargo watches, while the chief officer was on day-work.

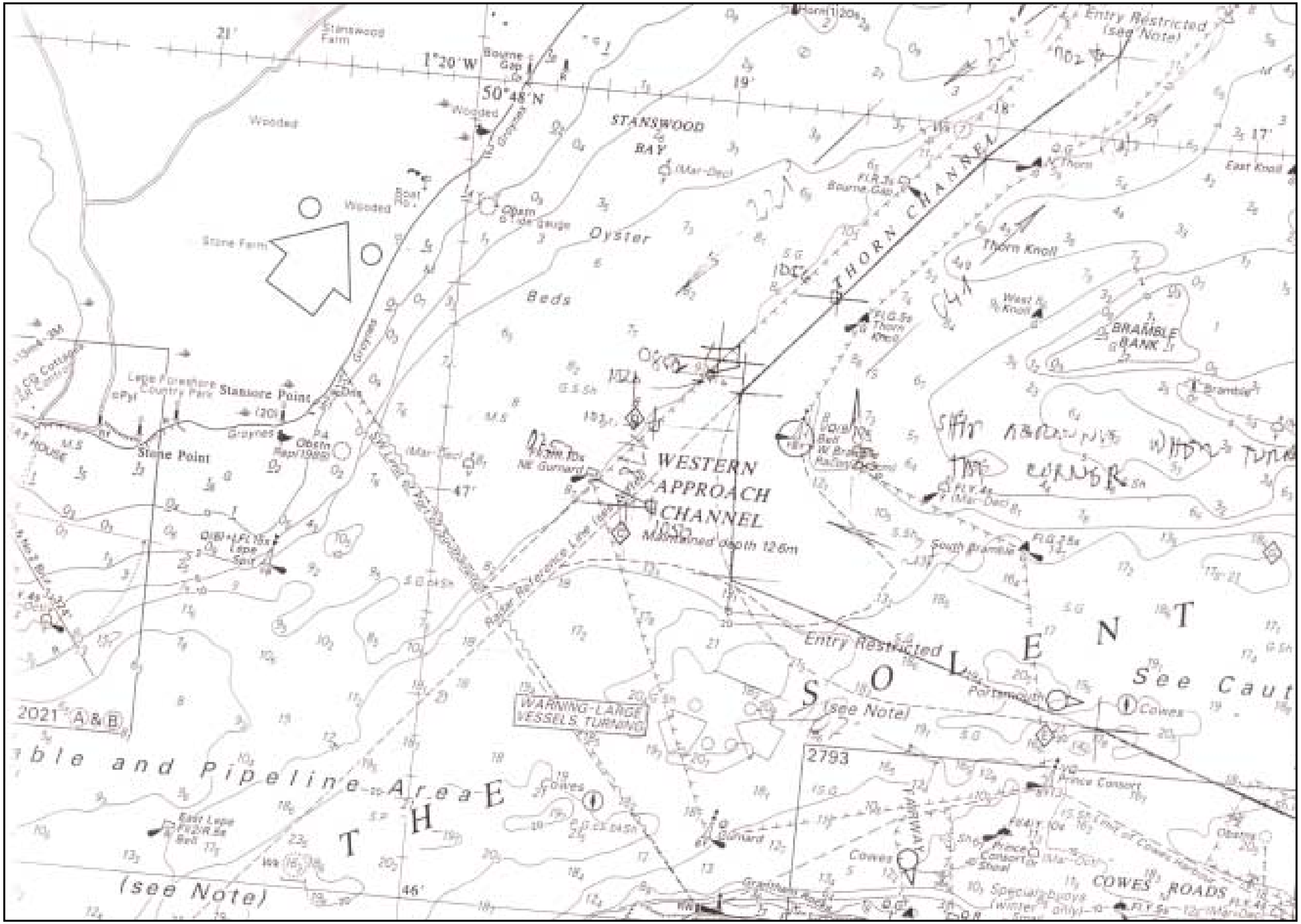
As part of the passage plan, waypoints were plotted from berth to berth, both on the paper charts and on the electronic ARCS charts **(extract of charts 3 and 4 and Section 2.3)**.

1.5 PILOTAGE

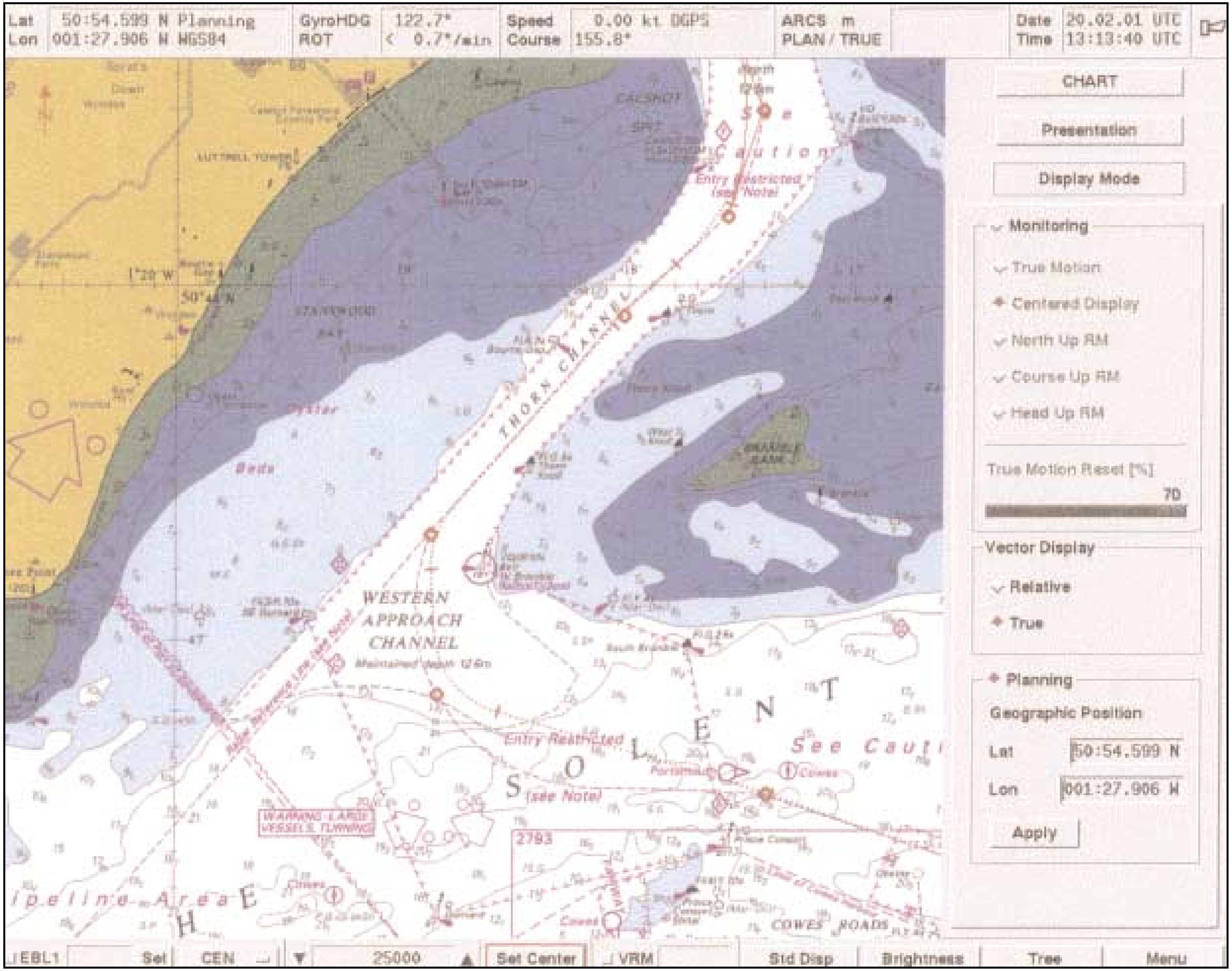
1.5.1 The pilot

The pilot was 46 years old and began his career as an apprentice pilot with the Mersey Docks and Harbour Board in 1970. Before leaving the pilotage service, he served 12 months sea time on foreign-going general cargo ships in order to obtain his Class 2 certificate of competency. He then joined Canadian Pacific as second officer from 1978 to 1983, after which he joined a company trading in offshore supply vessels, serving as chief officer and master (after obtaining his Class 1 certificate of competency in September 1986) until 1987. He then attended Liverpool Polytechnic for two years, where he obtained a degree in nautical studies. He then became a superintendent for another company trading in offshore supply vessels. He moved to Southampton and became an authorised pilot in July 1990 and a first class pilot in 1992. In 1993 he became a choice pilot for P&O Containers Ltd.

Chart Extract 3



Extract of working chart



Extract of electronic chart

Chart Extract 4

During 2000, the pilot had performed 331 acts of pilotage, 150 of which were as *choice* pilot. He had piloted *P&O Nedlloyd Magellan* on three previous occasions before the accident, as well as her sister ships *P&O Nedlloyd Vespucci* and *P&O Nedlloyd Torres.*

The working roster for Southampton pilots is 24 hours on duty, followed by 48 hours off. Three working day cycles are followed by an 8-day rest period. However, as a *choice* pilot, the pilot could be called out during his rest period. He piloted *P&O Nedlloyd Sydney* outbound on Monday 19 February 2001, sailing at 0100. He disembarked at the Nab Tower at 0300, arrived home at 0500 and went to bed. He awoke at 0930 and returned to bed at 2100. He was awoken at 0330 on Tuesday 20 February and embarked *P&O Nedlloyd Magellan* at 0530 **(Section 1.3)**.

From 2100 on Saturday 17 February to 0330 on Tuesday 20 February, the pilot estimated that he had had 18.5 hours of sleep in four separate periods.

1.5.2 General pilotage directions

Pilotage in ABP Southampton pilotage area is compulsory except for:

Her Majesty's ships;

Ministry of Defence owned/operated ships;

Naval ships of Commonwealth countries;

Foreign naval vessels;

All vessels, including fishing vessels, not exceeding 61m in length; and

Those vessels in which the master and mates hold first and second class pilot exemption certificates.

The port of Southampton is approached from the West Solent or from the East Solent, and is entered through the Western Approach Channel. The latter channel leads to Thorn Channel, which is from 1.75 to 3 cables wide, and maintained to a depth of 12.6m. Vessels of up to 14.9m draught can be accepted in the Western Approach Channel, but those of this maximum draught are only permitted to enter during the high water period.

There is a radar reference line on the Admiralty charts, which runs from between the forts off Portsmouth harbour, to the Dean's Elbow buoy in Southampton Water. The harbour radar can indicate the position of a vessel relative to the line **(Sections 1.6.2 and 2.3)**.

The Admiralty Sailing Directions Channel Pilot makes the following observation:

> *Mariners in large and deeply laden tankers may be unable to follow the charted reference line when making the turn from east into Thorn Channel. When north of the Prince Consort light-buoy such vessels may alter course to port to pass about 1.25 cables north of the Gurnard light-buoy before altering course to starboard to regain the radar reference line west-north-west of the West Bramble light-buoy.*

1.6 VTS

1.6.1 The role of VTS

The IMO's resolution A.578 (14) defines VTS as:

> *Any service implemented by a competent authority designed to improve safety and efficiency of vessel traffic and the protection of the environment. The service shall have the capability to interact with marine traffic and to respond to traffic situations developing in the VTS area.*

The following are extracts from the IMO resolution A.857 (20) Guidelines for VTS:

.9.1 An <u>information service</u> is a service to ensure that essential information becomes available in time for on-board navigational decision-making.

.9.2 A <u>navigational assistance service</u> is a service to assist on-board navigational decision-making and to monitor its effects.

.9.3 A <u>traffic organization service</u> is a service to prevent the development of dangerous maritime traffic situations and to provide for safe and efficient movement of vessel traffic within the VTS area.

2.1 The purpose of VTS is to improve the safety and efficiency of navigation, safety of life at sea and the protection of the marine environment and/or the adjacent shore area, worksites and offshore installations from possible adverse effects of maritime traffic.

2.1.2 The type and level of service or services rendered could differ between both types of VTS; in a port or harbour VTS a navigational assistance service and/or a traffic organization service is usually provided for, while in Coastal VTS usually only an information service is rendered.

2.3.4 When the VTS is authorised to issue instructions to vessels, these instructions should be result-orientated only, leaving the details of the execution, such as course to be steered or engine manoeuvres to be executed, to the master or pilot on board the vessel. Care should be *taken that VTS operations do not encroach upon the master's responsibility for safe navigation or disturb the traditional relationship between master and pilot.*

As suggested in *2.1.2* above, there are two types of VTS: port/harbour and coastal, both of which can be found throughout the world. The former is a service provided for ships entering and leaving the confines of a port and/or transiting within harbour limits, and the latter is concerned with traffic passing through an area outside harbour limits.

A difference between a coastal VTS and a port/harbour VTS is in the amount of control of shipping. A port/harbour VTS can, for example, direct a ship to leave an anchorage at a certain time, to slow her speed down or to enter a certain channel.

1.6.2 VTS Southampton

The operations room of the VTS centre is situated at 37 berth in Southampton Eastern Docks and is continuously manned 24 hours a day by a minimum of three people, comprising one VTS officer and two VTS assistants. The VTS port operations and information service covers the Solent and Southampton Water, excluding the port of Portsmouth north of a line between Gilkicker Point and Horse Sand Fort, and involves the monitoring and co-ordination of shipping movements.

By using four radar scanners, its radar service area extends from East Lepe buoy, Western Solent, to No Man's Land Fort in the Eastern Solent. In practice, however, the radar coverage is more extensive and continues beyond Nab Tower in the east. The station maintains a listening watch on VHF radio channels 12, 16 and 14. VHF channel 12 is the principal working frequency used for communication with VTS, as well as inter-ship communications throughout the area. Harbour radar information and selected harbour operations work on VHF radio channels 18, 20 or 22. All vessels of over 20m LOA must maintain a listening watch on VHF channel 12 when in the area.

In this way, VTS can identify the presence and intentions, and then monitor the progress of all vessels of over 20m LOA which are approaching and within the area. Additionally, the radar echo of each identified vessel is flagged on the VTS radar screens. This gives the VTS operators the ability to monitor the traffic situation continuously.

A vessel navigating in the Southampton harbour radar coverage area can, at any time, on request by VHF radio to the VTS centre, be supplied with continuous information about her progress relative to navigational marks, other vessels, channel margins and the West Bramble and Calshot turns. Alternatively, vessels are advised of their position as a distance left or right of the charted radar reference line relative to their direction of progress and as a distance along the line to a navigational mark.

1.7 PASSAGE PLANNING

The following are relevant extracts from the Nautical Institute's *Bridge Team Management - A Practical Guide by Captain A J Swift MNI*:

> *In the open sea and offshore coastal waters when navigating on small-scale large-area charts, course alterations will usually coincide with the planned track intersections. This will not be the case in confined waters when navigating on large-scale charts and where the margins of safety may require the ship to commence altering course at the wheel-over position some distance before the track intersection in order to achieve the new planned track.*
>
> *Often such wheel-over positions will be determined by the pilot using his own judgement, based upon experience.*
>
> *Planned wheel-over positions should be determined from the ship's manoeuvring data and marked on the chart. Suitable visual and radar cues should then be chosen to determine when the ship is at the wheel-over position. The best cues for large alterations of course consist of parallel indexes or bearings parallel to the new track, whereas for small alterations a near beam bearing is often better.*
>
> *Even when the pilot has the con, the wheel-over position should be shown on the chart so that the OOW will be aware of the imminence and importance.*
>
> *Ideally, the master and his team will be aware of the pilot's intentions and be in a position to be able to query his actions at any stage of the passage.*
>
> *When the pilot enters the bridge it is good practice for the master to make time for a brief discussion with the pilot. The master may need to delegate the con to the OOW or other officer, as appropriate, in order to discuss the intended passage with the pilot. This will include such items as the pilot's planned route, his anticipated speeds and ETAs, both enroute and at the destination, what assistance he expects from the shore, such as tugs and VTS information and what contingencies he may have in mind.*
>
> *The ship's progress needs to be monitored when the pilot has the con exactly as it has to be under any other conditions. Such monitoring needs to be carried out by the OOW, and deviations from the planned track or speed observed and the master made aware exactly as if he had the con. From such information the master will be in a position where he can question pilotage decisions with diplomacy and confidence.*

The following extracts are from the Port Marine Safety Code issued by the DTLR:

The object of port passage guidance as required by this Code is to ensure that:

- *all parties know relevant details of any particular port passage in advance;*
- *there is a clear, shared understanding of potential hazards, margins of safety and the ship's characteristics;*
- *intentions and required actions are agreed for the conduct of the port passage – including the use of tugs and their availability - and any significant deviation should it become necessary.*

Harbour authorities should take the lead in promoting the use of passage planning. They should take an overall view of the scope and content of passage plans for use in their areas…. They should seek to establish a general guidance - in simple cases for an entry to the port; in others, elaborated for particular berths, ship sizes, cargoes, conditions, tidal constraints, tug allocation, holding areas, etc.. Particular attention should be paid to critical port movements, for example the movement of deep draught vessels to particular berths

1.8 ACTIONS TAKEN BY ABP SOUTHAMPTON SINCE THE ACCIDENT

1. The harbour authority has started a fundamental review of the current pilot rota and choice systems.

2. A fog watch system and procedures have been introduced through a harbourmaster's instruction to staff in August 2001.

3. A Thorn Channel Review Group has been formed to review all aspects of this accident and guidelines for the use of the Thorn Channel.

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, if any, with the aim of preventing similar accidents occurring again.

2.2 THE TURN AROUND BRAMBLE BANK

At the beginning of *P&O Nedlloyd Magellan*'s turn, the 1.5-knot tidal stream was from right ahead. During the middle of the turn, the rate was about 1.0 knot on the port beam and, at the end of the turn the rate was still 1.0 knot but on the port quarter/stern. With the flood tidal stream setting from the west, there was danger of drifting on to the Bramble Bank, if the ship kept to the radar reference line. With this in mind, the pilot's intention was to travel outside the radar reference line to counteract the effect of the tidal stream. This is common practice with large container ships and tankers. By travelling outside the radar reference line, and by starting on a heading of 260°, to take full advantage of the space available, instead of 272° as suggested by the line, the turn is longer and deeper.

Speed is normally adjusted to give a balance between going slowly enough to have control and having reserve power to enhance manoeuvrability should it become necessary. Typically a large container ship enters the turn at a speed through the water between 10 and 12 knots, which varies from ship to ship depending on rudder size and hull form.

The turn is difficult in that the ship has to swing through a large angle and enter a narrow channel, which, at the Thorn Knoll buoy, is only 1.8 cables wide. The difficulty is compounded by the ship entering shallower water as the turn progresses, with the attendant effects on the ship's manoeuvrability. The aim is that at the end of the turn the ship is on the correct heading and in a safe position to transit the channel. The turn should be monitored sufficiently so that adjustments can be made to helm and/or speed to achieve this target.

At the start of the turn the heading was 260°; the required heading through Thorn Channel was 041°. This gave a total alteration of heading of 141°. From wheel-over to the grounding, the turn took about 7.5 minutes. Therefore, if the ship had completed the intended turn, the average rate of turn would have been about 19° per minute. However, the rate of turn is not constant, because the intention is to have a high rate of turn in the initial stages after which the helm is eased to achieve the entry into Thorn Channel.

The final heading on grounding was 035°, which in fact gave an average rate of turn of 18° per minute. Therefore, the difference between the desired and the actual average rate of turn was only 1° per minute, and shows that means other than the rate of turn indicator were needed to monitor the effectiveness of the helm and engine orders.

From an analysis of the playback of the VTS radar, and the ship's course, helm and engine movement recorders, the following table shows the sequence of events:

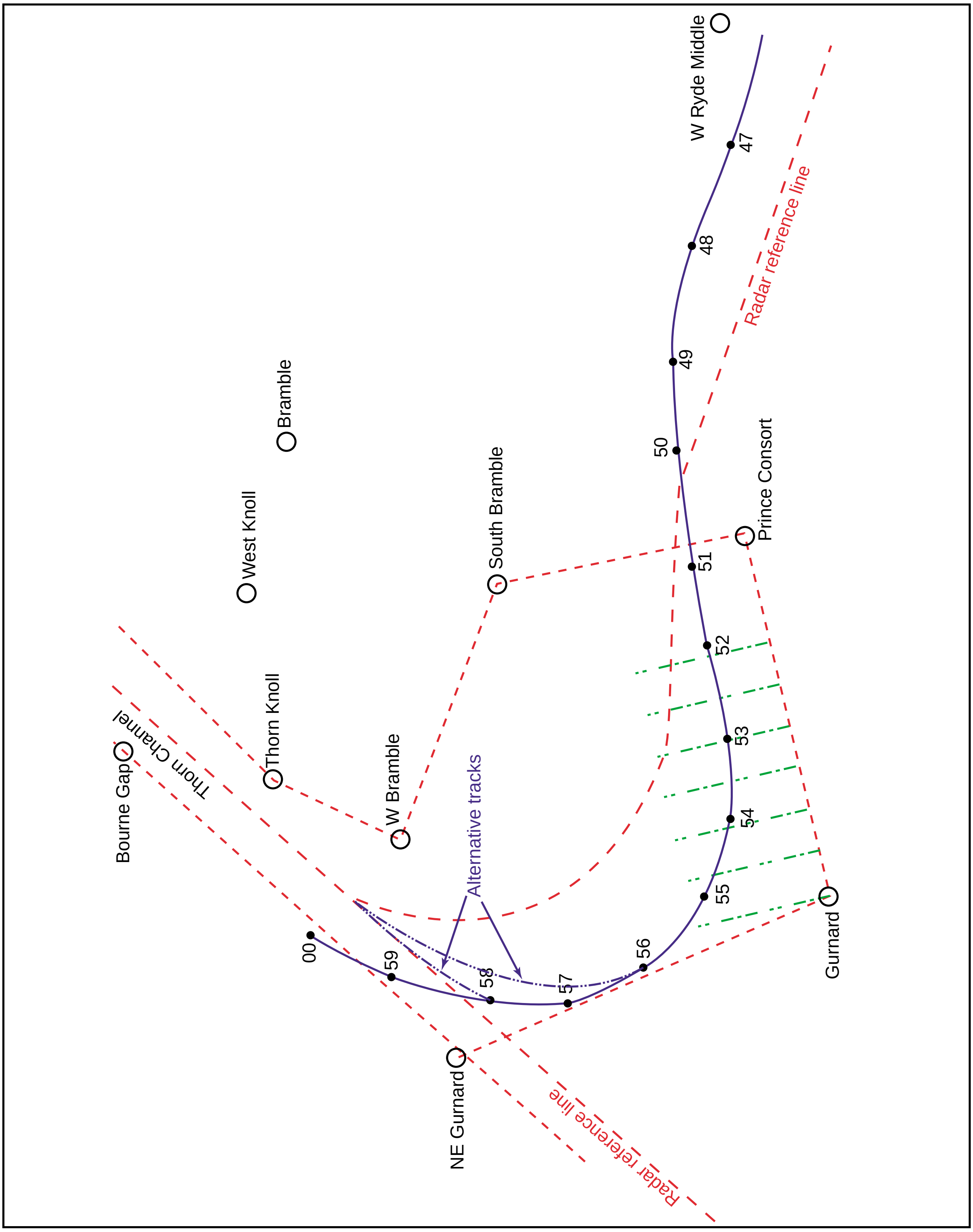
Time	Event
0646	Ship passed W Ryde Middle buoy. Course 290°. Speed reduced to half ahead.
0648	Ship altered course to port.
0650	Heading steady on 260°.
0652.5	Helm put over to 15° to starboard.
0654	Helm eased to 5° to starboard.
0655	Helm increased to 10° to starboard.
0656.5	Helm increased to 15° to starboard.
0657	Speed increased to full ahead.
0657.5	Helm increased to 20° to starboard.
0658	Speed reduced to half ahead and then slow ahead.
0658.5	Helm eased to 10° to starboard.
0659	Speed increased to half ahead.
0659.5	Speed reduced to dead slow ahead. Helm to hard-to-starboard.
0700	Ship grounds. Engine stopped. Slow astern

*The above times are considered accurate to within 30 seconds.

Taken from the VTS radar recording of the event, **Figure 1** shows a reconstruction of the turn, on which is imposed alternative tracks to take the ship on to the radar reference line and the centre line of Thorn Channel. The turn began normally but, after 0656, the curve flattened out, enough to give 1 cable distance between the grounding position and the centre line of the channel. When the pilot saw that the rate of turn indicator read about 30°/min he had the helm eased to 5° at 0654.

From his experience, the vessel ideally should have been passing through a heading of 320°/325° when NE Gurnard buoy was ahead at a distance of 7 cables. If the distance was greater, the helm should have been eased as the vessel would have been turning too quickly. If the distance was less than 7 cables, the helm should have been either maintained or increased. The VTS

Figure 1



A reconstruction of the grounding

playback indicates that, at about 0656, the bridge of *P&O Nedlloyd Magellan* was 5 cables from the buoy when she was on a heading of between 320°/325°. The distance to the NE Gurnard buoy at this time was less than ideal because, at least in part, of the pilot reducing the helm from 15° to 5° at 0645. He had done this when he had seen the rate of turn indicator reading the desired 30°/minute. In accordance with his normal procedure, he subsequently increased the helm from 10° to 15° to quicken the turn.

His belief that the ship was entering the channel safely, might have been because of an error by the pilot reading the EBL incorrectly. He thought that he had set the EBL on 040° (the approximate course through Thorn Channel) on the azimuth ring around the outer edge of the screen. This would have been correct if the origin on screen had been centred, but, in off-centre mode to the south, the true reading was only about 025°. Therefore, he believed he was making the desired heading but it was actually short of it **(see Figure 2)**.

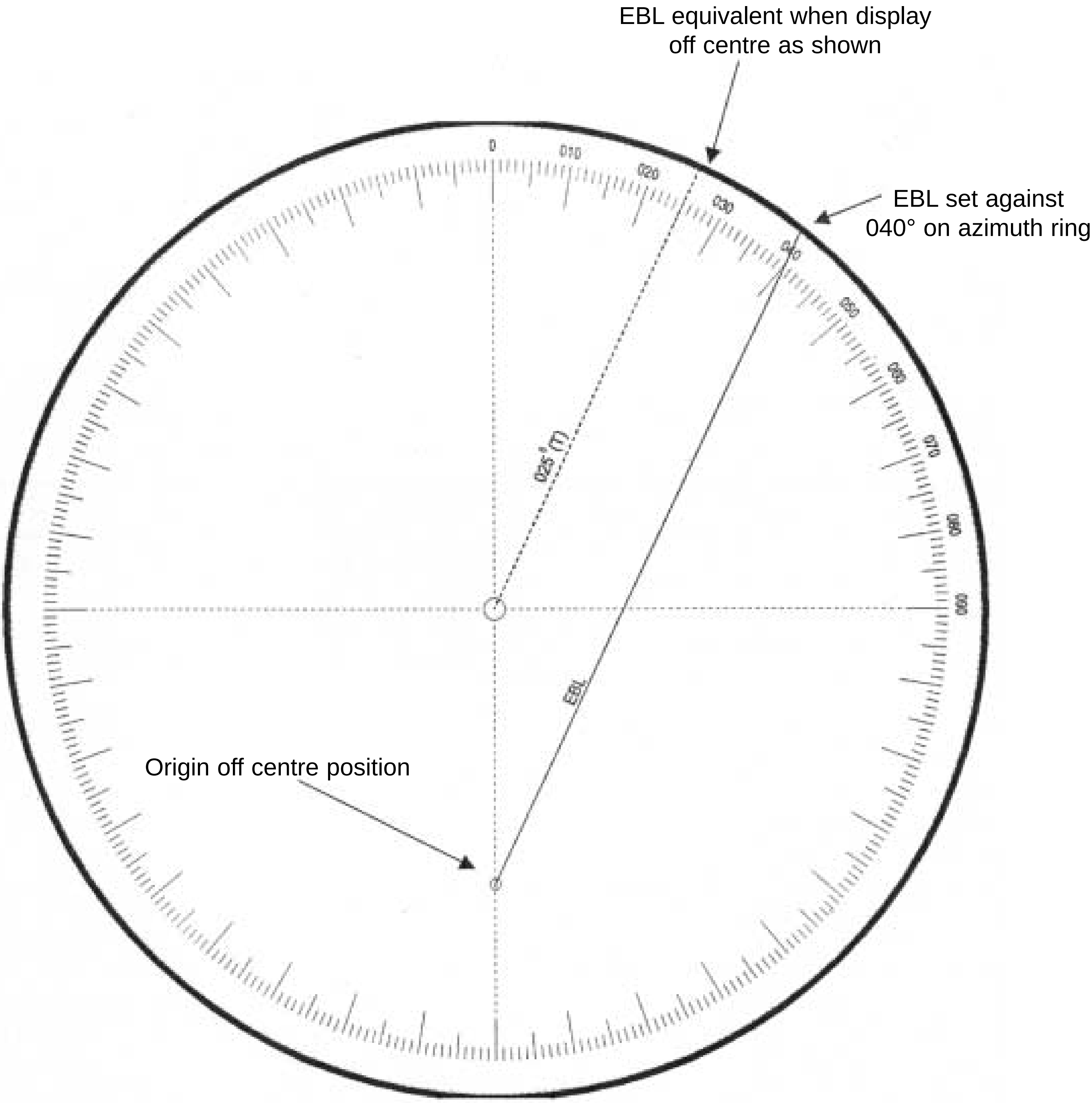
When the pilot saw the W Bramble and NE Gurnard buoys, he realised, through experience, that the ship was in the wrong position for the heading she was on. Despite further helm and engine orders, the vessel grounded at 0700 on the edge of the channel.

The turn began when the pilot could see neither the NE Gurnard nor W Bramble buoys. He and the bridge team did not have any visual references, which are important in monitoring such a large turn into a narrow channel. Previous reports of restricted visibility in the Solent should have alerted the pilot, the bridge team and VTS to a potentially hazardous situation with the possibility of restricted visibility in any area along the passage. The potential for grounding was increased and extra measures should have been put in place to monitor the progress of the ship even more closely, and to support the pilot. Other reference sources were available from the bridge team's navigational equipment/practices and from the VTS. These could have been used, but were not.

This whole manoeuvre was left to the pilot's judgment, experience and execution **(Sections 2.3 and 2.4)**. With the pilot's experience, the VHF radio conversations should have alerted him to potential problems with visibility ahead of the ship and he could have made further enquiries **(Section 2.5)**. With more accurate reports on the state of visibility in the channel, he probably would have decided to abort the passage. However, as the turn progressed, the pilot was faced with restricted visibility in Thorn Channel, for which there was no preparation, and he had to rely on his experience and skill alone to execute the manoeuvre.

In another European port where radar reference lines are also used, these are backed up by leading lines denoted by marks/lights, which are especially useful when coming on to a new heading after a turn. Although leading lines would not have helped in this case, because of the restricted visibility, they would be an extra and reliable way of helping to judge the later stages of a turn into Thorn Channel. Another possible help would be an additional buoy opposite, and north-west of, the W Bramble buoy. The two buoys would make a gateway for the ship to pass through, and again provide a reliable way of helping to judge the later, critical, stages of the turn **(see Section 1.8)**.

Figure 2



Reconstruction of radar display on *P&O Nedlloyd Magellan*

1.5 mile range

Reproduced courtesy of ABP Southampton

2.3 MONITORING BY THE BRIDGE TEAM

There were two significant issues relating to the ship's passage plan:

- the waypoints laid down on the paper and electronic charts, and on the radar screen; and
- a difference between the pilot's intentions and the ship's passage plan.

The waypoints in **chart extracts 3 and 4** can be seen to adhere to the radar reference line. Three waypoints were entered for the turn: at the beginning, in the middle of the curve and at the end. The plan did not take into account that the turn would be a continuous one: not three separate rhumblines as indicated in the chart extracts.

The note on Admiralty chart No 2036 states:

> *The Radar Reference Line is used to indicate the position of a vessel by Harbour Radar. A vessel navigating in the Southampton Harbour Radar coverage area will at any time, on request by VHF to the Vessel Traffic Services (VTS), Southampton, be given her position relative to the line, or, where the line is not shown, relative to the navigational marks.*

The passage plan assumed that the ship would follow the radar reference line, but Rule 9 (a) of the International Regulations for Preventing Collisions at Sea states:

> *A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable.*

While navigating in the confines of the Thorn Channel and Southampton Water, such a large ship as *P&O Nedlloyd Magellan* generally must keep to the radar reference line, which marks the centre line. However, she does not have to in the wider channels of the East Solent, or when making the turn in the Western Approach Channel.

During the exchange of the pilot's and the master's passage plans, **(Section 1.7 above)**, the pilot did not mention that he intended the ship to move off the radar reference line, which was in conflict with the ship's passage plan. This deviation began as early as W Ryde buoy, when the pilot was keeping to the starboard side of the channel for the approach to the turn into Thorn Channel. However, none of the bridge team questioned the pilot as to why he had allowed the ship to leave the line.

The master was monitoring the starboard radar screen, which had the same waypoints imposed on it as seen in **chart extracts 3 and 4**, and the electronic chart screen. The master must have seen that the ship was taking a wider turn than the reference line but again the pilot's actions were not questioned. The ship's position was not being plotted on the paper chart by the OOW, who therefore had no grounds for questioning why the ship was taking a different track to that planned on the chart.

The ship's wheelhouse poster (IMO Resolution A.601(15) *Provision and display of manoeuvring information on board ships*) showed turning circles at maximum rudder angles in ballasted and loaded conditions. There were no data for advance and transfer distances for various speeds, rudder angles and loaded/light conditions to enable wheel-over points to be calculated. Therefore, the bridge team could not properly plan the turn in advance and thereby could not monitor the pilot's actions properly during the turn.

Parallel indexing lines should have been set up on the radar, whether there was restricted visibility or not, to monitor the safe passage of the ship, especially in such confined waters and with such a large turn to execute. These would have assisted the pilot, and also the bridge team in monitoring the ship's position.

2.4 MONITORING BY THE VTS

Traffic control centres, such as the VTS centre in Southampton, operate to process radar and vessel data to produce a continually updated overall traffic situation picture. This allows operational measures to be taken for planning safe traffic-flow situations, as well as for preventing accidents, such as collisions and groundings.

The technical and operational sides of VTS arrangements and installations are being brought to internationally recognised standards, as in air traffic control systems.

During *P&O Nedlloyd Magellan*'s passage from the pilot boarding station to the Western Approach Channel, various VHF radio conversations on the port's working frequency, mentioning the state of visibility at different locations, had taken place. However, the VTS was not aware of severely restricted visibility in the area of the Western Approach and Thorn Channels probably because the visibility reduced quickly as the vessel approached. Therefore, a warning was not given to the pilot in time for him to abort the passage. This left him committed to turn into an area that was affected by fog, making navigation even more difficult.

While the VTS centre is positioned so that the operators can see the length of Southampton Water, the East and West Solent are out of sight and the VTS has to rely to a certain extent on vessels reporting restricted visibility in those areas. *P&O Nedlloyd Magellan* had entered a localised fog bank just as she was making her critical turn into a narrow channel. Before the accident, two ferries operating between Cowes and Southampton had passed each other, and had not reported fog in the area. The harbour launch, preceding the ship did not report to the pilot or VTS that there was restricted visibility in Thorn Channel. There is a closed circuit TV at Calshot, which can cover the Thorn Channel and the southern end of Southampton Water, but this did not alert the VTS operators that there was restricted visibility in Thorn Channel.

The monitoring of visibility at strategic points in the Solent would give a pilot advance warning of restricted visibility. He could then make a more informed decision as to whether to abort the passage or to carry on.

The role of the VTS officer is to give the pilot a countdown to the wheel-over point by using the special lines imposed on his radar screen for the purpose **(Annex 1)**. The VTS officer erroneously stated the 5-cable countdown, when the ship was at the 6-cable mark, although the error did not have any effect on the grounding. However, it is significant to note that the VTS officer did not notice, until the harbour launch had informed him, that the ship had gone aground. At sometime after the countdown, the VTS officer was not watching his radar screen, because he had become preoccupied with other tasks. If the pilot had told the VTS officer that the ship was entering restricted visibility, the latter may have been more vigilant to a potential hazardous situation. There was no dedicated watch in the VTS room for *P&O Nedlloyd Magellan*'s turn into Thorn Channel, even with the threat of restricted visibility. Even if there had been, it would have been difficult to predict the ship's grounding. A plan of the turn imposed on the VTS radar screen (similar to the countdown distances from the Gurnard buoy **- see Annex 1**), would be of much assistance to the VTS officer in monitoring the ship and in giving positional information to the pilot.

A certain European port situated on a river some distance from the sea, follows a special routine (fog watch), **(see Section 1.8)** when visibility is reduced to 3000m in the river, or 2000m in the port. A pilot goes to the VTS centre and, using one of the radars, gives advice, himself, to pilots on board ships in transit on the river. This method of giving advice to pilots on ships by another pilot stationed in the VTS Centre, is not carried out in ABP Southampton's Fog Routine, but is very effective in European ports and in a large UK container port. This European port still relies on ship reports of restricted visibility, but also monitors the situation with CCTV cameras placed in strategic positions along the river.

2.5 PILOT FATIGUE

(With reference to The Transportation Safety Board of Canada's *A Guide for Investigating for Fatigue)*. There are a number of indicators to show that fatigue might have been a contributing factor.

Displayed decreased vigilance and did not observe warning signs

There had been VHF radio conversations in which restricted visibility had been mentioned, although none of the reports were as severe as that found at the time of the events leading up to the grounding. However, given the pilot's experience, the reports should have alerted him to the possibility of fog patches in areas other than those being reported. The harbour launch, waiting for the ship off Cowes, could have been asked for a visibility report in Thorn Channel before *P&O Nedlloyd Magellan* arrived at the abort point. The pilot's normal practice was to have asked the bridge team to set up parallel indexes, but he did not do so on this occasion because he was not expecting restricted visibility in Thorn Channel.

Displayed poor judgment of distance, speed and/or time

When the pilot realised that the ship was in the wrong position, he reacted by ordering full ahead and then increasing the starboard helm, but then reduced speed and helm before his remedial action was able to take proper effect.

Failed to respond altogether to normal, abnormal or emergency stimuli

The pilot failed to inform the VTS of the grounding at the earliest opportunity. He also knew that a tanker was at some distance behind him and her pilot/master needed to know of the grounding so that her passage through Thorn Channel could be aborted.

To quote further from the Transportation Safety Board of Canada's guide on fatigue:

Essentially, every aspect of human performance can be degraded by sleep loss and sleepiness, including physical, pschychomotor and mental performance; mood can be affected, and attitudes toward risk-taking and safety can change.

Cumulative sleep debt occurs when insufficient quantity of sleep continues over several consecutive days.

A person deprived of sleep for an extended period will usually take two normal nights of sleep to recover.

Everyone's sleep needs are unique; however, over 90% of the population needs between 7.5 and 8.5 hours of sleep per 24-hour day.

In Section 1.5.1, it can be seen that the pilot had had irregular sleep periods during the three days before the accident; 18.5 hours sleep in four separate periods in the previous 52.5 hours. The *choice* pilotage acts occurred during his normal rest period and, on the day before, and on the day of, the accident, in the early hours of the morning. He had also carried out *choice* pilotage acts over the previous weekend, which had also disturbed his regular sleep pattern. Although the pilot had sufficient hours of sleep, as suggested by the guide, his periods of sleep were irregular. It is therefore concluded that he was possibly suffering from fatigue, but to what degree it contributed to the accident is uncertain.

See Section 1.8 on ABP Southampton's review of pilot rota and choice pilotage systems.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

1. With the flood tidal stream setting from the west, by keeping to the radar reference line, there was the danger of the ship drifting on to the Bramble Bank. [2.2]

2. The pilot's intention was to travel outside the radar reference line to counteract the effect of the tidal stream. [2.2]

3. The turn is difficult in that the ship has to swing through a large angle and enter a narrow channel. The difficulty is compounded by the ship entering shallower water. [2.2]

4. This whole manoeuvre was left to the pilot's judgment, experience and execution. [2.2]

5. The difference between the desired and the actual average rate of turn was only 1° per minute, and shows that means other than the rate of turn indicator were needed to monitor the effectiveness of the helm and engine orders. [2.2]

6 The turn began when the pilot could see neither the NE Gurnard nor the W Bramble buoys. [2.2]

7. Previous reports of restricted visibility in the Solent should have alerted the pilot, the bridge team and VTS to a potentially hazardous situation with the possibility of restricted visibility in any area along the passage. [2.2]

8. Non-visual reference sources, which could have been used but were not, were available from the bridge team's navigational equipment/practices and from the VTS. [2.2]

9. The turn began normally but, after 0656, the curve flattened out. By easing the helm to 5° at 0645 the rate of forward motion increased, while the rate of turn decreased. [2.2]

10. When the pilot saw the W Bramble and NE Gurnard buoys, he realised, through experience, that the ship was in the wrong position for the heading she was on. [2.2]

11. The ship's passage plan had the waypoints drawn on the radar reference line. [2.3]

12. The ship's passage plan did not take into account that the turn would be a continuous one: not in three separate rhumblines as indicated on the working paper and electronic charts. [2.3]

13. During the exchange of the pilot's and the master's passage plans, the pilot did not mention that he intended the ship to move off the radar reference line, which was in conflict with the ship's passage plan. [2.3]

14. During the passage, none of the bridge team questioned the pilot as to the reason why he had allowed the ship to leave the radar reference line. [2.3]

15. The master was monitoring the starboard radar screen, which had the same waypoints imposed on it as seen in the working charts. [2.3]

16. The ship's position was not being plotted on the paper chart by the OOW, who therefore had no grounds for questioning why the ship was taking a different track to that planned on the chart. [2.3]

17. Because there were no data for advance and transfer distances to be able to calculate wheel-over points, the bridge team could not properly plan the turn in advance and thereby they could not monitor the pilot's actions properly during the turn. [2.3]

18. Parallel indexing lines should have been set up on the radar, whether there was restricted visibility or not, to monitor the safe passage of the ship, especially in such confined waters and with such a large turn to execute. [2.3]

19. Parallel indexing lines would have assisted the pilot, and also the bridge team in monitoring the ship's position. [2.3]

20. As well as parallel indexing lines, other positional indicators could have been used to show if the turn was progressing safely. [2.3]

21. Various VHF radio conversations mentioning the state of visibility at different locations had taken place. However, the VTS was not aware of severely restricted visibility in the area of the Western Approach and Thorn Channels. [2.4]

22. A closed circuit TV at Calshot did not alert the VTS operators that there was restricted visibility in Thorn Channel. [2.4]

23. The VTS has to rely to a certain extent on vessels reporting restricted visibility in their locations. [2.4]

24. *P&O Nedlloyd Magellan* had entered a localised fog bank just as she was making her critical turn into a narrow channel. [2.4]

25. The monitoring of visibility at strategic points in the Solent would give a pilot advance warning of restricted visibility. He could then make a more informed decision as to whether to abort the passage or to carry on. [2.4]

26. At sometime during the turn the VTS officer was not watching his radar screen, because he had become preoccupied with other tasks, and did not notice that the ship had gone aground. [2.4]

27. If the pilot had told the VTS officer that the ship was entering restricted visibility, the latter may have been more vigilant to a potential hazardous situation. [2.4]

28. There was no dedicated watch by anyone in the VTS room for *P&O Nedlloyd Magellan*'s turn into Thorn Channel. [2.4]

29. If there had been a plan of the turn imposed on the VTS radar screen, the VTS officer could have assisted the pilot by giving positional information during the turn. [2.4]

30. The pilot had had irregular sleep periods during the three days before the accident; having had 18.5 hours sleep in four separate periods in the previous 52.5 hours. [2.5]

31. The *choice* pilotage acts occurred during his normal rest period, and, on the day before and on the day of the accident in the early hours of the morning. [2.5]

32. The pilot was possibly suffering from fatigue, but to what degree it contributed to the accident is uncertain. [2.5]

3.2 THE CAUSE

The cause of the grounding was an error of judgment by the pilot during the execution of the turn into Thorn Channel. [2.2]

3.3 CONTRIBUTING FACTORS

1. The restricted range of visibility not giving the pilot, nor the bridge team, any visual reference points with which to monitor the turn. [2.2]

2. The lack of warning of restricted visibility in the Thorn Channel. [2.2]

3. The lack of navigational preparation by the bridge team for the execution of a large turn. [2.3]

4. The lack of full monitoring of the pilot's performance by the bridge team, because of deficiencies in the ship's passage plan and turning data, and the lack of full understanding of the pilot's intentions. [2.3]

5. The pilot was reading the EBL for the course through the Thorn Channel incorrectly, because he forgot that the radar origin was off-centred rather than centred. [2.2]

6. The bridge team did not question the pilot when the ship left the radar reference line and hence their passage plan. [2.3]

SECTION 4 - RECOMMENDATIONS

ABP Southampton is recommended to:

1. Where practicable, implement an improved system of monitoring areas of restricted visibility in its pilotage area.

2. Implement a dedicated VTS service for the turn into Thorn Channel and consider using a plan imposed on the VTS radar screen.

3. Send generic port passage guidance to ships visiting Southampton before they arrive (as suggested by the Port Marine Safety Code) and ensure a comprehensive pilot/master exchange of their respective specific passage plans on arrival.

E R Schiffahrt is recommended to:

4. Monitor, more closely, the standard of passage plans and navigational procedures on board its managed ships.

5. Produce, for its large container ships, turning data for various loaded conditions, speeds and degrees of helm.

The UK Hydrographic Office is recommended to:

6. Amend the note on Chart No 2036 concerning radar reference lines to the effect that they are not to be taken as the required track and that Rule 9(a) of the Regulations for the Prevention of Collisions at Sea still applies.

Marine Accident Investigation Branch
May 2002

ANNEX 1

Computer extracts of the VTS radar sequence of events

Reproduced courtesy of ABP

0653

0654

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0655

0656

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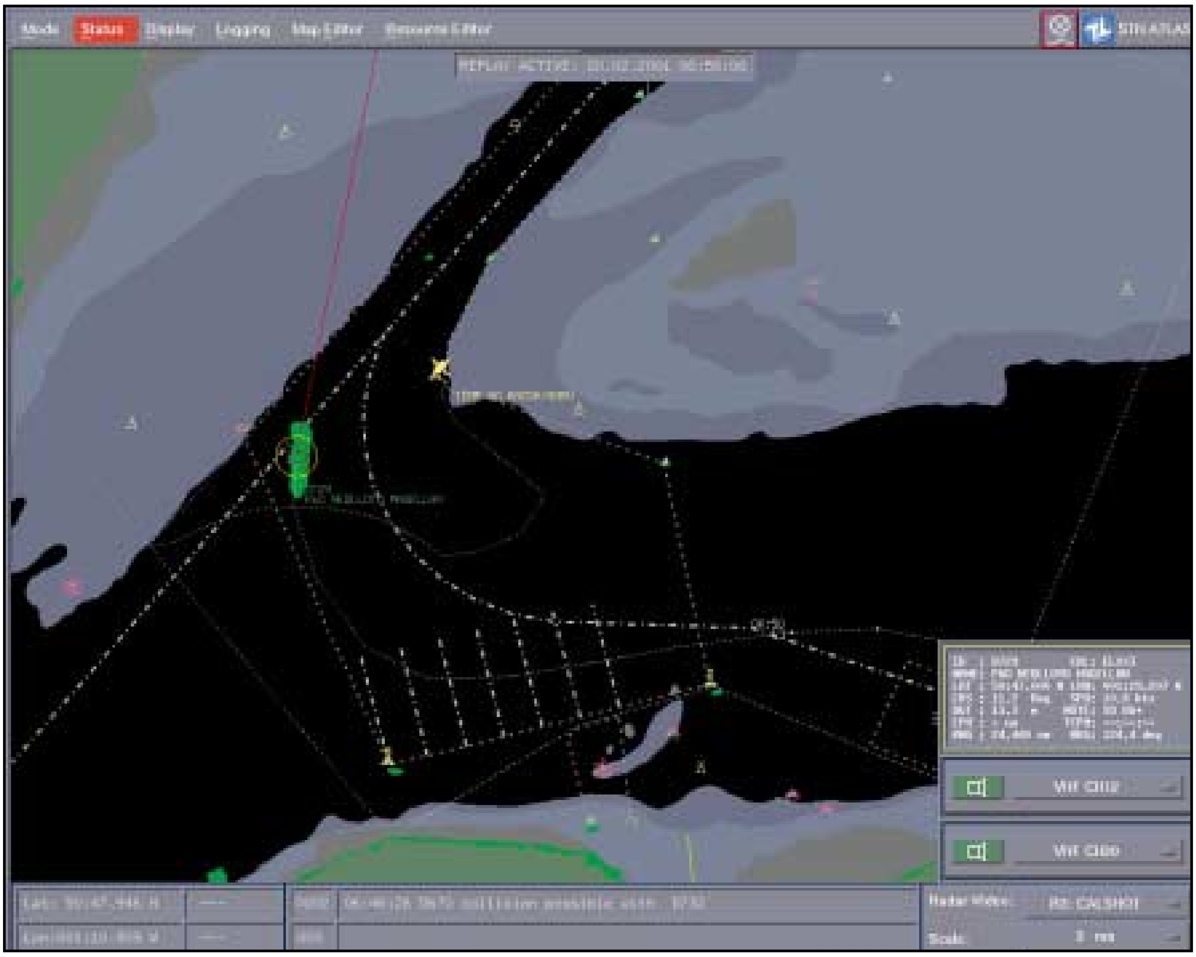
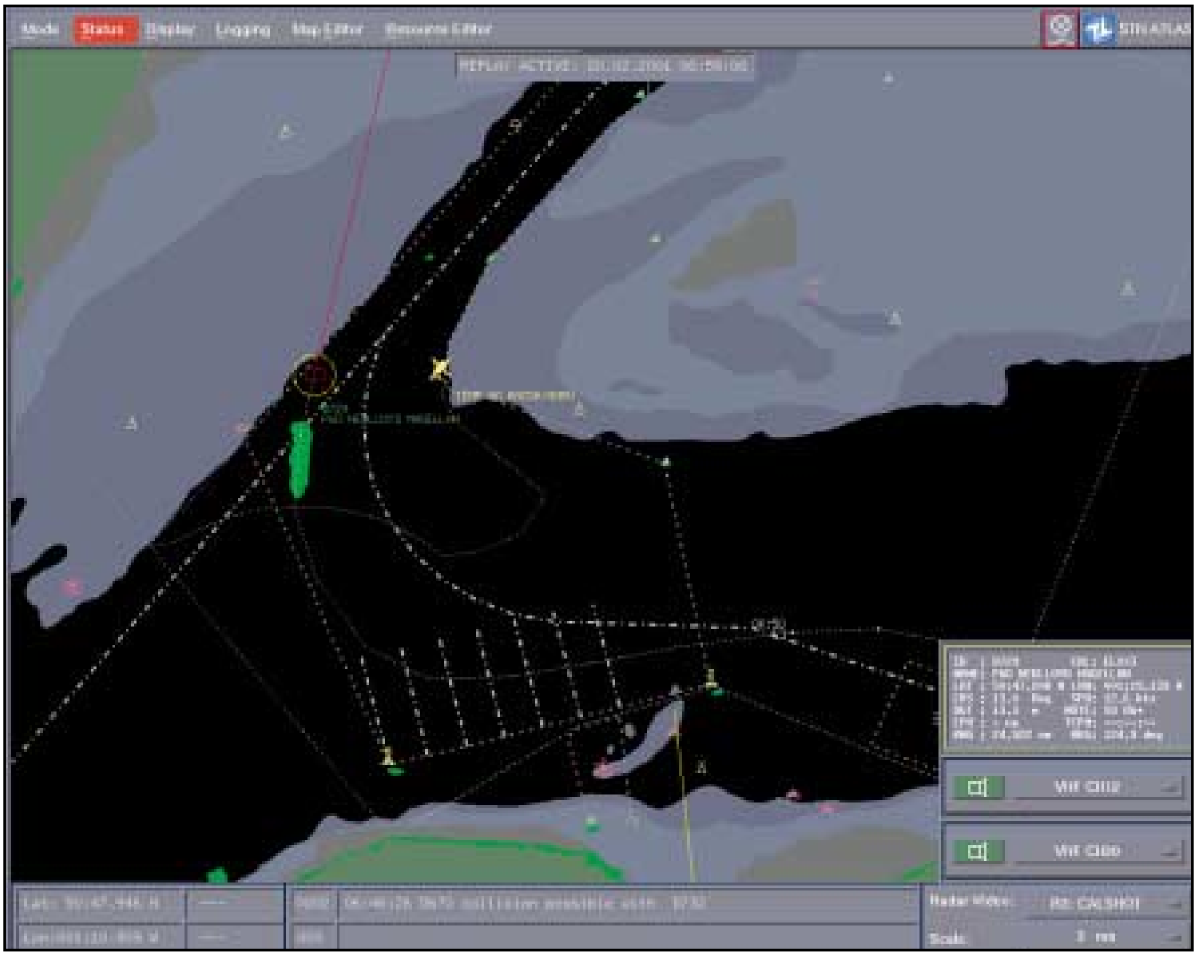
0657

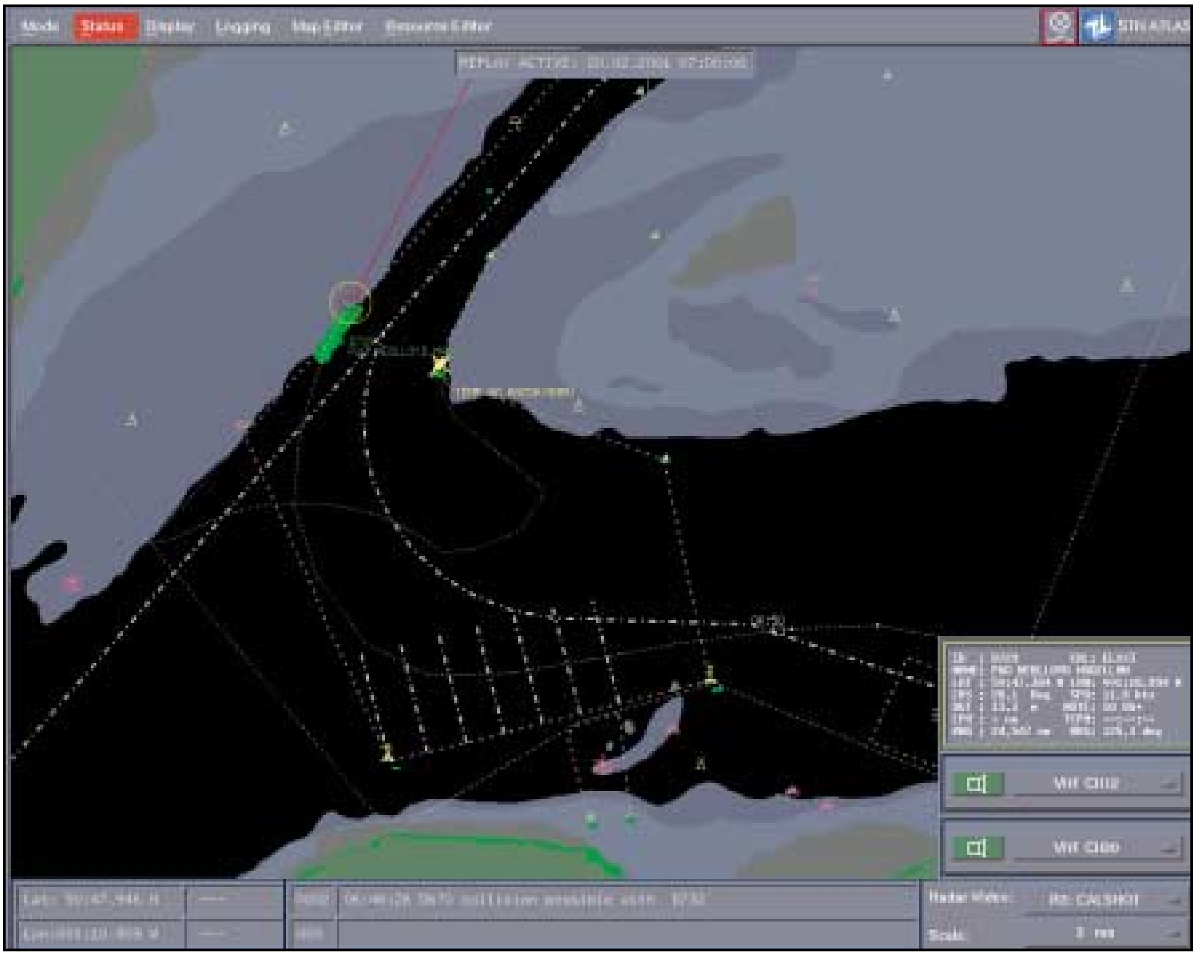


0658

Reproduced courtesy of ABP



0659



0700

Reproduced courtesy of ABP

0700 19

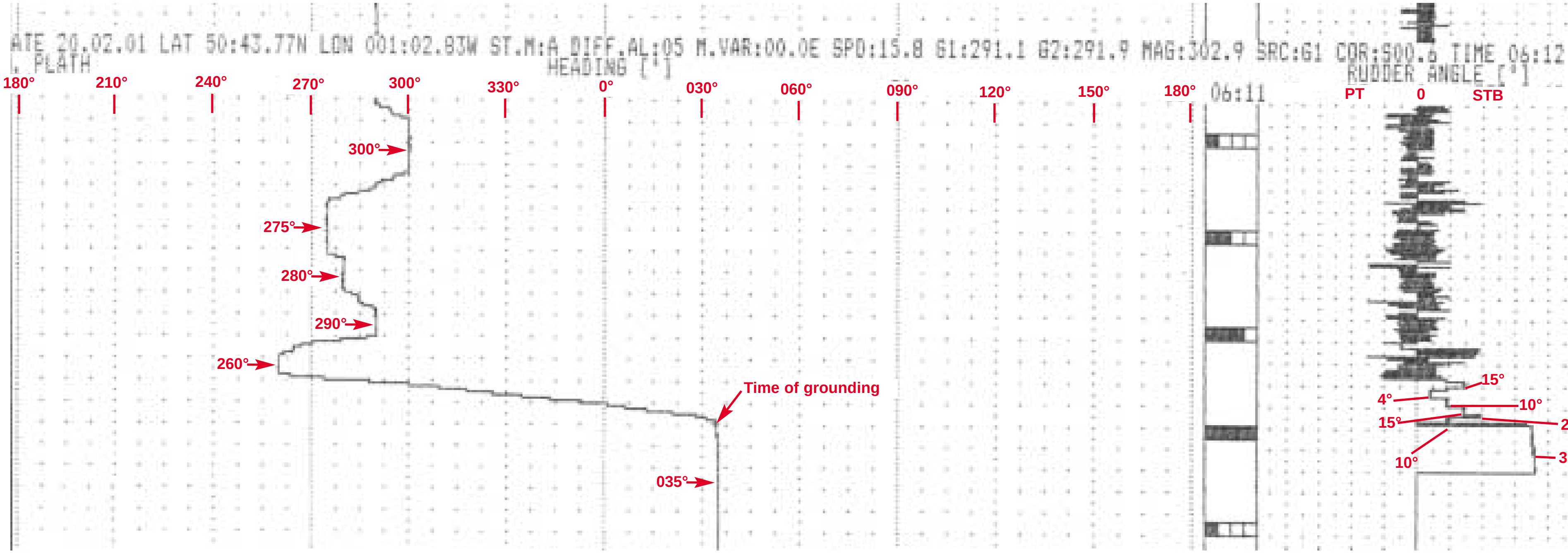
ANNEX 2

An extract from the ship's course recorder

```
 BRIDGE  CONTRL 06.46:28
>0:HALF   AHEAD   54 RPM
 BRIDGE  CONTRL 06.46:39
>                 47 RPM
 BRIDGE  CONTRL 06.57:02
>0:FULL   AHEAD   49 RPM
 BRIDGE  CONTRL 06.57:10
>                 58 RPM
 BRIDGE  CONTRL 06.58:12
>0:HALF   AHEAD   55 RPM
 BRIDGE  CONTRL 06.58:16
>0:SLOW   AHEAD   48 RPM
 BRIDGE  CONTRL 06.58:29
>                 34 RPM
 BRIDGE  CONTRL 06.59:08
>0:HALF   AHEAD   45 RPM
 BRIDGE  CONTRL 06.59:12
>                 47 RPM
 BRIDGE  CONTRL 06.59:42
>0:D.SLOW AHEAD   47 RPM
 BRIDGE  CONTRL 06.59:57
>                 27 RPM
 BRIDGE  CONTRL 07.00:10
>0:STOP           11 RPM
 BRIDGE  CONTRL 07.00:19
```

ANNEX 3

An extract from the ship's engine movement recorder



ATE 20.02.01 LAT 50:43.77N LON 001:02.83W ST.M:A DIFF.AL:05 M.VAR:00.0E SPD:15.8 G1:291.1 G2:291.9 MAG:302.9 SRC:G1 COR:S00.6 TIME 06:12
, PLATH
HEADING [°]
RUDDER ANGLE [°]
180° 210° 240° 270° 300° 330° 0° 030° 060° 090° 120° 150° 180°
06:11
PT 0 STB
300°
275°
280°
290°
260°
Time of grounding
035°
15°
4°
10°
15°
20°
10°
35°