Report of the Chief Inspector of Marine Accidents

into the grounding and subsequent salvage of the tanker

SEA EMPRESS

at Milford Haven

between 15 and 21 February 1996

Marine Accident Investigation Branch
Department of Transport
5/7 Brunswick Place
Southampton
Hampshire SO15 2AN

27 March 1997

The Right Honourable Sir George Young Bt MP
Secretary of State for Transport

Sir

In pursuance of Regulation 9 of the Merchant Shipping (Accident Reporting and Investigation) Regulations 1994, I submit my Report following the Inspector's Inquiry into the grounding and subsequent salvage of the tanker SEA EMPRESS at Milford Haven, on 15 February 1996.

I wish to place on record appreciation for the co-operation which was extended to the Inspectors who carried out the Inquiry, by the many parties concerned. In particular to the flag state of the vessel; the Liberian Authorities carried out an investigation of their own into the initial grounding in parallel with the Inspector's Inquiry.

Acknowledgement is made to Birkenhead & Associates Ltd for advice on salvage matters, to the Institute of Maritime Law at the University of Southampton for advice on salvage law, to Lloyd's Register of Shipping for stability calculations, to ABP Research and Consultancy Ltd for research into the tidal streams and to Harland & Wolff Shipyard for the measurements of the damage sustained by the vessel.

I am, Sir,
Your obedient servant

Captain P B Marriott
Chief Inspector of Marine Accidents

Extract from
The Merchant Shipping
(Accident Reporting and Investigation)

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

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MAIB - Report of the Chief Inspector of Marine Accidents into the grounding and subsequent salvage of the tanker SEA EMPRESS

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Glossary and Summary

GLOSSARY OF ABBREVIATIONS AND TERMS

Abeam	Position or direction which lies horizontally at right angles to the vessel's fore and aft line
AHTS	Anchor handling/tug/supply vessels
Anchor Cables	Chains for attaching the anchors to the vessel
Bar	A unit of pressure which is 10^5 N/m^2, equivalent to 14.5 lb/in^2
Bollard Pull	The maximum pulling, or pushing, power of a tug
Bow Thruster	An independently powered propeller fitted in a transverse tunnel in the bows of the vessel to improve the handling characteristics during manoeuvring
Bulkhead	A vertical partition in the vessel which is often watertight
Cable	Unit of distance equalling 1/10th of a nautical mile (608 ft/185 metres)
CHA	Competent Harbour Authority
Course Made Good	The actual track of the vessel
DNV	Det Norske Veritas
Draught	Distance from the waterline to the bottom of the vessel when the vessel is afloat
dwt	Deadweight tonnes which is the carrying capacity of the vessel
ETA	Estimated time of arrival
Frame	A continuous structure supporting the sides, bottom and deck plating of the vessel
Gyro	A type of compass
Hawse Pipes	Tubes built into the vessel's bows through which the anchor cables run
IMO	International Maritime Organization
Inert Gas	A gas with an oxygen content of less than 8% which does not support combustion and is pumped into the ullage space above oil cargoes
Knots	Nautical miles per hour
Leading Lights	Two or more lights which identify a line of safe approach when they are in line
Lee	Downwind side of the vessel
List	Transverse inclination of the vessel caused by unsymmetrical distribution of weights
Local Commander	The senior MPCU official in attendance at the scene of the incident
LOF	Lloyd's Standard Form of Salvage Agreement
MARPOL	International Convention for the Prevention of Pollution from Ships 1973/78
MEOR	Marine Emergency Operations Room (situated in The Coastguard Agency headquarters at Southampton)
Merchant Shipping	Notices issued by the Department of Transport to the Notices (M Notices) Shipping Industry, identified by the letter M and a number
MHPA	Milford Haven Port Authority
Mile	Nautical mile, about 1.15 statute miles
MoD	Ministry of Defence
MPCU	Marine Pollution Control Unit of The Coastguard Agency
MPSC	Marine Pollution Salvage Centre which holds MPCU's stockpile of pollution control and clean-up equipment.

MRC	Marine Response Centre located at Milford Haven Coastguard Station during the duration of the incident
MRCC	Marine Rescue Co-ordination Centre of HM Coastguard
MRSC	Marine Rescue Sub-Centre of HM Coastguard
MSA	Marine Safety Agency of the Department of Transport
Overall Commander	The senior Coastguard Agency officer who co-ordinates the efforts of HM Coastguard, MPCU and other organisations involved in dealing with the emergency
P & I	Protection and Indemnity Association
Pressure/Vacuum Valves	A device fitted at the top of a cargo tank to prevent either an over-pressurisation or a vacuum forming within the tank
RNLI	Royal National Lifeboat Institution
SERS	Lloyd's Register of Shipping, Ship Emergency Response Service
Shackle	Length of anchor chain equivalent to 15 fathoms (90ft/27 metres)
Speed Made Good	Average speed of the vessel
Squat	An increase of the vessel's draught caused by her movement through the water
tbp	Tonnes bollard pull
Trim	Difference between the forward and after draughts of the vessel when afloat. The vessel is trimmed by the head when the forward draught is greater than the after draught
Ullage	The measurement between the top of the tank and the surface of liquid in the tank
VHF	Radios using Very High Frequency which have designated marine channels
VLCC	Very large crude carrier (greater than 200,000 dwt)
VTS	Vessel Traffic Services for handling shipping movements within harbour limits
Weigh anchor	To lift the anchor from the seabed
Windlass	Machinery for deploying or recovering the anchors

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1. SUMMARY

The motor tanker SEA EMPRESS loaded with a cargo of 130,018 tonnes of Forties light crude oil grounded off the Middle Channel Rocks in the approaches to Milford Haven at 2007 hrs on 15 February 1996. A pilot was on board and the vessel was entering the Haven via the West Channel. Although the main engine was stopped, put astern and both anchors dropped the vessel continued to run ahead and came to rest aground, approximately 5 cables northeast of the initial grounding position. The weather was fine and clear with a west-northwesterly force 4/5 wind.

The vessel is constructed with some side ballast tanks but no double bottom tanks. The starboard side cargo and ballast tanks were ruptured when the vessel first grounded resulting in a heavy trim by the head and a starboard list. A quantity of oil was released from the damaged cargo tanks.

Both the Milford Haven Port Authority's Emergency Plan and the Marine Pollution Control Unit's National Contingency Plan were implemented promptly. Within hours the managers of SEA EMPRESS had accepted an offer of assistance from a salvage consortium on the terms of Lloyd's Standard Form of Salvage Agreement, "No Cure - No Pay" (LOF95).

SEA EMPRESS was manoeuvred into deeper water where she could be anchored and held in position with the aid of the harbour tugs from Milford Haven. This was achieved without further loss of cargo and the intention was to lighten the casualty as soon as possible so as to allow her to enter the Haven and discharge the remainder of her cargo. A suitable lightening vessel was identified and preparations were commenced to ready SEA EMPRESS for this operation.

The prediction of gale force winds led to the decision to turn the casualty and re-anchor her so that she would be heading into the wind. This operation was carried out on 17 February while the preparations for lightening were still underway. It was just after this turning operation, and when the weather conditions had already deteriorated, that control of the casualty was lost and she grounded off Saint Ann's Head.

For the next four days efforts by the salvors to regain control of the casualty were unsuccessful and the casualty went aground again on a number of occasions, both off Middle Channel Rocks and Saint Ann's Head. It was not until 21 February that the casualty was successfully refloated and brought under control. She was then taken to a berth inside the Haven where the remainder of her cargo was discharged.

There was no loss of life or serious injuries.

The cause of the initial grounding has been found to be due to pilot error.

The main factors, apart from the bad weather, which resulted in the salvage operation taking so long, were insufficient tugs of the appropriate power and manoeuvrability, together with a lack of full understanding of the tidal currents in the area.

The initial grounding resulted in approximately 2,500 tonnes of crude oil escaping and about a further 69,300 tonnes was lost to the sea during the period of the salvage operation.

A number of recommendations have been made, which are addressed to Milford Haven Port Authority, the Department of Transport/Marine Safety Agency, The Coastguard Agency and Acomarit (UK) Ltd.

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PART III ANALYSIS OF INCIDENT (SALVAGE OPERATION) continued

20. DAMAGE TO VESSEL AND DISCUSSION ON DOUBLE HULL VESSELS

Introduction

20.1 From the time the initial grounding took place to the completion of the salvage operation one question which was raised in many quarters was whether the consequences would have been different if the vessel had been of double hull construction. The vessel was thoroughly examined by the Inspectors after she had been taken to the shipyard in Belfast and a comprehensive record taken of the damage which had been sustained. This section of the Report examines the full extent of that damage and discusses whether the pollution would have been substantially reduced, or avoided entirely, if the vessel had been constructed to the standard of a double hull tanker or equivalent. It also examines the regulatory framework for the avoidance of oil pollution under which tankers operate.

Overview of Damage Sustained by the Vessel

20.2 A broad overview of the hull bottom damage is shown in Figure 6 (Image 63k). It can be seen that the most severe damage ran in a continuous band from around the Fore Peak and down the length of the starboard wing tanks. In marked contrast the port wing tanks showed only isolated areas of damage, whilst the majority of the area in way of the centre tanks was largely undamaged or only lightly so. The entire damaged area exhibited pounding damage with the plating dished in between adjacent stiffeners with fractures running along the lines of bulkheads and frames (see Photographs 3 - 6).

Photograph 3 - General View of Bottom Damage to SEA EMPRESS (Image 45k)

Photograph 4 - General View of Bottom Damage to SEA EMPRESS (Image 45k)

Photograph 5 - General View of Bottom Damage to SEA EMPRESS (Image 45k)

Photograph 6 - General View of Bottom Damage to SEA EMPRESS (Image 45k)

A more detailed account of the damage to various areas of the hull bottom follows.

Starboard Bottom

20.3 The most striking aspect of the damage was the extreme degree of deformation to the starboard bottom right along the line of the starboard wing tanks. In this area the turn of bilge had disappeared over virtually the whole of the cargo tank length, and the bottom shell appeared to meet the side shell along a knuckle line some 3 to 4 metres above the keel. Over large areas the longitudinal bulkhead plating had protruded through and then been forced flat against the bottom shell.

20.4 In some areas it was possible to observe earlier fore/aft aligned damage which had been overlain by the plating which had been thrust athwartships. The original raking grounding damage which occurred on Thursday 15 February at the outset of the accident was to a large extent obscured by the overwhelming pounding damage incurred over the ensuing six days to Wednesday 21 February and cannot be entirely separated out. However, the initial bottom raking damage ended at a point about 82% of the length of the vessel aft of the forward perpendicular. This is greater than the 60% figure allowed for in the current MARPOL regulations for a vessel of the size of SEA EMPRESS.

20.5 The damage which caused the initial flooding to No 1 Centre tank, is thought to have been along the line of the longitudinal bulkhead as this was the only damage which was found on the starboard side which would have opened No 1 Centre tank to the sea. The source of the initial flooding to the pump room was found at bulkhead 41. Associated with this damage were fore/aft scores in the hull plating along a line about 6 metres off the centre-line. These two damages suggest that the initial raking damage extended inboard from the starboard side to about 6 metres off the vessel's centre-line. This is illustrated in Figure 7 (Image 37k).

20.6 A section of plating some 2 metres square was missing from underneath No 2 Starboard tank while underneath No 3 Starboard tank there were several areas of plating completely detached from their stiffeners and sagging down. There was also an area some 5 metres long by 2 metres wide which had been folded back along the bottom shell leaving a clear opening in the

bottom. The bottom of No 4 Starboard tank had suffered catastrophic damage, the bottom shell structure having been destroyed over almost the entire area of the tank.

Port Bottom

20.7 The turn of bilge over the majority of the parallel mid-body was largely undamaged, apart from the damage to the bilge keel itself. The damage on the port side was concentrated at the ends of the vessel, and usually appeared as discrete indentations. The most notable damage was in way of the pump room.

20.8 The damage to the port side forward of bulkhead 77 was similar to the general pounding damage shown on the starboard side.

Midships Damage

20.9 A massive indentation in the bottom shell structure was present over an area of 10 metres either side of the vessel's fore and aft centre-line. This extended 7 to 10 metres forward from bulkhead 62. The crown of the indentation was some 1.1 metres above the keel while at the crown the bottom plating had fractured along a length of about 17 metres and the faces of the fractured plating were pulled apart by about 150mm and displaced vertically by a further 300mm. The bottom plating in this area is between 18 and 22mm thick. It is thought that this damage occurred as the tide fell on the evening of Monday 19 February when, it is surmised, the vessel must have pivoted about a point somewhere near amidships to achieve the dramatic reduction in her low water draught which the large oil loss at that time indicated.

Pump Room and Slop Tank Damage

20.10 The area of the initial damage to the pump room bottom plating which caused flooding to the pump room was identified just aft and in way of the forward bulkhead 41 on the starboard side. The bottom plating had been pressed upwards with the bulkhead over a length of about 9 metres. In so doing it had split along the base of the bulkhead allowing the ingress of seawater. It is not known to what extent this damage was caused by the initial grounding. However, the damage as inspected is consistent with the limited rate of flooding observed by the salvors and others during Friday and Saturday. The bottom plating on the forward side of bulkhead 41 in way of the slop tank was also pressed upwards, to a greater extent than on the aft side. This split was about 6 metres long, and made the two spaces open to each other and the sea. It is reasonable to suppose that oil escaping from the slop tank was drawn into the pump room via this area of common damage.

20.11 The most notable damage was in way of the pump room on the port side. This damage, which probably occurred on Monday or Tuesday, prevented the pump room from being pumped dry. The damage was less than one frame space away from penetrating the engine room.

20.12 The initial minor damage to the pump room resulted in the atmosphere becoming unsafe when the pump room flooded with seawater and cargo. This meant that lightening operations using the casualty's own cargo pumps could not take place until the pump room had been pumped out and ventilated. This was not achieved until the afternoon of Saturday 17 February. It is arguable that but for this enforced delay to the start of the lightening operation SEA EMPRESS might have been salved on the Saturday without a further loss of cargo. Certainly the lightening tanker was available from 0600 hrs on the Saturday morning.

Damage to Heavy Fuel Oil Tanks

20.13 The first indications of heavy fuel oil pollution came from the remote sensing aircraft whilst the casualty was still in the 'pool'. Prior to refloating it was thought that all the oil had been transferred out of the damaged tank and that the leak had been stemmed. The casualty was not leaking fuel oil on her transit to Herbrandston Jetty. Recognising the potential for pollution from a damaged bunker tank and the amount of bunkers remaining on board, an off-loading vessel was tasked to berth alongside the casualty and remove the majority of her bunkers, thus removing the risk of further pollution. However, during the transfer operation on the morning of 22 February, the casualty's crew began transferring bunkers internally and fuel oil was lost overboard from a tank or piping previously thought to have been undamaged. It was found that both Nos 2 and 4 Fuel Oil tanks on the starboard side were damaged. The damage to No 2 Fuel Oil tank was associated with the damage running along the line of the longitudinal bulkhead (on the port side) aft of frame 43. The damage to No 4 Fuel Oil tank (which is immediately aft of No 2 Fuel Oil tank) was high up on the casualty's side on frame 43. This damage, some 13 metres above the base, was undoubtedly due to contact with the hull made by the tugs during the salvage operation.

Discussion on Double Hull Oil Tankers and Equivalents

20.14 As a consequence of the EXXON VALDEZ accident in 1989, and the unilateral action by the United States

Government in favour of double hull oil tankers, there has been a renewed urgency within the marine industry to find a design of vessel which offers the most effective protection against oil pollution in the event of a collision or grounding accident. Several authoritative studies have been carried out into the problem and there is almost unanimous agreement that no one design produces the best results in all the possible grounding or collision scenarios which can be envisaged. There is also general agreement on the following broad conclusions, namely that:

- double hull vessels in low energy (typically low velocity) accidents should not pollute;

- vessels which carry cargo in contact with a single skin (with sea on the other side) will cause some pollution in any accident where a cargo tank is penetrated. However, certain design alternatives will minimize the amount of pollution in some specified scenarios;

- high energy accidents nearly always result in pollution. The relative advantages of various design alternatives in reducing pollution from particular scenarios are highly dependent on the assumptions made in the scenarios.

20.15 There are many design concepts which have been proposed to reduce the risk of pollution in the event of an accident. International attention is increasingly focused on three main types: the Double Hull tanker, the Mid-deck tanker and the Coulombi Egg tanker. A typical cross-section for each of these types is shown in Figure 8 (Image 37k), but to date only the double hull tanker type has actually been constructed.

20.16 One of the original objectives in examining the damage to SEA EMPRESS was to provide data for a subsequent computer analysis to determine how the structure of a double hull tanker (or equivalent) would have withstood similar loads. However, the damage to SEA EMPRESS was found to be both extreme and complex and it was concluded that it was not possible to accurately derive the loading regime which might have caused the observed damage. The plan to carry out a computer analysis of alternative tanker structures was therefore abandoned. Nevertheless a number of scenarios have been selected and utilising the detailed information gained from the inspection of SEA EMPRESS and other areas of the inquiry an assessment, based solely on engineering judgement, has been made to determine how tankers of different structural configuration would have responded to the loadings encountered by SEA EMPRESS.

20.17 To include within this Report the full details of the various scenarios examined is not appropriate, however the findings are given below. The scenarios cover an initial grounding followed by anchoring in the 'pool' (in the same way as SEA EMPRESS) and a further grounding on the shoals off Saint Ann's Head (in the same location as SEA EMPRESS on the Saturday evening). All scenarios envisage tankers of an equivalent size to SEA EMPRESS.

The Double Hull Tanker

20.18 This type of vessel derives its defence against oil spillage, in the event of grounding or collision, by surrounding the entire cargo tank length by a 2 or 3 metre wide void space which separates the cargo tanks from the outer skin of the vessel. In order for an oil spillage to occur the damage has to rupture two skins. In the first scenario with a vessel of this construction, the initial grounding would only rupture the outer skin and there would not be any leakage of cargo. However as the double skin does not encase the pump room that space would be lightly damaged allowing flooding from the sea, however without any oil entering it. The total of this damage would result in an increase in draught which prevents the vessel from proceeding to her berth. It is probable in these circumstances, because the pump room atmosphere is safe, that the flooding is quickly brought under control and the lightening operation (for which a tanker was available from about 0600 hrs on the Saturday morning) is concluded on the Saturday. The casualty is then taken in to the safety of the Herbrandston Jetty during the evening of the Saturday thus avoiding the need to turn the casualty into the weather. The vessel is thus salvaged without any loss of oil. The probability of this outcome would be increased if the pump room were fitted with a double bottom and consequently did not flood initially.

20.19 In the second scenario it is assumed that, for some reason, it is decided to turn the vessel before beginning the lightening operation, that the vessel is turned and anchored in the same location as SEA EMPRESS on the Saturday evening. Then, like SEA EMPRESS, she would certainly be carried onto the shoals off Saint Ann's Head. In these circumstances it is likely that three cargo tanks would be breached with the loss of some 12,000 tonnes of oil. However, in contrast to SEA EMPRESS she could not be salvaged from this location without a prolonged lightening operation, the outcome of which cannot be predicted, but certainly further substantial oil losses would be a real possibility.

The Mid-deck Tanker

20.20 This type of vessel derives its defence against oil spillage, in the event of collision, by protecting the sides along the entire cargo tank length by a 4 to 5 metres wide void space which separates the cargo tanks from the outer side skin of the

vessel. The underside of the cargo tank region is unprotected and the cargo is in direct contact with the bottom shell. However, the cargo tanks are split horizontally by an oil-tight deck. The height of the oil-tight horizontal deck is chosen so that in the event of bottom damage the external water pressure should exceed the head of oil in the lower cargo tanks thus forcing the oil to be retained within the vessel. In the first scenario with a vessel of this construction the initial grounding would rupture the void space along the starboard side, at least Nos 1 and 6 Lower Cargo tanks and the pump room. There would be an increase in the draught which prevents the vessel from proceeding to her berth and there would be some oil released. It is possible that the draught of the vessel could be reduced sufficiently, as a result of pressurising the void spaces, to allow the casualty to be taken to the safety of the Herbrandston Jetty. Thus the casualty is salvaged with a minimal loss of oil. Published research data suggests that the total oil loss would have been of the order of 100 to 200 tonnes.

20.21 In the second scenario it is assumed that, for some reason, it is decided to turn the vessel before beginning the pressurising of the void space, that the vessel is turned and anchored in the same location as SEA EMPRESS on the Saturday evening. Then, like SEA EMPRESS, she would certainly be carried onto the shoals off Saint Ann's Head and by the Tuesday would be stranded there. Oil losses up to this time would increase to some 1,000 to 2,000 tonnes. In contrast to SEA EMPRESS, she could not be salvaged from this location without a prolonged lightening operation, the outcome of which cannot be predicted, but certainly further substantial oil losses would be a real possibility.

The Coulombi Egg Tanker design

20.22 At first sight this configuration appears to be a variant of the mid-deck tanker but it differs in three important respects from that type. Firstly the width of the wing tanks is about 50% greater, secondly the wing tanks are divided horizontally into upper and lower tanks with the lower wing tanks dedicated to cargo, and thirdly the upper wing tanks are not only dedicated segregated ballast tanks but also perform the function of "rescue tanks". The Coulombi Egg tanker has an emergency cargo transfer system which allows oil from damaged cargo tanks to be directed into the sound empty upper wing tanks, thus minimising the oil lost to the sea in the event of a collision or grounding. The system utilises the fact that the external pressure from the sea due to the vessel's laden draught will be greater than that due to the head of oil in the damaged cargo tanks, thus the oil in the damaged cargo tanks will be forced into the "rescue tanks". There is only a single skin underneath the pump room. As with the mid-deck tanker no vessel of this type has yet been built but the concept of the "rescue tanks" has been shown to work in model tests.

20.23 In the scenario with a vessel of this construction comparison with the damage found on SEA EMPRESS suggests that the initial contact would rupture the bottoms of the starboard lower wing cargo tanks, Nos 1 and4 Centre Lower Cargo tanks and the pump room. The immediate effect is that the damaged lower tanks would be pressed full as water floods in below the oil and forces it up into the ullage spaces and access trunks. There would be no loss of oil due to hydrostatic effects, but a small loss of oil could be expected due to the forward motion of the ship through the water. The draught of the vessel is increased slightly and there is a small angle of list to starboard due to the small quantity of water which has entered the tanks and due to the flooding of the pump room. In these circumstances it would be possible to proceed directly to Herbrandston Jetty and the salvage operation would be largely circumvented. Published research data suggests that the total oil loss would be of the order of 1,000 tonnes.

Regulations for the Reduction of Oil Pollution from Crude Oil Tankers Following Grounding Accidents

20.24 SEA EMPRESS was required to be designed and built to comply with Annex 1 of MARPOL 73/78 which came into force in October 1983. By these regulations she was required to have segregated ballast tanks arranged to minimise oil outflow and the subsequent pollution resulting from a collision or grounding. The protective area can be placed either in the sides or the bottom of the vessel. These were the standards to which SEA EMPRESS was completed in 1993. Her protective area was concentrated in the sides, against the expectation of collision, in Nos 2 and 4 Port and Starboard Ballast tanks. It is of interest to note that BORGA, which grounded off Milford Haven in October 1995, was designed to the same standard, although in her case the designers elected to obtain the required protective area by fitting a double bottom.

20.25 The fitting of protective areas clearly reduces the risk of damage to the protected cargo tanks. However, one drawback to this mode of pollution avoidance is that in the case where the empty protective segregated ballast tank is ruptured, a significant increase in the draught of the vessel can be expected, accompanied possibly by a large angle of list. This was a critical factor in the SEA EMPRESS accident. It illustrates that in some circumstances the protection of cargo tanks by large void spaces can impede the entry of a casualty to a safe refuge and thus adversely affect the salvage operation.

20.26 The US National Transportation Safety Board in its report on the grounding of EXXON VALDEZ concluded: "....*if the EXXON VALDEZ had been fitted with a double bottom, the oil outflow would have been significantly reduced, if not, eliminated*." Since double bottoms offer no protection against collisions the double hull was identified as offering the best

overall protection against both grounding and collision. In August 1990, as a consequence of that accident, the USA brought into force the Oil Pollution Act of 1990 (OPA90). The most significant requirement of the Act is that new tankers entering the waters of the USA have to be of double hull construction. It also requires that existing tankers, at a date dependent upon their age, have to be retrofitted to double hull standard or removed from service. This effectively means that all single hulled tankers will be excluded from US waters after 1 January 2010 and existing double bottom or double side tankers by 2015. (An exemption from the double hull requirement until 2015 is made in favour of vessels delivering to a lightening operation and/or servicing the Louisiana Offshore Oil Port.)

20.27 In 1992, following the introduction by the USA of OPA90, Annex 1 of MARPOL 73/78 was substantially revised. The amendments came into force in July 1993 and the major amendment was that every new oil tanker of over 5,000 dwt to be of double hull or mid-deck construction or to be of a design approved by the IMO as offering an equivalent level of protection against oil pollution. All existing oil tankers of a size covered by these regulations must comply with the amended provisions no later than 30 years after their date of delivery. This effectively means that by the year 2026 (at the latest) all tankers will comply.

20.28 The MARPOL requirements for double hull tankers, or their equivalent, were enacted in their entirety in the UK Merchant Shipping legislation by Statutory Instrument 1993 No 1680 The Merchant Shipping (Prevention of Oil Pollution) (Amendment) Regulations1993. Thus, like the USA, the UK is also committed to the requirement that all new oil tankers of over 5,000 dwt should be of double hull construction. However the USA requires that existing tankers shall comply by the year 2015 at the latest whereas the UK and IMO require compliance by 2026.

20.29 OPA90 also requires tanker owners/managers to produce an oil spill emergency response plan, which has to be approved by the United States Coast Guard before the tanker can operate in US waters. One requirement of this, which is recorded in the Code of Federal Regulations is: "Owners and operators of oil tankers and offshore oil barges shall ensure by no later than January 21, 1995, that their vessels have pre-arranged, prompt access to computerised, shore-based damage stability and residual structural strength calculation programs". The managers of SEA EMPRESS had a contract with Lloyd's Register of Shipping, Ship Emergency Response Service (SERS) for this support. This support was therefore available during the SEA EMPRESS accident.

Conclusions

20.30 The SEA EMPRESS accident has highlighted only too clearly some of the fundamental problems which have to be overcome in the design of oil tankers if the risk of oil pollution following grounding damage is to be minimised. However, it has also produced an abundance of information to assist with the development of measures to significantly reduce the risk of oil pollution in similar accidents.

20.31 An analysis of the grounding damage and an exploration of alternative scenarios leads to the following broad findings:

- the easier it is to salvage a casualty the more the risk of further pollution is reduced;

- in coastal waters (where most groundings can be expected to occur) large increases in draught and list following a grounding accident adversely affect the ease with which a casualty can be salved;

- if, because of a large increase in draught, a lightening operation is required in order to salve the casualty it is imperative that the casualty's own cargo pumping system is operable;

- large increases in draught, following grounding accidents, are associated with the rupture of the protective void spaces around the cargo tanks;

- recovering the buoyancy of damaged ballast tanks through pressurisation is more easily accomplished if the ballast tanks are not contaminated with significant quantities of cargo;

- large increases in draught, following grounding accidents, can be avoided by having the tanks adjacent to the bottom skin full of cargo or ballast;

- little oil is lost from breached cargo tanks where the cargo "head" is less than the external positive pressure due to the vessel's draught;

- conversely, massive oil losses can occur if the external pressure due to the casualty's draught falls below that of the cargo "head", as would occur if the casualty were stranded over a low water period;

- of the three generic types of tanker examined only the double hull type has actually been constructed;

- of the three generic types of tanker examined the Coulombi Egg appeared to give the highest probability of avoiding oil losses in excess of 1000 tonnes in a repeat of the SEA EMPRESS accident;

- of the three generic types examined the double hull tanker was the only one offering the chance of zero oil loss in a repeat of the SEA EMPRESS accident;

- the fitting of a double bottom to a pump room would protect the space against flooding and gassing, in the event of a grounding, and have the potential for making a salvage operation easier.

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comments

on this site.

ANNEX A

MARINE SALVAGE

General

A.1 Over the last three decades there has been a decline in the world's salvage capacity, especially in Northern Europe and the United Kingdom. This is due to a number of factors but primarily because it is perceived by those who invest in the industry that the financial returns fail to justify the capital outlay. The era when salvage tugs were maintained on station at strategic locations on the world's shipping routes in anticipation of a casualty occurring, has all but disappeared, due to escalating costs and poor returns.

A.2 The modern international salvor must have available an extensive range of vessels and equipment in order to handle diverse eventualities and, more importantly, must employ highly trained, experienced and motivated personnel to undertake salvage operations. Whilst there still remains a niche for the smaller salvage companies, because of the nature of the business, when they are in competition with the larger organisations they may not be so successful.

A.3 No company has ever remained viable on the proceeds of salvage alone. Traditionally salvors have undertaken activities such as ocean towage, the provision of harbour tugs and the undertaking of specialised heavy lifts in order to maintain their equipment and manpower for salvage operations. With the advent of the offshore industry some companies, especially those in Northern Europe, diversified into this field where they could obtain better long term returns on their capital and steady employment for their personnel.

A.4 Whilst there are some who have the opinion that the mere provision of a tug and other equipment is adequate for salvage services, it is the provision of experienced, knowledgeable and skilled personnel that is the essential element of the salvage industry. Without adequately trained and experienced manpower the commercial salvor is all but powerless to act. Today, very few operations are conducted solely using in-house resources, even the large international companies now sub-contract elements of a salvage. Given the changing pattern of the industry, salvors increasingly find it convenient and expedient to form consortia with other operators for specific operations in order to speedily fulfil their obligations; thus helping not only themselves but also some of the smaller companies.

A.5 Against this background of decline there has been a growth in public awareness of environmental matters and increasing demands for instant action, especially with respect to marine casualties which pose the threat of pollution. In an era when marine casualties rarely attracted attention outside the world of maritime affairs the salvor worked in relative isolation with only an Underwriters' surveyor and possibly a Harbour Master to satisfy, and his problems were primarily confined to the physical aspects of the salvage operation. Now the salvor works in the searchlight of publicity where environmental matters, especially those relating to the highly visible aspects of marine pollution, have become a mainstream political issue which has greatly increased the demands on the Salvage Master.

A.6 The Salvage Master must endeavour to satisfy the requirements of all interested parties. He must use his judgement in heeding or rejecting advice, much of which is unsolicited, whilst remaining aware that he is accountable for undertaking the task for which he is contracted. The Salvage Master is the key person in any salvage operation and is in overall charge of that operation while the salvors are custodians of the casualty. The Master, however, remains in overall command of his vessel notwithstanding the signature of a salvage agreement, and has ultimate power to dismiss the salvor, although this power is rarely exercised. The owner and his employees are required by Clause 3 of the LOF contract to co-operate fully with the salvors in relation to the salvage operation. There is, by implication, a reciprocal obligation on the salvors to co-operate with the owner and his staff. The success of the operation depends to a very large extent on the Salvage Master's ability to act decisively in what can be a rapidly changing and often dangerous situation. It is his knowledge, experience and skill which determine the conduct of the operation through all the phases of planning and implementation. Salvage is a risk business in which every operation is different and the Salvage Master not only has to cope constantly with commercial, bureaucratic and environmental pressures, but he must always be alert to the dangers of the operation. Salvage is an extremely physical occupation in which there are different levels of danger and it is the responsibility of the Salvage Master to determine to what degree of danger he and his team are prepared to be exposed. For example, in the case of a badly damaged tanker where some

of the built-in safety systems may have been severely damaged or destroyed, particularly one with a cargo of crude oil, whilst the emotive pressures of the potential environmental damage and public disquiet are of concern, the paramount responsibility of the Salvage Master is for the safety of his own team and those on board who are working under difficult conditions in a high risk situation.

A.7 Marine salvage is a commercial enterprise subject to all the vagaries of the open market. The salvor's sole role is to provide the Owner of a casualty and his Underwriters with a service, within strict contractual terms, to the best of its ability in order to save the vessel and cargo. Recently this undertaking has been extended to the Owner's third party insurers to minimise or, where possible, prevent pollution. The salvor is under no obligation to accept a contract; gives no guarantee of success; nor is constrained by time, but undertakes to use his best endeavours to resolve a problem which is usually beyond the Owner's own capability. He undertakes the contract in the knowledge that if, after the event, he cannot come to an amicable settlement with the Owner/Underwriters the matter will be referred to Arbitration, overseen by an Arbitrator appointed by the Council of Lloyd's of London and governed by the law of England, including the English Law of Salvage. After an extremely close scrutiny of the salvor's actions the Arbitrator will make an Award for the services rendered, based upon the following ten points, set out in Article 13 of the International Convention on Salvage 1989, which indicate the salvor's aims and objectives:

- the salved value of the vessel and other property;
- the skill and efforts of the salvor in preventing or minimising damage to the environment;
- the measure of success obtained by the salvor;
- the nature and degree of danger;
- the skill and efforts of the salvor in salving the vessel, other property and life;
- the time used and expenses and losses incurred by the salvor;
- the risk of liability and other risks run by the salvor or their equipment;
- the promptness of the services rendered;
- the availability and use of vessels or other equipment intended for salvage operations;
- the state of readiness and efficiency of the salvor's equipment and the value thereof.

A.8 A salvage reward assessed under LOF95, or indeed by a court of competent jurisdiction such as the Admiralty Court in London, is usually expressed as a lump sum payable to the salvor, or separate sums to each salvor if there are more than one. It is not a percentage of the value of vessel and cargo as salved, but it cannot exceed those values. Where however, the vessel and/or her cargo threatens damage to the environment and the reward so assessed is insufficient to cover the salvor's expenses, the Special Compensation payable in accordance with the 1989 Salvage Convention (now incorporated into LOF95) will cover the shortfall, together, in appropriate cases with a "bonus" at the tribunal's discretion of up to 100% of those expenses if the salvors have in fact prevented or minimised environmental damage. It is by this mechanism that salvors are encouraged to act promptly and to use their best efforts to avert environmental damage.

The Contractual Agreement of Salvage Operations

A.9 The "Lloyd's Standard Form of Salvage Agreement" (LOF) has been the most frequently used and internationally accepted form of 'no cure, no pay' salvage agreement since it was first introduced in 1882. Since its inception the agreement has undergone a number of revisions in order to encompass the needs of the salvage industry and more especially the requirement to protect the environment from the results of marine casualties.

A.10 The LOF80 version of the agreement included one of the most significant developments in the law of salvage in that, for the first time, there was a departure from the traditional 'no cure, no pay' reward for the salvor's services in that it introduced, in certain circumstances, a safety net concept. This guaranteed a salvor, who responded to a pollution threat from a laden tanker casualty, his expenses plus a possible discretionary increment of up to 15% of those expenses, irrespective of whether his endeavours were successful or not. However LOF80 was solely confined to laden tankers and did not take account of the threat of pollution from other types of vessels, or indeed cargoes.

A.11 This anomaly was addressed in the International Convention on Salvage, developed by the International Maritime

Organization (IMO) and adopted at a Diplomatic Conference in London in 1989, in which the importance of the salvor's role in preventing pollution from marine casualties was recognised. Also recognised was the need to recompense salvors with a special incentive when there was a threat of pollution occurring, even in those cases where there was little or no prospect of a satisfactory 'no cure - no pay' salvage award. The Convention therefore created a new concept of "Special Compensation" by which salvors can be encouraged to attend or continue an operation which has serious environmental consequences, but which would otherwise be unprofitable. This Convention was incorporated by Lloyd's into the 1990 edition of LOF, and therefore became immediately effective, although the ratification by 15 states necessary for entry into force of the Convention as International Law was not achieved until 1995.

A.12 The incorporation of the principal articles of the 1989 Salvage Convention, including the Special Compensation provisions, into LOF90 gave it immediate effect in those salvage services governed by that contract. In reality this applied to the majority of salvage services. However, the Government took the initiative of adopting the entire Salvage Convention as part of English Law from 1 January 1995 by the Merchant Shipping (Pollution and Salvage) Act 1994, despite the fact that the Convention itself did not come into force internationally until 14 July 1996. The Corporation of Lloyd's published a revised version of LOF to reflect these developments known as LOF95, and it is this form which was signed by the owners and salvors of SEA EMPRESS.

Tanker Salvage Operations

A.13 It is acknowledged that all salvage operations are different. A variety of procedures might be carried out and the following is an outline of some of those which might be used during a tanker salvage operation. Not all of these were necessarily employed during the salvage of SEA EMPRESS.

A.14 A tanker with hull damage, where her cargo tanks have been ruptured, is likely to require a cargo transfer either to lighten the casualty, so she can be moved for total discharge at a terminal, or a much longer operation to completely discharge the cargo on location. Such operations may require salvage tugs and, on some occasions, additional ground anchoring arrangements to hold the casualty in position.

A.15 The damaged tanker is likely to develop an increased draught, list and excessive trim, which may require some correction before the casualty can continue on passage and be accepted in a safe port. In order to lighten a damaged tanker, to reduce her draught, the salvors carry out a "ship-to-ship cargo transfer" operation. If possible, the tanker's own high capacity cargo pumps would be used to transfer cargo from the intact tanks by way of hoses to a lightening vessel berthed alongside the casualty.

A.16 When cargo tanks have been breached in a grounding, depending on the level of the oil in the tanks, either oil will escape to the sea or sea water will enter the damage creating a water plug beneath the oil. As the draught lessens during the ship-to-ship transfer operation, the level of the oil in the breached tanks would fall as well. If this was allowed to happen either more oil would escape or the water plug would be lost through the damaged hull until eventually oil would also be lost to the sea. To prevent this happening, the salvors endeavour to either create or maintain the water plug in the damaged tanks, by lowering hydraulically driven submersible pumps into the oil and transfer cargo into the intact tanks which are being discharged to the lightening vessel. This practice is known as "over-the-top transfer". The lightening operation can therefore only proceed at the capacity of the hydraulic pumps, rather than the higher capacity of the casualty's own pumps.

A.17 When salvors pump cargo over-the-top out of damaged tanks, the oil is replaced through the damage by sea water, creating an ever increasing water plug. Thus the vessel's trim and list would remain approximately the same in the damaged condition. Another salvage method, in order to create extra buoyancy and to help bring the casualty upright and on an even keel, is to pressurise breached ballast tanks so as to push sea water out through the bottom damage. If oil enters breached ballast tanks the presence of oil floating on top of the sea water is likely to cause an explosive atmosphere within the ullage space in the tank. During pressurisation of the ullage space, it would be desirable to use inert gas, rather than air, to render it safe. However the normal tanker's inert gas system is not capable of producing inert gas to the desired pressure and is not designed to supply the ballast tanks. To overcome this, salvors use an empty cargo or ballast tank on board as a buffer tank the atmosphere of which they render inert from portable inert gas generators. From the buffer tank, a portable compressor takes the inert gas and transfers it to the ballast tank under pressure in order to push the sea water out through the damaged hull. To maintain the pressure, the ballast tank's air vents would have to be secured by blanks, which would have to be specially manufactured.

A.18 Ship-to-ship and over-the-top cargo transfer operations, combined with pressurisation of tanks, was the basis of the Salvage Master's plan for the salving of SEA EMPRESS.

A.19 It cannot be emphasised enough that the risk of fire and explosion are ever-present dangers in tanker salvage operations.

The salvage team will always have to consider the need to cease their operations and evacuate the casualty if these dangers appear to be increasing.

Salvage Consortium

A.20 It is not unusual for a consortium to be formed to undertake a particular salvage operation. Such was the case in the SEA EMPRESS incident. The selected salvage consortium was made up of Smit Tak BV, Cory Towage Limited, and Klyne Tugs (Lowestoft) Limited.

A.21 Smit Tak is part of Smit International Group of companies who have been in the salvage business over 150 years and are world renowned. It has undertaken over 117 tanker salvage operations resulting in the salvage of 10.5 million tonnes of cargo. Most of its salvage operations are performed under LOF.

A.22 Cory Towage Limited was founded in 1872. It operates a large fleet of tugs throughout the UK, including Milford Haven, and other parts of the world. As well as providing towage within ports it is also a specialist in fire fighting, pollution control and salvage. It has carried out a number of salvage services over the years and was involved with Smit Tak in the salvage of BORGA at Milford Haven in 1995.

A.23 Klyne Tugs (Lowestoft) Limited is a relatively new salvage company based in Lowestoft. It has a working commercial salvage arrangement with Smit Tak and its two largest salvage tugs were involved with the salvage of SEA EMPRESS. It was also involved with Smit Tak in the salvage of BORGA.

ANNEX B

GOVERNMENT ROLE IN MARINE EMERGENCIES

B.1 The Government's responsibility for dealing with major civilian marine emergencies is discharged through the Department of Transport and The Coastguard Agency. Within that Agency HM Coastguard has responsibility for maritime search and rescue, and the MPCU exercises the Government's response to spillages of oil and other hazardous substances at sea from vessels which threaten UK interests. Since 1994/95 The Coastguard Agency has been responsible for the two emergency tugs, stationed in the Dover Straits and at Stornoway, as a trial during winter months. Since the SEA EMPRESS incident a further emergency tug has been stationed in the South Western Approaches. These provide cover when vessels pose a threat to the UK coastline and are a direct result of one of Lord Donaldson's recommendations from his Inquiry into the Prevention of Pollution from Merchant Shipping after the BRAER tanker incident in 1993.

B.2 MPCU is a small command, control and rapid response organisation which was formed in 1978 in the aftermath of a number of accidents which threatened the UK coast with major oil pollution. The Unit, based in Southampton, maintains a National Contingency Plan and stockpiles of both beach and at-sea clean-up equipment. With the decline of the UK's own salvage industry MPCU has also built up a national stockpile of cargo transfer equipment which it maintains, coincidentally in Milford Haven, in a state of readiness to ensure that sufficient equipment is available within the UK at short notice to carry out a major ship-to-ship cargo transfer operation. The unit also provides advice and assistance to local and port authorities on their contingency planning. Regular exercises are arranged to practise both central government and local response to major pollution incidents. A two-day major exercise involving all members of MPCU and their principal contractors had been completed on the day that SEA EMPRESS first went aground. Additionally MPCU provides funding for research programmes relating to both at-sea and on-shore clean up and disseminates the results to interested parties.

B.3 In fulfilling its primary roles MPCU works closely with government departments, government agencies and other organisations.

B.4 The response to a major civilian marine emergency is co-ordinated through the Marine Emergency Operations Room (MEOR) which is situated within The Coastguard Agency headquarters building in Southampton. During a major marine emergency the MEOR will be manned by, among others, an Overall Commander, usually the Chief Executive of The Coastguard Agency, who will co-ordinate the efforts of HM Coastguard, MPCU and other organisations involved in dealing with the emergency. In the case of an emergency involving at-sea pollution MPCU will be represented on scene by a MPCU Local Commander and beneath him an On-Scene Commander. In the SEA EMPRESS incident it was necessary to set up the following additional posts: On-Scene Commander Air, On-Scene Commander Oil Recovery Ships, On-Scene Commander Transfer Operations and On-Scene Commander Equipment. Additionally a Land Co-ordinator will be responsible, under the Overall Commander, for the co-ordination of the central/local government shoreline counter pollution response. The title

"Commander" as used by MPCU refers to command of MPCU assets and not to command of the operation as a whole. A potential for confusion arises from the use of these titles.

B.5 It is not the intention of the Government to become involved in the practical aspects of salvage. It is the policy to ensure that professional salvors are engaged by the owners or Master. Thereafter the actions of MPCU might be limited and involve no more than monitoring the actions of those in charge of the vessel to satisfy itself that the wider public and environmental interests are being safeguarded. However, at the other extreme, MPCU could assume a central role, including issuing directions or taking charge of operations. The Secretary of State for Transport has considerable powers to intervene and direct those in possession of a vessel where there is a risk of large scale pollution. These powers can be exercised by the Chief Executive of The Coastguard Agency, the Director of MPCU or the Chief Coastguard.

B.6 MPCU personnel are not, in themselves, salvage experts. In order to perform the required role in a salvage incident the organisation looks mainly to the Ministry of Defence Salvage and Moorings Department for salvage expertise and advice. The Coastguard Agency have sought a formal agreement in the form of a Memorandum of Understanding (MOU) with the Ministry of Defence Salvage and Mooring Department for the provision of salvage advice and assistance. This MOU was in the latter stages of negotiation at the time of the SEA EMPRESS incident. Although not finally agreed the draft MOU was used as the basis for their involvement as advisers to MPCU during the incident.

B.7 In short, the Department of Transport's role in the SEA EMPRESS salvage and pollution incident was:

- to provide search and rescue services to protect safety of life;

- to ensure that competent salvors were quickly appointed and thereafter to monitor the salvage operation with a view to intervening if necessary to protect the wider public or environmental interest;

- to control the at-sea counter pollution measures;

- to assist the local authorities in the on-shore counter-pollution measures through a Joint Response Centre.

ANNEX C

TUGS AND THEIR HIRING

General

C.1 The availability and provision of tugs played a major role throughout the salvage operation, it is therefore helpful to give some general information on tugs.

C.2 Tugs are specialist vessels invariably designed and constructed individually or in limited numbers. The characteristics of the hull form, engine power and equipment of each vessel or class of vessel are dictated by the particular function for which the tug is to be used, and the environment in which it will be employed. Due to the numerous combinations of hull form and engine power it is extremely difficult to determine the exact power of any given tug. Whilst there are a number of empirical methods used to determine tug performance, one which has been standard for some years relates to the tug's continuous static bollard pull. This is a dynamometer reading, measured in tonnes, of the load on the tow line when the tug is pulling at full power against a static load and is commonly expressed as "tonnes bollard pull" (tbp). However, because this test is undertaken in calm conditions, usually in harbour, it is not a true measure of the power exerted in constantly changing operational conditions and must therefore be considered only as a quantitative indication of the tug's towing capabilities.

C.3 In order to apply her full power when towing out at sea, a tug must deploy as long a length of her tow line as possible to create a catenary so that it sags in the water. This enables the line to withstand the dynamic loads (snatching) imposed upon it when the tug and tow are moving in a seaway and prevents the line parting. Tugs employed in ocean and coastal towing activities usually use wire tow lines. Tugs employed within harbours usually use either solely synthetic ropes (such as the Milford Haven harbour tugs) or a combination of rope lines and wire pennants, which are much shorter than the above wires. These are easier to manhandle and as most harbours are not exposed to seaways they do not experience snatching.

C.4 Whilst the design parameters of individual tugs will differ, with some being able to fulfil more than one role, they can be categorised broadly into three types dependent upon their function. These are ocean towing salvage tugs, anchor handling/tug/supply vessels (AHTS) and harbour/coastal tugs. Brief characteristics of each type follow.

Ocean Going Salvage Tugs

C.5 This type of tug, equipped with salvage gear for ocean rescue or to be employed in long haul tows, is designed to work in the severe conditions of the ocean environment. One of the essential features is the engine power which, in addition to providing a fast free running speed, has the power and reliability to tow extremely large vessels long distances, sometimes in appalling weather conditions. The hull form characteristics of long length, deep draught and broad beam provide the tug with high lateral resistance which is ideal in maintaining direction and steerage way in ocean conditions, but reduces the ability to manoeuvre in close quarter situations. In addition, its relatively deep draught makes it highly unsuitable for working in shallow water. Another feature is the towing equipment, which having to be compatible with the high engine power, is heavy and cumbersome making connection to a casualty difficult and lengthy. Also, because of the tug's potential power, the connection on board the casualty has to be compatible and able to withstand the forces involved in the towing operation.

Anchor Handling/Tug/Supply Vessels (AHTS)

C.6 This type of tug has evolved from the design of specialised vessels employed in the offshore oil and gas industry and, whilst capable of fulfilling a multi-purpose role including towing, is also used for the deployment and recovery of anchors during mooring operations of mobile rigs in the offshore industry. The principal characteristics of this design are its engine power, thruster(s) for maintaining position, manoeuvrability and the towing arrangements being directly from a winch. Many AHTSs now have an engine power/bollard pull comparable with that of the large ocean going salvage tugs.

Harbour/Coastal Tugs

C.7 The harbour/coastal tug, whilst capable of undertaking short haul coastal towage, is principally designed and employed to assist in manoeuvring and berthing vessels within the confines of a harbour. There are numerous designs and different means of propulsion for this type of tug, ranging from the conventional open screw single plate rudder type to the omni-directional water tractor concept. However the prime characteristics are a satisfactory degree of engine power for the intended purpose, a good free running speed, coupled with a very high degree of manoeuvrability and the means of rapid connection. Whilst the general purpose tug is capable of pushing by the bow, the towing mode is principally from astern. The advent of large tankers has introduced the purpose built berthing tug which almost exclusively pushes/pulls by the bow. The truly omni-directional tug has almost equal power both ahead and astern.

Hiring of Tugs

C.8 The hiring of tugs is in principle no different from that of hiring any other type of vessel, other than in an emergency situation when there is usually a greater degree of urgency. In such situations clearly the LOF is the most expedient method of securing tugs' services. There are other arrangements used to sub-charter tugs within an existing agreement, but as with all negotiations these can take time, as the tug owner requires to know what is expected of his vessel, the work it is to perform, where it is to take place and the financial terms on which the tug is to be engaged.

C.9 Tugs for hire are described as 'prompt/available', however this is with the unwritten caveat 'subject to satisfactory negotiated terms'. Standardised contracts greatly assist in a rapid conclusion of an agreement and are an element of the matter to be considered, especially when time is an important factor. Once satisfactory terms have been agreed in principle, whilst there may be operational delays such as obtaining port clearance, it is reasonable to expect that the tug will be on its way within two hours. Indeed this is not an unusual contractual term, which if the tug owner fails to comply with could cause a breach of contract and even its cancellation.

C.10 The "Towhire" Agreement is a standardised contract whereby, in principle, the tug owner waives his right to salvage in return for a negotiated daily rate, usually based on a basic minimum of days for which the tug will be employed. In essence, by entering into a "Towhire" Agreement, the tug is contracted to work as directed by the salvor.

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Figure 1.

SEA EMPRESS
General Arrangement and Tank Layout

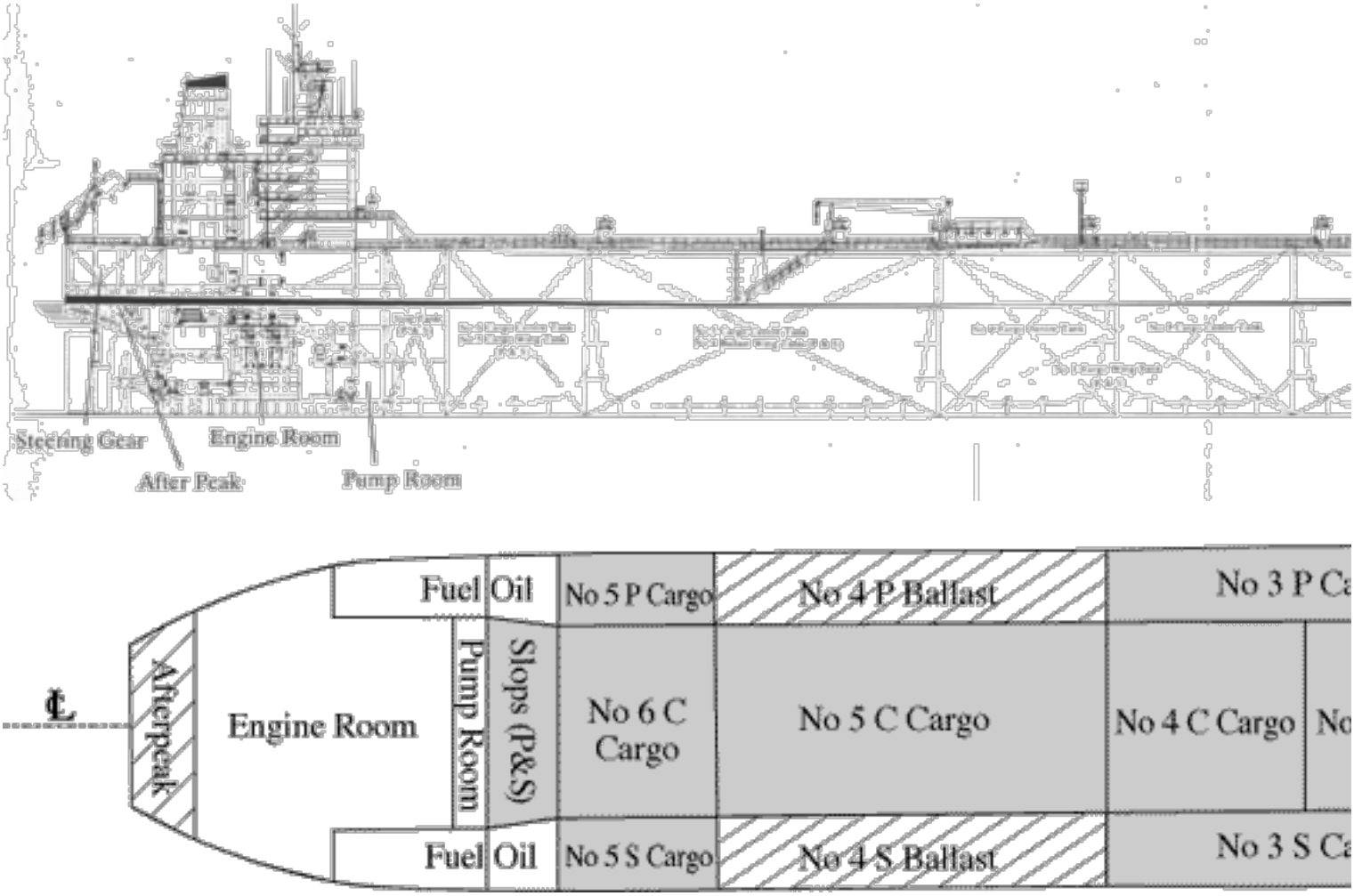

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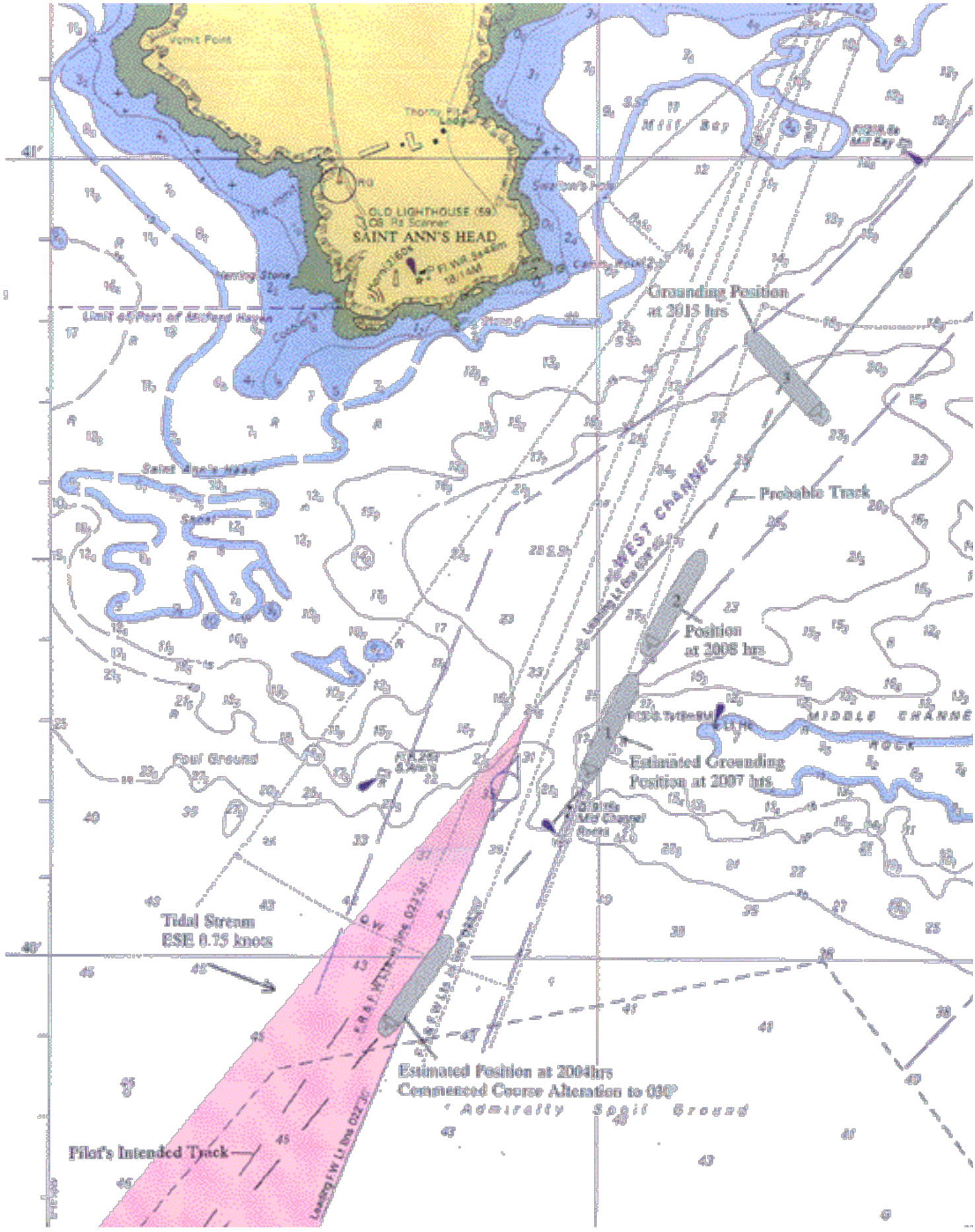
Figure 2.

Positions of the SEA EMPRESS on Thursday 15 Febuary



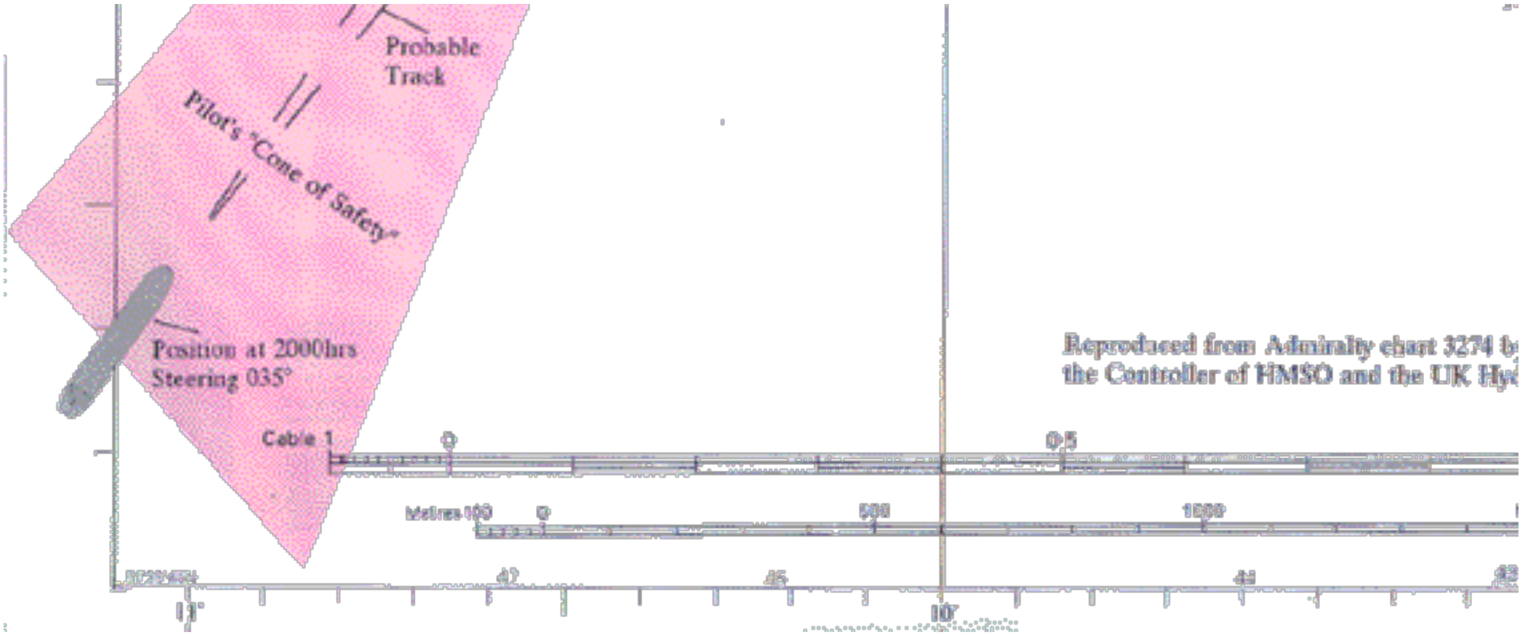

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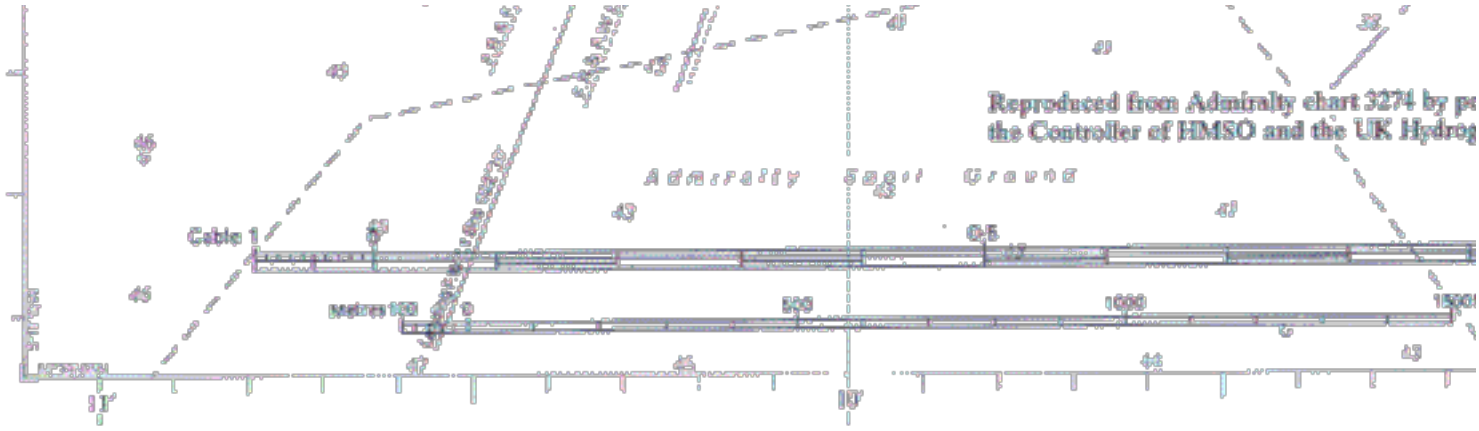
Figure 3.

Positions of the SEA EMPRESS on Saturday 17 Febuary to Sunday 18 February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Admiralty Sand Ground
Cable 1
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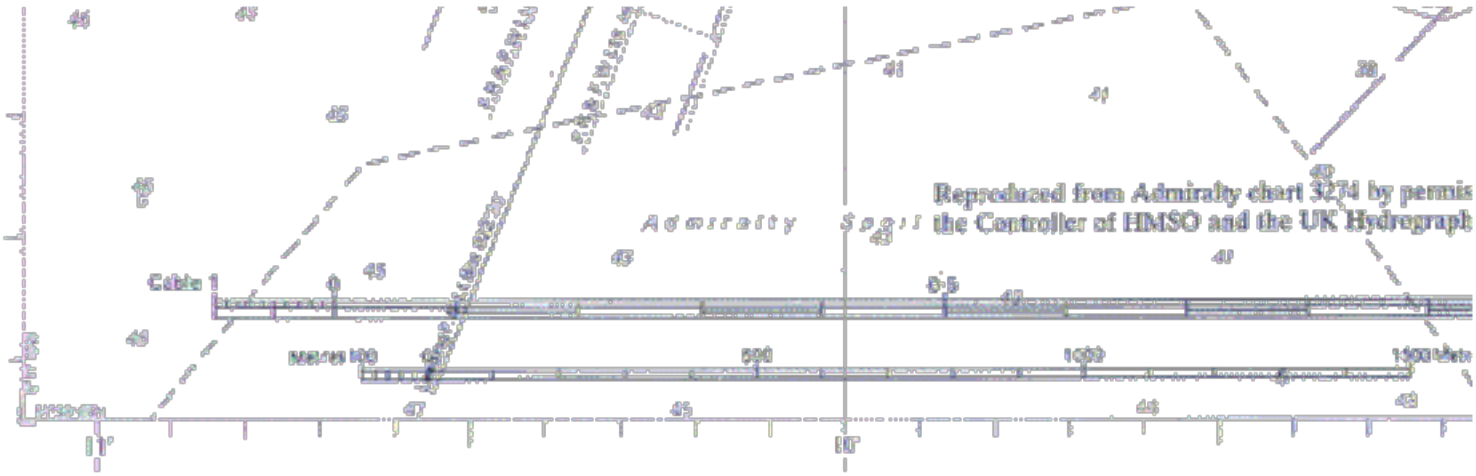
Figure 4.

Positions of the SEA EMPRESS on Sunday 18 Febuary to Final Floating on Wednesday 21 February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the Controller of HMSO and the UK Hydrograph
Admiralty Spoil
Cable 1
Metres 100
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comments

Figure 5.

The Entrance to Milford Haven and the Pool

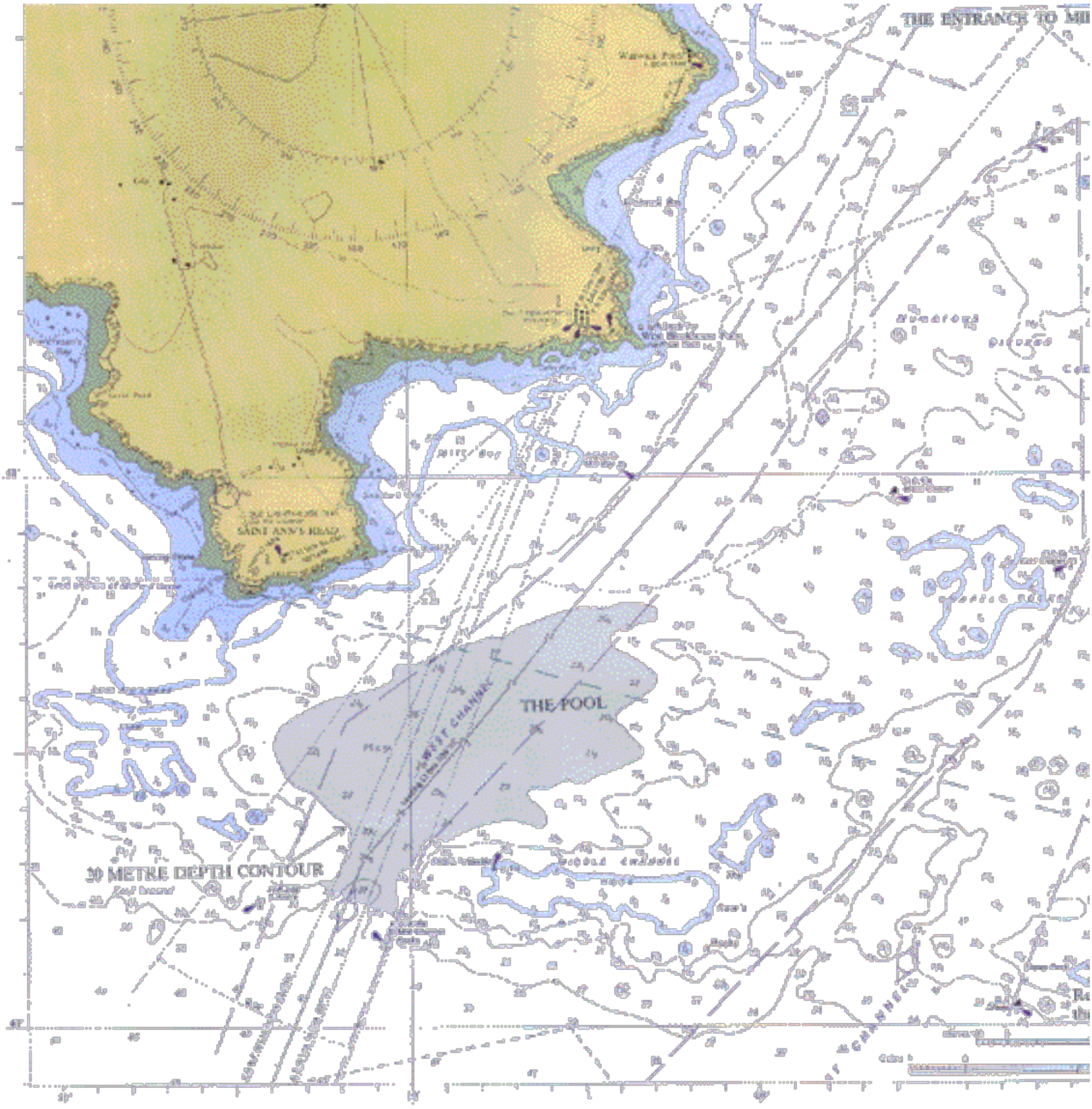

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Figure 6.

An Overview of the Damage to SEA EMPRESS

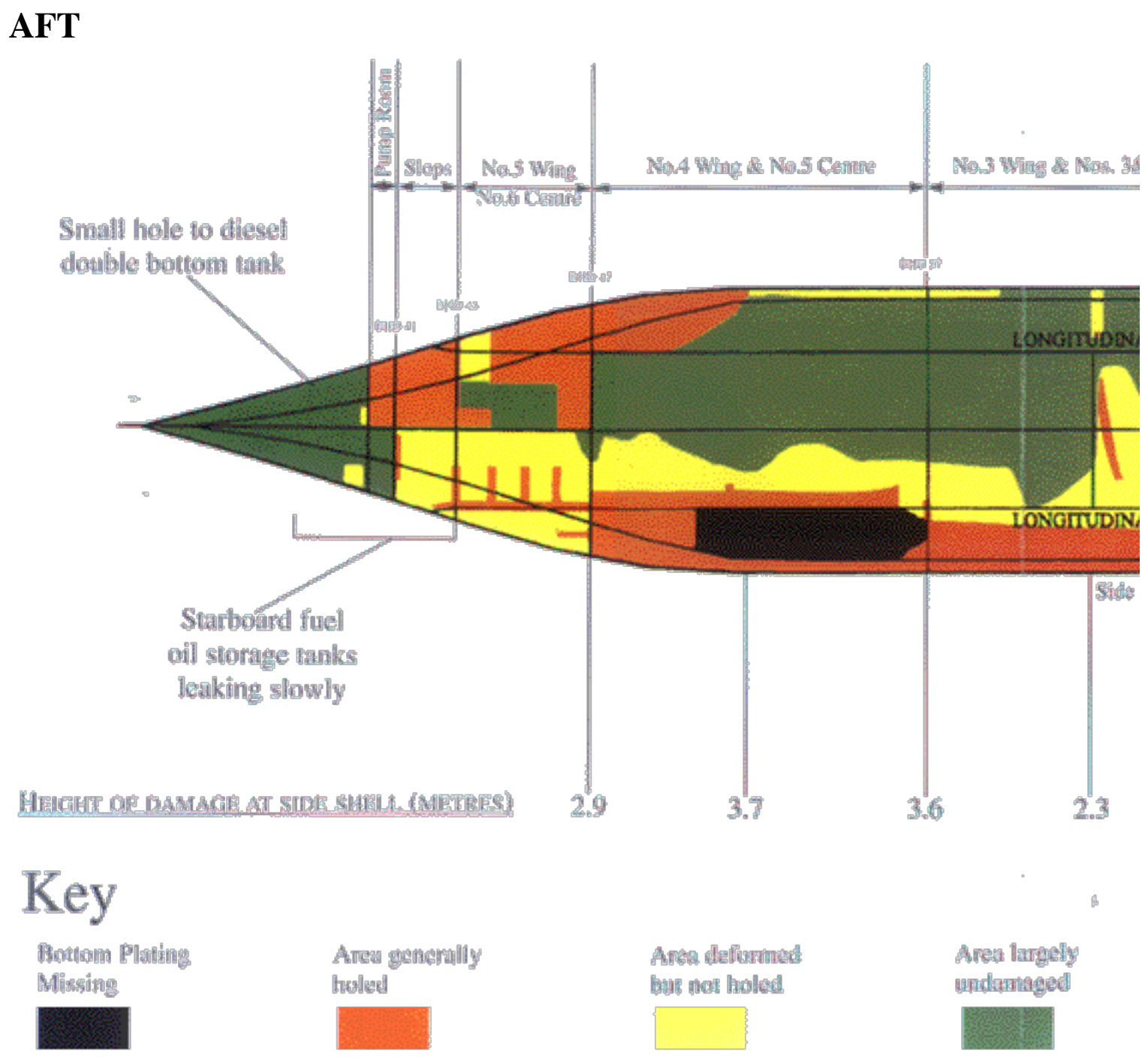

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Figure 7.

An Estimation of the Extent of the Initial Damage to SEA EMPRESS

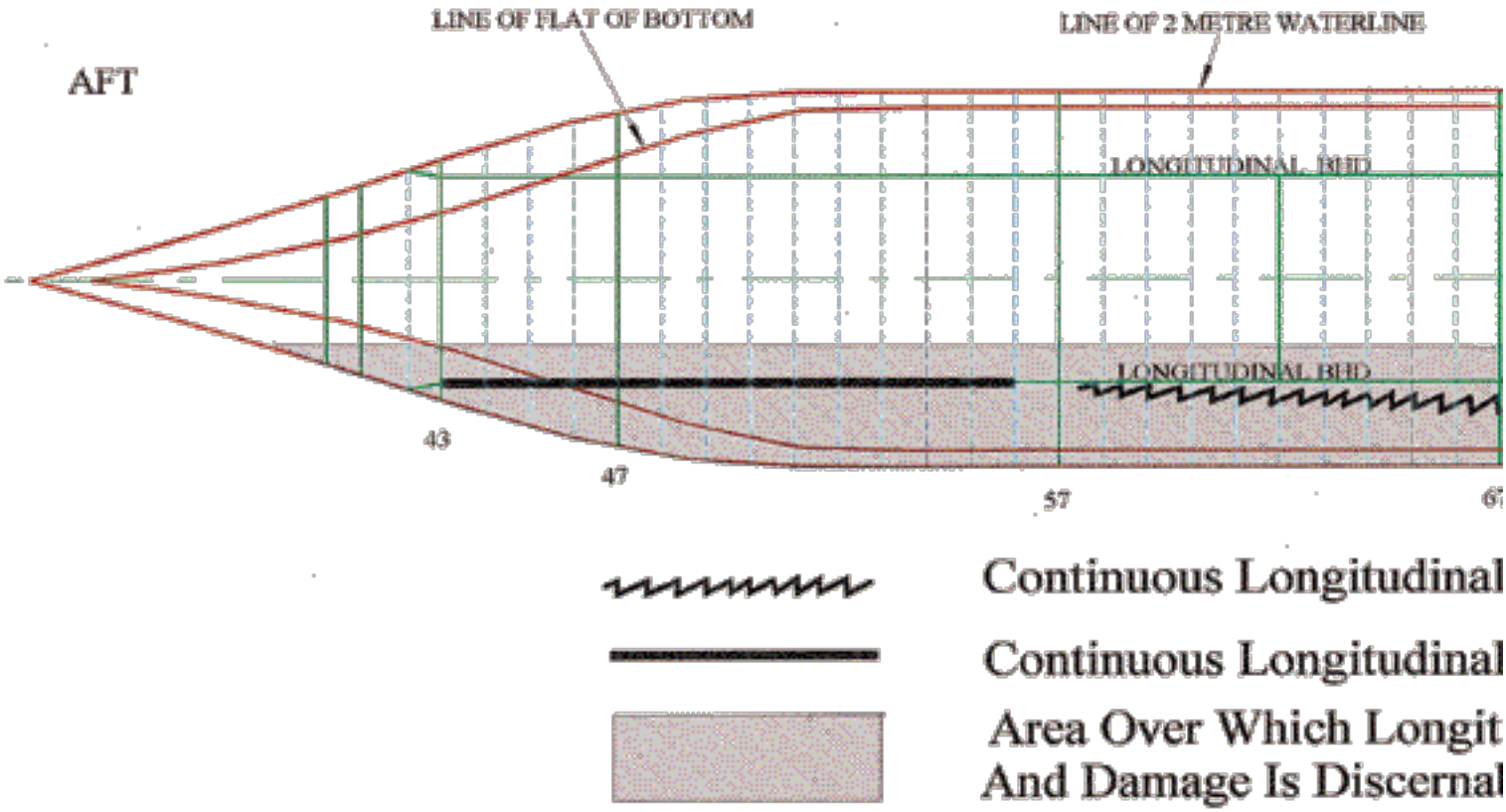

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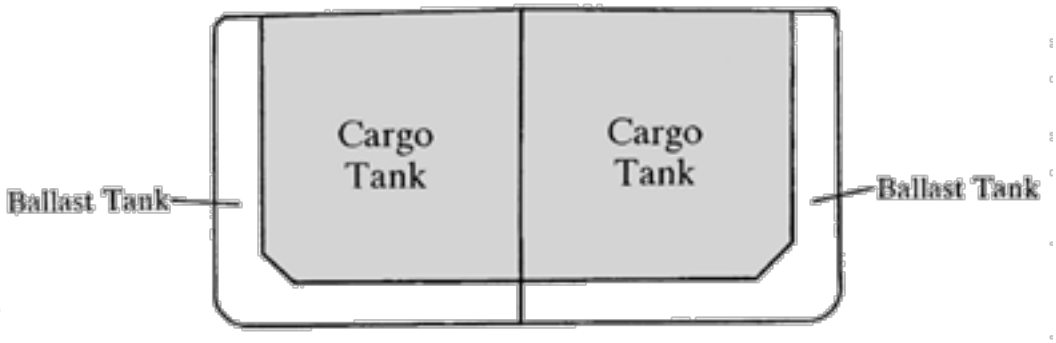
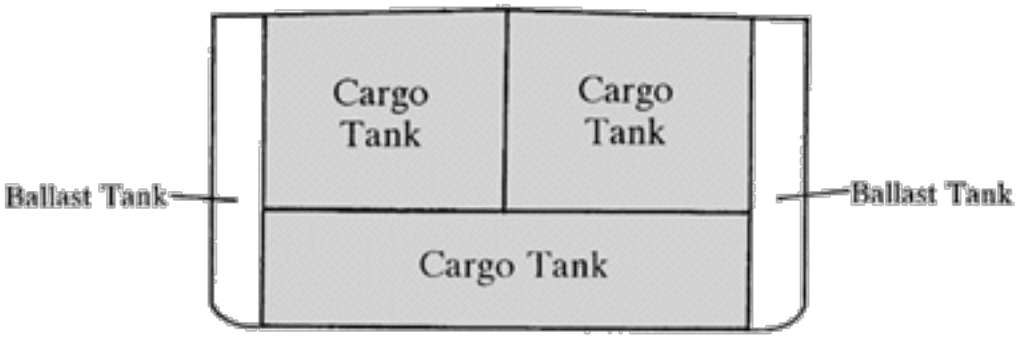
Figure 8.

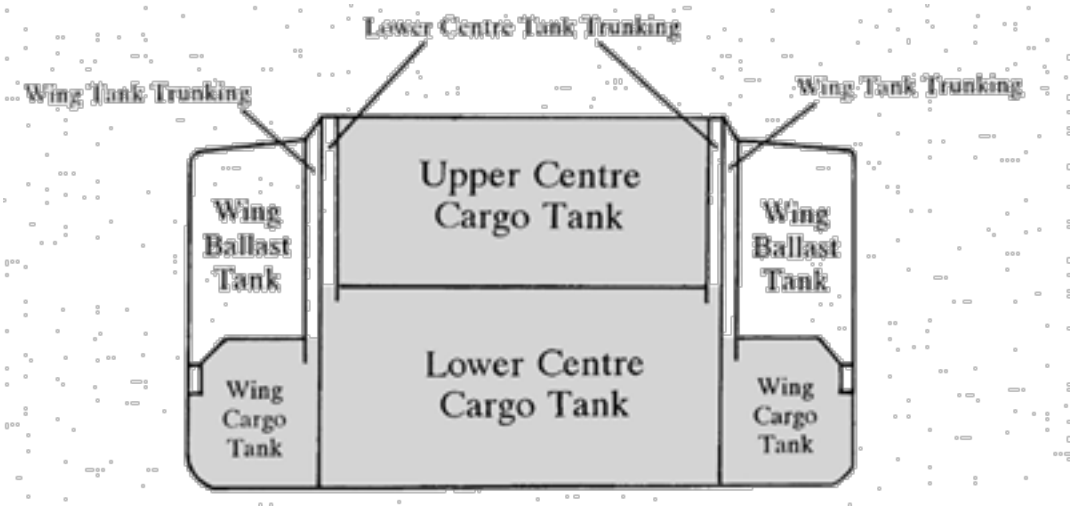
Typical Cross Sections of Various Tanker Types



General Layout of Double Hull Tanker



General Layout of Mid Deck Tanker



General Layout of Coulombi Egg Tanker

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comments

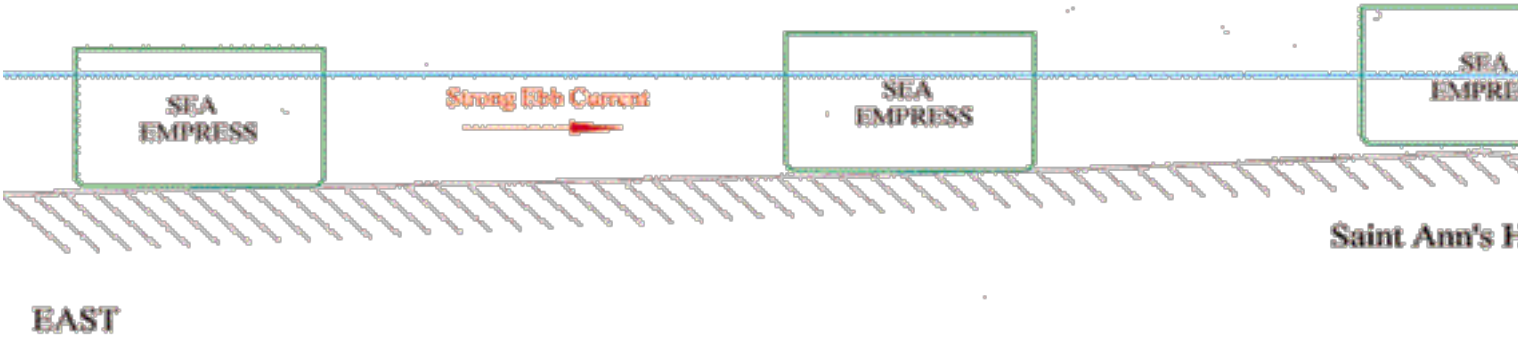
Figure 9.

An Illustration of the Factors Involved in the Failed Refloating Attempt of Tuesday 20 February and the Sucessful Refloating Attempt on Wednesday 21 February

Monday 19/02 - Vessel grounds on Saint Anne's Head Shoal. Her mean draught at the time was approx 19.3 metres.

Tuesday 20/20 - During the failed re-floating the vessel is held against the shoal by the strong ebb current and carried into shallower water, finally grounding with a mean draught of about 16.6 metres. There was insufficient tug power available to pull her away from the shoal against the ebb current.

Wednesday 21/02 - The v at about 12 metres, has bee extent that she now floats can be turned by the tugs s the ebb current, greatly red and allowing the tugs to pu



comments

Photograph 1.

SEA EMPRESS on Sunday 18 February

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comments

Photograph 2.

SEA EMPRESS and tugs on Wednesday 21 February

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comments

Photograph 3.

General View of Bottom Damage to SEA EMPRESS

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comments

Photograph 4.

General View of Bottom Damage to SEA EMPRESS

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comments

Photograph 5.

General View of Bottom Damage to SEA EMPRESS

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comments

Photograph 6.

General View of Bottom Damage to SEA EMPRESS

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comments

on this site.

SALVAGE STRATEGY AND EXECUTION - PERIOD 3

General

D.3.1 Period 3 covers the time from 1830 hrs on Saturday 17 February to 0900 hrs on Sunday 18 February.

The weather throughout this period was poor, with the wind from the west, increasing to force 8, gusting force 9, generating rough seas and a heavy swell at the site of the casualty.

The weather forecast issued at 1824 hrs on Saturday 17 February predicted a southwesterly wind of force 4 with gusts to force 6, which would increase in strength to force 6/7 with gusts of force 9 by midnight. This wind would moderate a little to force 5 with gusts of 8/9.

The 1824 hrs extended forecast predicted that during Sunday the westerly wind would quickly increase to force 7/8 with gusts to force 10, then veer to the northwest and slowly decrease to force 6. During Sunday night and Monday morning the wind would veer to the north and increase to force 8 with gusts to force 10/11.

Predicted low water at Milford Haven on Saturday was at 2334 hrs and high water at 0530 hrs on Sunday.

Sunrise on Sunday was at 0728 hrs.

Narrative and Discussion

D.3.2 After SEA EMPRESS ran aground on Saint Ann's Head Shoal at about 1805 hrs the onboard planning had to be revised quickly to take account of the change in circumstances. There was a risk of explosion as some of the cargo tanks were only partially inerted and the effects of being aground introduced the possibility of structural failure of the hull. The first priority was therefore the safety of the 54 people on board the casualty. The emergency services, including the fire, police and ambulance, were alerted. Simultaneously rescue helicopters from Culdrose (R193) and Chivenor (R169) were mobilised along with the Angle and St David's RNLI lifeboats. Attempts were made by the lifeboats to come alongside the casualty to take off people. However, due to a combination of darkness, occasional rain and poor sea conditions it was decided that it was dangerous to evacuate via the lifeboats and that the operation would be undertaken by helicopters. The lifeboats were requested to stand by and after the initial evacuation was completed they were stood down.

D.3.3 Initially 11 persons were winched off the casualty and airlifted ashore. By 1930 hrs it was realised that the need for a total and immediate evacuation was no longer necessary and that only those who were not essential to the salvage operation should be evacuated. A further 15 people were airlifted ashore leaving 28 persons (two helicopter loads) on board.

D.3.4 Following this operation the services of R193 were required for an emergency on the Scilly Isles and it was released. R169 was left at Milford Haven on standby in case further evacuation from the SEA EMPRESS was required.

D.3.5 With the removal of non-essential personnel from the casualty and an evacuation procedure established, the problems concerning the casualty were addressed. The Salvage Master advised his Head Office in Rotterdam of the situation and he requested another anchor handling tug. In turn he was told that DE YUE (200 tbp) was available at Falmouth and VIKINGBANK (62 tbp) was available in the southern North Sea. He was advised about an hour later that DE YUE (200 tbp) was fixed and would arrive on Sunday morning.

D.3.6 A review of the situation revealed that whilst the casualty had grounded some 40 minutes after the predicted high water, as the tides were increasing in magnitude and the wind increasing in velocity from the west it was a possibility that the casualty would float free at about 0500 hrs on Sunday just before the next predicted high water. The only power available to the casualty was her own engine, as yet untested since the grounding of Saturday evening following the turn. The casualty was without the benefit of her anchors, had limited room to manoeuvre and insufficient effective tug power. If she did float free the pilots preferred option was, once again, to take her to sea.

D.3.7 The salvors considered that the risk of attempting to take the casualty out through the entrance was too high. Further, in the prevailing weather conditions there was nothing that could be done with her if she did get to sea. In these circumstances the salvors decided to ballast down the casualty and hold her where she was.

D.3.8 The salvors, having decided to ballast the casualty in order to hold her in the grounded location until the weather

abated and other resources were available, were concerned about the ballasting sequence. The Salvage Master wanted to undertake the ballasting in such a way as to protect the engine room. If the watertight integrity of the engine room was lost, not only would the machinery and electrical plant be rendered inoperable, but also the remaining major component of the casualty's reserve buoyancy would be removed. If this occurred it was highly likely that the casualty would break up, causing even greater pollution.

D.3.9 Through Acomarit, the salvors sought the advice of SERS on how their objective might be achieved. At about 0005 hrs SERS were contacted to investigate the grounding reaction with the casualty grounded forward and floating aft, utilising a combination of the Fore Peak tank and Nos 2 and 4 Port Ballast tanks. SERS advised that a combination of a full Fore Peak tank and No 2 Port Ballast tank 70% full would generate a ground reaction of 3,800 tonnes at high water. Despite some operational problems, by 0316 hrs the salvors with the assistance of the crew had carried out the ballasting of the Fore Peak and No 2 Port Ballast tank. A representative of SERS travelled to Milford Haven to enhance Acomarit's emergency response team on Sunday morning. Thereafter Acomarit/SERS were able to provide those on board with rapidly available advice as to the structural effect of the various ballasting/deballasting permutations under consideration.

D.3.10 In the early hours of Sunday morning the wind strengthened further and, following discussions with HM Coastguard concerning the availability of the helicopter, it became apparent that there was only sufficient fuel for two trips. It was decided to make one trip and evacuate half the people on board at this time. This operation was undertaken by R169 and was concluded by 0238 hrs, after which the helicopter remained at Milford Haven on standby.

D.3.11 By about 0400 hrs the wind force had increased with gusts up to 60 knots causing a rough sea. Water was sweeping over the foredeck of the casualty, which was by now working in the seaway, causing movement of the hull and the stern was felt to ground. Sounds emanating from the hull were indicative of structural failure and, since not all the tanks were fully inerted and crude oil began blowing out of the cargo vents, the Salvage Master considered that the combination of factors could result in either fire or explosion and decided a total evacuation was warranted. At 0421 hrs an immediate evacuation of the remaining persons was requested and this was undertaken by R169 which landed all 14 persons at Milford Haven at 0450 hrs.

D.3.12 Shortly before the salvors decided to evacuate the casualty at about 0400 hrs DALEGARTH (45 tbp) was ordered to let go because the situation was becoming dangerous. By this time the seas were becoming rough and the casualty's heading changed suddenly. The three remaining tugs, ANGLIAN DUKE (100 tbp), ANGLIAN EARL (84 tbp) and ESKGARTH (50 tbp), were advised of the danger of explosion and asked if they would be able to let go from the casualty if she was left unattended. The unanimous decision of the tug masters was that if necessary the tow lines would be slipped from the tugs.

D.3.13 At about 0420 hrs ESKGARTH (50 tbp) parted her tow line at the winch leaving only the two Klyne tugs connected to the casualty. With the increase in wind and corresponding sea conditions the smaller harbour tugs were ineffective and over the next hour were ordered to stand down and await further orders. The Masters of ANGLIAN EARL (84 tbp) and ANGLIAN DUKE (100 tbp) were presented with a dilemma; if the tow was lengthened too much to distance the tug from the casualty and the wire dropped on the bottom it was liable to became snagged, thus tethering the tug. If the line was too short, not only would this place the tug in close proximity to the casualty, but in a heavy seaway the tow line was liable to snatch and part. The tug masters elected to extend the tow lines to 650 and 750 metres respectively and lay downwind of the casualty.

D.3.14 Following the final evacuation of the casualty the salvors had their own meeting ashore. At that meeting it was decided to reboard the casualty when the weather permitted. It was also decided to order more generators, pumps, inert gas plant and hoses and additional salvage personnel from Smit Tak in Rotterdam. Additionally it was decided that a tug master from Klyne Tugs would attend on board DE YUE (200 tbp) as the salvors' liaison officer when the tug arrived.

D.3.15 Following this meeting the salvage team, some of whom had come from another operation, and all of whom had been working without respite for about 48 hours, were able to get some rest. However the Salvage Master was unable to take this opportunity to rest as he was required to attend meetings to discuss the various salvage options. (At 0200 hrs the Salvage Master had requested the help of another salvage master from Rotterdam. This had been agreed but he could not arrive in Milford Haven before noon that day.)

D.3.16 MPCU staff had just finished a major exercise prior to the grounding on Thursday night. The effects of this, combined with the need to travel to Milford Haven, and having to cope with both the salvage and the clean-up operations, were beginning to have their effect.

D.3.17 Throughout the period up to predicted high water at 0530 hrs and for about three hours after, ANGLIAN DUKE (100 tbp) and ANGLIAN EARL (84 tbp) maintained station without undue incident. At about the time of the half tide at 0820 hrs the Master of ANGLIAN DUKE (100 tbp) noticed that SEA EMPRESS was moving and it became apparent that she was

being carried easterly across the 'pool' but the tugs were unable to hold her. In an attempt to control the movement ANGLIAN EARL (84 tbp) parted her tow line which had snagged on the bottom and ANGLIAN DUKE (100 tbp) alone tried to keep the stern of the casualty away from the Middle Channel Rocks Light. However at about 0840 hrs she grounded to the north of the Light and ANGLIAN DUKE (100 tbp) had to slip her tow because she herself was manoeuvring too close to the rocks and in danger of grounding (see Figure 3 Image 100k).

Conclusions

D.3.18 The salvors could do no more than they did to ballast the casualty down to try and hold her in the grounded position.

D.3.19 The salvors were correct in chartering DE YUE (200 tbp) as the only large tug in the area, but it is considered this should have been backed up immediately by mobilising two large AHTS vessels.

D.3.20 The two AHTS tugs under the control of HM Coastguard should have been mobilised to the site, as a back-up to the tug ordered by the salvors.

D.3.21 The rapid deterioration in the situation, caused by the grounding, led to the salvors being under-manned at this stage. They had been active since the start of the incident and fatigue must have been making itself felt. Also MPCU staff, who had just finished a major exercise prior to the grounding on Thursday night and were having to cope with both the salvage and the clean-up operations were fatigued and under-manned.

SALVAGE STRATEGY AND EXECUTION - PERIOD 4 General

D.4.1 Period 4 covers the time from 0900 hrs on Sunday 18 February to 0900 hrs on Monday 19 February.

Throughout this period the wind remained westerly force 6/7, occasionally increasing to force 8/9.

The weather forecasts issued at 0430 hrs, 0815 hrs and 1022 hrs on Sunday 18 February, predicted a westerly wind of force 6/7 gusting to force 10. Later into Sunday evening there would be a temporary decrease in strength of the wind to force 4 but it would veer to the north and increase to force 7/8 with gusts to force 10, which would persist to the end of this period.

The 0815 hrs extended forecast predicted that for Monday the northerly wind would slowly decrease to force 5 with gusts to force 7. The further outlook for Tuesday and Wednesday was that the wind would slowly ease to become force 3/4 by Wednesday.

Predicted low water at Milford Haven was at 1158 hrs on Sunday with high water at 1755 hrs and on Monday predicted low water was at 0019 hrs and high water at 0615 hrs.

Sunset on Sunday was at 1741 hrs and sunrise on Monday at 0726 hrs.

Narrative and Discussion

D.4.2 With the casualty having been swept across the 'pool' to reground in the vicinity of the Middle Channel Rocks Light the situation had changed yet again. The first priority now was to regain control of the casualty.

D.4.3 The ocean salvage tug DE YUE (200 tbp) arrived at Milford Haven at 0915 hrs. Because the sea conditions were rough the Master was requested to proceed into the entrance channel in order to embark the liaison officer from Klyne Tugs and a pilot. DE YUE (200 tbp) then undertook a trial approach to within 100 metres of the stern of the casualty, simulating the connection of the tow line and familiarising the Master with the locality. DE YUE (200 tbp) then proceeded to anchor in Dale Roads to prepare for the connection and take delivery of a lightweight Dyneema tow line supplied by SMIT ORCA. This line was a highly manageable substitute for the tug's own much heavier and cumbersome tow line and pennant.

D.4.4 The meetings of the Marine Team became more formalised in this period. The first minuted meeting occurred at 1030 hrs on Sunday. Those attending this meeting included, amongst others, the Harbour Master, a representative from the MPCU, the Salvage Master and Assistant Salvage Master, together with representatives from Cory's, Acomarit, the pilots and Texaco (the cargo owners). The timing of this meeting coincided with DE YUE (200 tbp) making a trial run towards the stern of the casualty and the salvors' boarding crew being airlifted to the casualty.

D.4.5 At this meeting the Salvage Master stated that his intentions were to put the engineers of SEA EMPRESS and a salvage team back on board as soon as possible, to regain power and connect the tugs' lines. He ruled out the possibility of

connecting a tug forward because of the lack of main electrical power and the prevailing sea conditions with the consequent danger to those trying to make the connection.

D.4.6 The meeting then proceeded to address the options for handling the casualty in the future:

1. hold SEA EMPRESS in her present location, aground to the north of the Middle Channel Rocks Light. This was rejected because the position was too exposed with the consequent high risk of further damage; or

2. take SEA EMPRESS to sea. This was rejected because of the unacceptable risk of negotiating the entrance with a single tug on the stern and the consequent risk to life and of further pollution; or

3. take SEA EMPRESS into Mill Bay and either beach her or keep her afloat. The first of these was rejected because of the possibility of blocking the channel and the difficulty in maintaining position. Additionally, the casualty's trim was unsuitable for forward beaching and it would have been impossible to manoeuvre using only a stern tug. The second was rejected as the casualty was likely to block the channel. Further it was considered that the tugs could not tow the casualty far enough into the bay and there would be difficulties in maintaining position; or

4. maintain position afloat in the 'pool'. This was rejected by the Salvage Master, who stated that the position of SEA EMPRESS could not be maintained without ground tackle as tug power alone would be insufficient. Further, there was a possibility that the casualty might founder in the 'pool' in way of the channel. The laying of ground tackle was not feasible within the envisaged time scale. These views were reinforced by the pilot who expressed concerns about the strong tides and the weather; or

5. beach SEA EMPRESS between the East and West Channels. This option was rejected because of the exposed position and the unlikelihood of being able to position the casualty sufficiently far out of the channel.

D.4.7 Since all the above options were rejected by those attending the meeting, the only remaining strategy was to try to limit the movements of the casualty and, where possible, contain the situation by use of the tugs until further information regarding the casualty's condition was available.

D.4.8 HM Coastguard expressed concern about search and rescue helicopters being employed for long periods on what they considered to be a salvage operation. It was realised that the prevailing weather conditions precluded the use of boats to gain access to the casualty and the use of a helicopter with winch capabilities was essential. The salvors were urged to charter a heavy lift helicopter which should also be fitted with a winch.

D.4.9 While the above meeting was taking place a team comprising three salvors and three crew members of SEA EMPRESS (required to restart her generators) was ferried to the casualty by helicopter, R169. This team was led by a salvage foreman and before departure the casualty's crew members were advised that they were under no obligation to be lowered down onto SEA EMPRESS if they considered it to be unsafe. It transpired that because of the adverse weather conditions on site the crew members declined to go on board. However the salvors did board the casualty to handle the tug lines and succeeded in making the reconnection. Although the salvors attempted to restore the casualty's main electrical power supply these efforts were unsuccessful (see Section 18). The reconnection of the tugs therefore had to be undertaken in difficult conditions without the aid of the casualty's power supply.

D.4.10 At about 1245 hrs another Salvage Master from Smit Tak arrived in Milford Haven, in company with a further 11 salvors, to assist the Salvage Master. The newly arrived Salvage Master adopted the title of Senior Salvage Master to make it clear to those ashore as to whom they had to deal with insofar as the salvors were concerned. Following discussions to familiarise the Senior Salvage Master with the issues and circumstances of the incident the Salvage Master, who by now must have been feeling the effects of both physical and mental fatigue, retired to rest.

D.4.11 It was the intention of the Klyne Tugs liaison officer on DE YUE (200 tbp) to make the towing connection to the casualty when the tidal stream was setting in a northeasterly direction away from her so that the tug would not be set down onto the casualty's stern. ANGLIAN EARL (84 tbp) was put on standby off the casualty. The approach by DE YUE (200 tbp) to the casualty was made as soon as the tow was ready and the MoD Chinook helicopter, which had previously been arranged by MPCU, was available. After several attempts aided by the helicopter, made difficult by the extremely adverse weather and the strength of the tidal stream, the Dyneema rope was connected to the stern of the casualty at 1520 hrs.

D.4.12 Once the connection had been made and when the tow line was being lengthened, the Klyne Tugs liaison officer instructed the Master to turn DE YUE (200 tbp) to port and head into the wind and tow the casualty into the 'pool'. This manoeuvre had to be accomplished before the tow line was paid out to the full operational length, and whilst there was no

weight on the line. However it was inevitable that as the tug moved away from the casualty some weight would come on the line. This weight, acting on the stern, coupled with the strong tide acting on the hull, together with a high windage area forward, created a set of forces which prevented DE YUE (200 tbp) from changing direction without outside assistance. Although DE YUE (200 tbp) has a bow thruster it did not help with these manoeuvres due to its low power. The pilot contacted the Signal Station and asked for instructions. They replied that the Marine Response Centre had made no decisions and could not give specific instructions.

D.4.13 Subsequently ANGLIAN DUKE (100 tbp) was instructed to assist DE YUE (200 tbp) and she made fast with one of her mooring ropes to the port bow of DE YUE (200 tbp) but at about 1700 hrs this mooring line parted. ANGLIAN DUKE (100 tbp) was then repositioned to push on the starboard bow of DE YUE (200 tbp), however in the swell conditions both tugs began to sustain damage and this operation was quickly aborted. At about this time ANGLIAN EARL (84 tbp) made fast on the port bow of the casualty after which the salvors had to leave the casualty as the helicopter (R169) had to return to its base at Chivenor. The casualty at this time was aground about 6 cables northeast of Middle Channel Rocks Light (see Figure 4 Image 97k).

D.4.14 At this stage there was a fundamental disagreement between the liaison officer, who was experienced in handling highly manoeuvrable AHTS vessels but had never handled a tug of the type and size of DE YUE (200 tbp), and the Master of DE YUE (200 tbp) who was fully aware of the advantages and disadvantages of his own vessel. The latter advised the liaison officer that under the existing wind and tidal forces it was impossible for his tug to maintain her position astern of the casualty. Based upon his experience he was of the opinion that it would be better to slacken the tow line, adjust the position of the tug and let go her anchors. As the two anchors were being streamed he wanted to winch in the main tow wire. Thus with the two anchors streamed forward and the weight on the tow line aft, the tug would be safely moored to await the time when the casualty would refloat. The liaison officer was against this idea because he considered it would restrict the manoeuvrability of the tug in the event that the casualty moved. The Master was persuaded not to anchor on the basis that another tug would be called to assist DE YUE (200 tbp). As DE YUE was on a "Towhire" Agreement requiring him to work to the salvors' instructions he had no option but to do as he was required.

D.4.15 Predicted high water was at 1755 hrs and at this time the wind was force 7/8 from the northwest, which was on the port beam of DE YUE (200 tbp).

D.4.16 At about 1830 hrs the Marine Team convened another formal meeting, at which the Senior Salvage Master outlined the current situation. He explained that the vessel was aground 5.7 cables to the northeast of the Middle Channel Rocks Light with the tugs ANGLIAN EARL (84 tbp) and DE YUE (200 tbp) fast forward and aft respectively. Further, that the salvors' intention was, in the short term, as far as possible to maintain the casualty in this position. As soon as the weather permitted, ground tackle would be laid to secure the casualty and then it would be possible to commence a lightening operation. It was estimated that, on the assumption that work could commence on Monday morning, it would take about two and a half days to deploy the moorings. It was then left to Smit Tak to discuss the provision of moorings with the senior MPCU adviser. It was also the salvors' intention to reboard the casualty at daybreak in order to restart the generators and the vessel's inert gas plant, to re-assess the damage, and continue pumping out the pump room with a view to the proposed lightening operation.

D.4.17 The salvors required a helicopter for personnel transfer purposes which also needed to have heavy-lift capabilities to transfer equipment on board and then to move equipment around the casualty. However, they were unable to charter a commercial helicopter with the winch facilities for Monday. MPCU made arrangements for the MoD Chinook helicopter to be placed at their disposal, on the understanding that the salvors were to make every effort to charter a commercial heavy-lift helicopter and allow the MoD helicopter to return to its military standby duties. It was then left to the salvors and MPCU to arrange flight schedules. Later that evening the Senior Salvage Master, in company with an MPCU adviser, inspected the mooring equipment held at the Admiralty Salvage and Mooring Depot.

D.4.18 By 1930 hrs, with the tide on the ebb, DE YUE (200 tbp) was about three points on the port quarter of the casualty, with the tow line leading over the port beam, and the tug TITO NERI (50 tbp) had made fast a mooring rope to her port bow. In this configuration TITO NERI (50 tbp) towed DE YUE (200 tbp) to the northwest but at about 2005 hrs the mooring rope parted. DE YUE was then set down along the length of SEA EMPRESS, between the casualty and shallow water, and let go her port anchor to two shackles in an attempt to arrest her drift.

D.4.19 It is not clear exactly what occurred next but apparently the pilot on board reported to the Signal Station that the crew of DE YUE (200 tbp) wanted to let the line go and enter port. Via the Signal Station it was stressed by the MPCU Local Commander that DE YUE (200 tbp) should remain attached at all costs. The Master assured the liaison officer that he understood he should not let go. However, he explained that he was unable to maintain position on a short tow line and wanted to lengthen the tow line in order to take off the weight, then move ahead and take the weight again on the line. A little while

later when the Master was asked by how much did he want to extend the tow line his reply was about 135 metres. The pilot relayed this to the MPCU Local Commander via the Signal Station, adding that if the tow line was lengthened by that amount DE YUE (200 tbp) would be in danger of being too close to shallow water, which concerned the pilot. The reply from the port authorities was that they would not permit the tug to lengthen her tow line as it would place her in an unsafe position, however another tug was being dispatched to give DE YUE (200 tbp) assistance.

D.4.20 Eventually DE YUE (200 tbp) fetched up between SEA EMPRESS and ANGLIAN EARL (84 tbp), which had to slacken her tow to preventing it fouling DE YUE. ESKGARTH (50 tbp) was called to assist DE YUE and after some difficulties due to the severity of the weather and the crude oil on deck, by 2345 hrs the crew of ESKGARTH (50 tbp) managed to connect a tow wire to the bow of DE YUE (200 tbp) and commenced to tow her clear. As DE YUE (200 tbp) was being towed astern of the casualty the tow line, which was still leading over the port side of the tug, became fouled in the bulwark gate, threatening to damage the line and sever the connection.

D.4.21 It was agreed by the Klyne Tugs liaison officer and the Master of DE YUE (200 tbp) that because of the threat to the line, and because the tug could not maintain position astern of the casualty, nothing more could be reasonably achieved at that time. It was therefore better to let go from the casualty and this decision was communicated to those ashore. Having let go from the casualty at 0044 hrs DE YUE (200 tbp) was stood down and went to anchor in Dale Roads. The Dyneema line was then grappled by ANGLIAN DUKE (100 tbp) and made fast to her tow line.

D.4.22 ANGLIAN DUKE (100 tbp) and ANGLIAN EARL (84 tbp) remained connected to SEA EMPRESS with instructions from the Senior Salvage Master, to hold the casualty on the east side of the 'pool'. At about 0600 hrs, immediately prior to the time of the predicted high water, the Masters of ANGLIAN DUKE (100 tbp) and ANGLIAN EARL (84 tbp) observed that the casualty was again moving. The stern was beginning to swing to starboard towards the Middle Channel Rocks Light. Despite the efforts of the tugs to control the casualty, at about 0900 hrs SEA EMPRESS ran aground again on an easterly heading, to the north of the Middle Channel Rocks Light (see Figure 4 Image 97k). The two tugs remained connected to the casualty laying to their tow lines.

Conclusions

D.4.23 Fatigue amongst some key personnel, especially with the Salvage Master who was required to attend meetings and brief others for several hours after he had evacuated SEA EMPRESS, was becoming an important factor.

D.4.24 Too much faith was put on the capability of DE YUE (200 tbp) to hold the casualty. It is considered that the circumstances on Sunday warranted more detailed consideration of all options. Possibly due to lack of personnel and consequent fatigue planning during this period was limited.

D.4.25 The value of helicopters for transferring personnel and heavy-lift helicopters for deployment of equipment was clearly illustrated in this period. Helicopters provided access to the casualty under very poor conditions which other means of transport could not.

D.4.26 The crew's decision not to be winched down onto the deck of the casualty in the conditions prevailing at the time was justifiable.

D.4.27 DE YUE (200 tbp) was not used to best advantage.

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comments