

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 salvaged 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 salvaging 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 salvaged, 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 salvaging 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.

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.

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 steering 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.

This Annex analyses the activities which were taking place, both on board SEA EMPRESS and ashore, and which contributed in one way or another to the salvage operation. It covers the six days from the time just after the vessel initially grounded until the casualty was successfully refloated and taken to Herbrandston Jetty. It is broken down into seven well defined periods (D.1 to D.7), where each period ends with a significant event, which in general, necessitated a change in the direction of the salvage operation.

SALVAGE STRATEGY AND EXECUTION - PERIOD 1

General

- D.1.1 Period 1 covers the time from 2007 hrs on Thursday 15 February to 1300 hrs on Friday 16 February.

During this time the wind was westerly force 5 with moderate sea and swell.

These wind conditions were reasonably well predicted. The forecasts issued at 2028 hrs on Thursday 15 February and 0844 hrs on Friday 16 February predicted the wind to be from west-by-north force 3/4 at first, increasing to force 4/5 later from between west and northwest-by-west.

The 0844 hrs extended forecast predicted that the wind would remain at force 4/5 from the west that night but would increase to between force 4 and 6 from the west-southwest during Saturday and increase further to force 7 by 2400 hrs. **(The Beaufort Wind Scale giving mean wind speed equivalents is at Annex E.)**

Predicted low water at Milford Haven on Thursday was at 2139 hrs, with high water at 0342 hrs on Friday and low water at 1011 hrs.

Sunrise was at 0732 hrs on Friday.

Narrative and Discussion - Immediate Grounding

- D.1.2 At about 2007 hrs SEA EMPRESS grounded on the western edge of the Middle Channel Rocks. As soon as it was realised what had happened, the pilot requested the immediate assistance of the tugs (which were waiting to berth the vessel). He used VHF Channel 12, because he knew that the tugs would be listening on that Channel. In the meantime, although her engines were stopped and then put astern and both anchors were dropped, SEA EMPRESS still made headway until grounding again 3.3 cables south-by-west of the Mill Bay Buoy, on a final heading of about northwest (see Figure 2).

- D.1.3 When the tugs arrived at 2018 hrs the casualty was aground, trimmed down by the head, listing to starboard with the main deck in way of the shoulder at sea level. The tug DALEGARTH (45 tbp) made fast to the casualty through the forward centre lead, with the tug THORNGARTH (45 tbp) on the port bow, both tugs using their bow lines. The tugs STACKGARTH (43 tbp) and TITO NERI (50 tbp) were stationed on each quarter of the casualty ready to evacuate the crew however this was not considered necessary.
- D.1.4 Within 20 minutes of the initial incident the casualty had listed to about 18° to starboard, by which time the ship's staff had established that Nos 2 and 4 Starboard Ballast tanks were breached as well as some cargo tanks. Further inspection established that the lower part of the pump room was flooding with an oily water mixture that was producing a gaseous atmosphere in this compartment.
- D.1.5 The message summoning tug assistance was heard by the Port Signal Station. It was also heard by Milford Haven Coastguard, which was fortunate because HM Coastguard do not normally monitor VHF Channel 12. The Harbour Master was notified and the port's Emergency Plan was activated. In response, the previously designated members of the port's Emergency Team gathered at the Signal Station. Simultaneously the ship's managers, Acomarit, and MPCU were notified and responded by immediately putting in hand their own contingency plans to mobilise and travel to Milford Haven. The MEOR, located at Southampton, was activated under the direction of the Chief Executive of The Coastguard Agency who assumed the role of Overall Commander for the incident under the National Contingency Plan.

Narrative and Discussion - Master's Response

- D.1.6 The Master's decision to counter the list was to fill the port side ballast tanks. The sea inlet valves in the pump room to the ballast system were now inaccessible, however, the branch lines between each ballast tank and the ballast main had isolating valves which, being controlled from the cargo control room, were accessible. It was possible therefore to cross flood these tanks. Whilst this gravitational method of partially filling the port ballast tanks was relatively slow it was effective in reducing the list. When the list was reduced to about 10° the ballast isolating valves were closed in order to prevent the draught of the casualty increasing further.
- D.1.7 The Master kept Acomarit fully advised of the situation at regular intervals. By 2315 hrs he was able to fax them an initial condition report indicating that Nos 1, 2, 3, and 4 Starboard tanks, together with No 6 Centre tank, were damaged. Also that the status of Nos 1, 2, 3, 4, and 5 Centre tanks could not be determined. They were also advised that the list was 10° to starboard and the bottom of the pump room was damaged on the starboard side and flooding. Although the

crew took no further direct action, throughout the salvage operation they continued to provide, whenever possible, all the services, machinery etc required to keep the casualty functioning. This was often carried out under difficult conditions.

Narrative and Discussion - Acomarit's Response

- D.1.8 Upon being advised of the incident Acomarit, in addition to despatching three company superintendents to the casualty, contacted salvage brokers to arrange for salvage services. By 2305 hrs they were able to confirm that a LOF95 had been awarded to the salvage consortium.
- D.1.9 Acomarit subscribes to Lloyd's Register of Shipping, Ship Emergency Response Service (SERS). With the computer model of SEA EMPRESS in their programme SERS are able to provide stability and residual strength calculations on a 24 hour basis. The first information concerning the casualty's condition was sent by Acomarit to SERS at 2330 hrs. At the same time Acomarit also copied information to MPCU. By midnight on Thursday SERS had completed the first computer runs for the vessel in the intact condition. Then several damage stability runs were made to try to reproduce on computer the draughts and angle of list which had been reported. The results were discussed with Acomarit and SERS were requested to await further instructions. At about 0700 hrs on Friday morning SERS were provided with the latest reported draughts of the vessel. However, these differed significantly from those computed, indicating that more accurate information and further calculations would be required. Also at this time Acomarit advised SERS that they were considering lightening the intact tanks first. At 0855 hrs SERS were stood down but later advised that they would be required to run a check on the salvors' proposals.

Narrative and Discussion - Salvor's Response

- D.1.10 Cory Towage had their harbour tugs and their local Fleet Manager already in attendance while Klyne Tugs mobilised their ANGLIAN DUKE (100 tbp) and ANGLIAN EARL (84 tbp) to Milford Haven, the ETAs being 0800 hrs Friday and 0800 hrs Saturday respectively. Smit Tak, in anticipation of being awarded an LOF had already diverted their salvage vessel SMIT ORCA to Newhaven to land a salvage team of six people that would travel directly to Milford Haven. SMIT ORCA arrived at Newhaven at 0400 hrs on Friday and after disembarking the salvage party proceeded to Milford Haven. Meanwhile a further team of six, including a Salvage Master and a naval architect, were being mobilised by charter flight from Rotterdam.
- D.1.11 The potential need for lightening tonnage was recognised at an early stage by those ashore. Although there was no specific plan at this stage, Cory Towage sought the assistance of shipbrokers in the tanker

market to determine the availability of suitable lightening tonnage. The initial response to enquiries was mixed for a number of reasons, however a number of suitable vessels were offered.

Narrative and Discussion - Response by the Authorities

- D.1.12 Port Authorities, Local Authorities and Government Agencies have emergency plans to cope with major incidents which threaten the safety of life or are likely to cause environmental damage. These plans, in general terms, lay down the framework upon which the control of the incident will be exercised. The plans should be complementary for multi-jurisdictional incidents, clearly laying down the responsibilities and liabilities of the various organisations in any foreseeable major incident. In Section 12 of this Report the relevant sections of Milford Haven's Emergency Plan and MPCU's National Contingency Plan are discussed with particular emphasis on how appropriate these were in the SEA EMPRESS salvage incident.
- D.1.13 An MPCU team led by the Head of Operations arrived in Milford Haven at about 0030 hrs on Friday. Under the terms of the National Contingency Plan he assumed the role of MPCU Local Commander and immediately entered into discussions with MHPA to progress matters. As MHPA recognised that they alone would be unable to cope with the at-sea pollution MPCU agreed to assume responsibility for this aspect.
- D.1.14 The Master and the pilot of SEA EMPRESS recommended to the Emergency Team ashore that advantage should be taken of the rising tide to attempt to refloat the vessel and, if successful, re-anchor her in the deep water 'pool'. The Master and pilot were advised by a message from the Signal Station timed at 0055 hrs that the Emergency Team were in agreement with their proposal.
- D.1.15 By floating free on the rising tide the casualty would not have to be pulled off the ground by tugs and the chances of further pollution would be minimised. The prime advantage of moving the casualty into the 'pool' was that she would be floating at all states of the tide in a stable condition, although with a large list, and would not be subjected to grounding stresses.

Narrative and Discussion - General

- D.1.16 SEA EMPRESS was free of the ground at 0204 hrs. With tugs STACKGARTH (43 tbp), TITO NERI (50 tbp), DALEGARTH (45 tbp) and THORNGARTH (45 tbp) holding her, combined with use of the casualty's main engine, she was manoeuvred into the 'pool' where the port anchor was let go at 0211 hrs. Later the starboard anchor was dropped and the cables ranged to improve the holding power (see Figure 3).

- D.1.17 In order to gain a reliable understanding of the condition of the casualty the MPCU Local Commander boarded SEA EMPRESS at about 0300 hrs. He was accompanied by an MPCU adviser and the local Fleet Manager from Cory Towage, who was the senior representative for the salvors until the Smit Tak Salvage Master arrived on scene. In company with the casualty's Chief Officer, the MPCU adviser and Cory's local Fleet Manager undertook a general inspection of the deck and the information concerning the vessel's condition was relayed to the Harbour Master ashore. This information did not substantially differ from that which was previously known but which was to be proven inaccurate as a result of the inspection by the salvors about twelve hours later. It was reported that the only option was to maintain the vessel in her present position and undertake a lightening operation. This advice was a factor in establishing the criteria for the salvage operation.
- D.1.18 At this time the main priority was to pump out the pump room in order to gain access to the valves to the cargo system. Provisions were then made through MPCU for the Marine Pollution Salvage Centre (MPSC), based in Milford Haven, which had already been alerted and had moved equipment out of its warehouse, for pumps, fans, etc and other equipment to be made available to pump out the pump room. This equipment was delivered to the casualty by the barge WICKNER at about 0600 hrs.
- D.1.19 The MPCU Local Commander left the casualty at about 0600 hrs to return ashore. Once ashore he updated MHPA on the situation on board and gave advice on the planning of the response organisation. The response to the shore pollution was to be co-ordinated and directed by the Joint Response Centre. He agreed the organisation ashore for the salvage and marine counterpollution response. The response to the marine aspects of the incident, including the salvage operation, were led by MPCU with the assistance and involvement of MHPA. The management of these two aspects of the incident were later separated and a Marine Team, led by the Harbour Master, was formed to deal with the casualty and its salvage. (See Section 13 for full details of the onshore management.)
- D.1.20 The Secretary of State for Transport through the MPCU, and the Harbour Authority, has considerable powers of direction and intervention if the actions of the Owners of the casualty or the salvors give rise for concern. Prior to the agreeing and signing of the LOF the Master was in sole charge of his vessel and it was only after the LOF had been agreed that the salvors became temporary custodians of the vessel. In the case of SEA EMPRESS the salvors were a consortium which included a team from Smit Tak, who were going to provide the Salvage Master. However, the team from Smit Tak would not be arriving in Milford Haven until about midday on Friday 16 February and, in the interim, decisions on what to do with the casualty and what could be reasonably undertaken as first aid measures prior to the salvors being fully in control of the situation had to be considered.

- D.1.21 There were disadvantages in holding the casualty in the 'pool' due to the relatively exposed location and the strength of the tides. Pending the arrival of the Smit Tak team the principals involved on site discussed other alternatives. These were to take the casualty to sea, beach her or take her directly to the berth at Herbrandston Jetty but all of these alternatives had their attendant risks.
- D.1.22 Taking the casualty to sea into predicted adverse weather may have resulted in her foundering, with a risk to life, before reaching deep water. This would have resulted in not only the vessel being lost, but the entire cargo escaping and polluting the coastal region and local fishing grounds.
- D.1.23 Beaching a distressed vessel is, in certain circumstances, a viable option used by salvors. Not only does this obviously prevent foundering but it allows the vessel to be held in relative safety until the salvors are able to mobilise their manpower and equipment. However it has to be carried out in controlled conditions and the site of the beaching and all the relevant circumstances need to be carefully considered. The beaching site is selected not only for the nature of the bottom material but also with respect to its ability to properly support the vessel for the whole of its length. Ideally the final selection of the site would follow a survey of the location by divers. Matters such as tidal range and ballasting have to be examined, taking account of the particular circumstances of the matter. In the case of a damaged laden tanker the tidal drop must not permit oil to escape. Ballast must be adequate to hold the vessel from moving but not so restrictive to prevent the vessel being refloated. Further, the location should provide adequate shelter from the weather and the sea to permit access and work to be undertaken on the vessel. There are a number of bays in the Milford Haven area which fulfil these requirements.
- D.1.24 To take the vessel directly to the berth at Herbrandston Jetty (a designated safe berth for casualties) the controlling factor was the draught of the casualty. SEA EMPRESS was listing to starboard with a maximum observable draught of 23.5 metres, therefore even with the six metres of tide predicted for 0342 hrs on Friday the vessel's draught was too great to move very far from the 'pool'.
- D.1.25 All three alternatives were ruled out, at least for the time being, because the lowest risk lay in leaving the casualty where she was, in the 'pool'.
- D.1.26 Despite TITO NERI (50 tps) parting the tow line at 0615 hrs and having to reconnect, the period after the vessel was relocated was without major incident. At about this time the pilot, who had been on board since boarding the vessel on her arrival off Milford Haven, was joined by another pilot and there were further reliefs later with sometimes two pilots being on board. During this time the pilots continued to hold the casualty in the anchored position with the aid of the four harbour tugs and the casualty's engine.

- D.1.27 During the morning the situation was discussed by the three pilots on board the casualty. They were concerned that with the worsening weather forecast and increasing strengths of tides, as the tidal cycle moved towards springs, they would need more tugs and/or ground tackle to hold the casualty in her present position. Their preferred option was for her to be taken out to sea or, if the list and trim could be reduced, to Herbrandston Jetty. These concerns and the pilots' consideration of the options were communicated to the Deputy Harbour Master at about 1130 hrs.
- D.1.28 There was some mooring equipment available at Pembroke Dock and the MPCU adviser informed the Cory local Fleet Manager in the early hours of Friday morning of these resources. Whether this equipment was suitable for the purpose of holding a vessel of the size of the SEA EMPRESS was not established at that time. The Cory local Fleet Manager was reluctant to initiate further salvage activities other than ordering pumps etc pending the arrival of the Smit Tak Salvage Master.
- D.1.29 At about 0800 hrs ANGLIAN DUKE (100 tpb) arrived on scene and was made fast to the casualty but almost immediately parted her 42mm wire pennant and had to resecure using a 62mm wire pennant. With the arrival of ANGLIAN DUKE (100 tpb) the collective available nominal bollard pull was 283 tonnes.
- D.1.30 By 1100 hrs, to the credit of all those involved, all the equipment necessary to pump out the pump room had been off loaded from the barge WICKNER and the pumps rigged ready to lower within the pump room by MPSC staff. However the MPCU adviser ordered the operation to be stopped because he considered that it was unsafe.
- D.1.31 At 1130 hrs the Salvage Master from Smit Tak arrived at Milford Haven and met with the Harbour Master, MPCU, and Acomarit's representatives, when he was informed about the reported condition of the casualty. By 1215 hrs the salvage team from Smit Tak was on board SEA EMPRESS assessing the situation and at about 1220 hrs the Director of MPCU, arrived at Milford Haven and took over as MPCU Local Commander.

Conclusions

- D.1.32 Without exception all the organisations, companies and individuals concerned in responding to the casualty did so promptly.
- D.1.33 The prompt action of the Master of SEA EMPRESS in ballasting the port side tanks is to be commended. Calculations undertaken since the incident show that without the prompt instigation of remedial measures the vessel would have developed a 30° list, thus making the initial situation far worse.

- D.1.34 The decision to move SEA EMPRESS from the initial grounding position to the 'pool' on the morning of the 16 February was prudent and reasonable, given the information available at the time.
- D.1.35 The extreme draught of the casualty severely limited the options which were available for dealing with the emergency. The decision to leave the casualty in the 'pool' at this stage of the incident and not take her to sea, nor beach her, was correct. However at this stage no attempt was made to determine to what minimum value the draught could be reduced. Given the ready access to SERS by the Marine Team this is surprising. As a result only two practical salvage options were known to MPCU and MHPA, namely to hold the casualty in the 'pool' and lighten her, or to take her to sea. The possibility of taking the casualty directly to Herbrandston Jetty without prior lightening was not fully explored. This possibility is discussed in Section 15.

SALVAGE STRATEGY AND EXECUTION - PERIOD 2

General

- D.2.1 Period 2 covers the time from 1300 hrs on Friday 16 February to 1830 hrs on Saturday 17 February.

During this time the weather conditions at the casualty slightly deteriorated. The wind remained westerly but increased to force 6 towards the end of the period with gusts of force 8.

The weather forecasts issued at 1531 hrs and 2041 hrs on Friday 16 February predicted that the northwest-by-west wind of force 4/5 occasionally force 6 would decrease to force 4/5 for late Friday and early Saturday morning. The 0518 hrs forecast on Saturday 17 February predicted an increase to force 5 with gusts to force 7 for the remainder of this period.

The 0518 hrs extended forecast predicted that during Saturday evening the southwest-by-west wind force 4 would increase to force 7, gusting 9 by midnight and would veer to west-northwest by 0600 hrs Sunday.

Predicted high water at Milford Haven on Friday was at 1614 hrs with low water at 2243 hrs. On Saturday predicted high water was at 0442 hrs, low water at 1109 hrs and high water at 1708 hrs.

Sunset on Friday was at 1737 hrs, with sunrise and sunset on Saturday at 0730 hrs and 1739 hrs respectively.

- D.2.2 During Friday and Saturday the MPCU team was reinforced with more personnel and a senior MPCU adviser arrived at Milford Haven to strengthen the team of salvage advisers. Senior personnel from Acomarit arrived, as did numerous solicitors, consultants and surveyors representing the various interested parties. A Marine Response Centre (MRC) based within the Coastguard Station became the hub of all shore based activities concerning the casualty and its salvage and was where most interested parties assembled.

Narrative and Discussion

- D.2.3 On boarding the casualty at about 1215 hrs the Smit Tak Salvage Master expressed reservations about the current assessment of the damage and, following a brief meeting with the Master and others, commenced an examination of the casualty. By 1530 hrs the salvors had gained sufficient information to be able to state that the casualty's condition was not as previously determined. In essence the damage was confined to No 1 Centre Cargo tank, Nos 1, 3 and 5 Starboard

Cargo tanks, plus No 6 Starboard Slop tank, Nos 2 and 4 Starboard Ballast tanks and the pump room, all being open to the sea.

D.2.4 Based upon this information the salvors' basic plan, as explained to the Acomarit representative and representatives of the various authorities on board, was to:

- regain control of the flooded pump room;
- test the casualty's inert gas and cargo pumping systems;
- lighten cargo from the centre tanks into a suitable vessel;
- transfer cargo out of the damaged tanks over the top (into the centre tanks) to improve the water plug;
- pressurise the damaged tanks with inert gas;
- undertake a diving survey to check on bottom damage;
- move the vessel to an appropriate berth once the draught had been suitably reduced in order to discharge the balance of the cargo.

It was anticipated that the foregoing would take at least three days, subject to weather.

D.2.5 In the subsequent discussions on board the Salvage Master considered the idea of taking the casualty to sea but explained that he was opposed to it because he considered it to be an unacceptable risk.

D.2.6 The Salvage Master was advised of the local resources which were available from MPCU and the Admiralty Salvage and Mooring Depot at Pembroke Docks.

D.2.7 In order to regain some of the buoyancy on the starboard side it was the salvors' intention to transfer some of the cargo over the top from the damaged tanks and then to slightly over-pressurise them with inert gas. To undertake this process it was necessary to mobilise the necessary plant and equipment and to have blank flanges with gas connections manufactured to seal the pressure/vacuum valves and other openings on deck. Whilst these preparations were being made the salvors lashed the pressure/vacuum valves closed in order not to lose the remaining inert gas in those tanks.

D.2.8 STAR BERGEN had been chartered as a lightening tanker, and would be available for use from 0600 hrs on Saturday. It was anticipated that the transfer operation would commence at 1100 hrs when the lightening vessel was alongside SEA EMPRESS and, subject to weather conditions, the operation was expected to last for 24 to 30 hours.

- D.2.9 To facilitate a speedy and safe transfer of the cargo from the casualty's centre tanks to the lightening tanker it was intended to use the main pumps of the SEA EMPRESS. However, this required the water in the pump room to be pumped out and the space to be ventilated because the atmosphere was well within the explosive range. This operation, which had previously been halted on the orders of the MPCU adviser, was recommenced at about 1400 hrs by the salvors using the pumps and equipment previously provided by MPCU. Two submersible pumps were used and ventilation had to be provided by portable units. This was necessary because the lower end of the compartment's ventilation trunking was below the water level. Until the water level was lowered sufficiently to uncover the trunking the casualty's own ventilation system could not be used.
- D.2.10 A list of further equipment needed for the operation was telephoned to the Smit Tak office in Rotterdam for prompt transportation by lorry. Further salvage equipment, including pumps, diving gear and an inert gas generator was on board SMIT ORCA which was expected to arrive at Milford Haven at about noon on Saturday.
- D.2.11 Despite the Marine Team having representatives on board the casualty who had been advised of the salvors' plans and intentions, the Marine Team ashore exhibited a degree of frustration at the operation's apparent slow start. At about 1800 hrs the Assistant Salvage Master went ashore at the request of MHPA to explain the salvage plan. In addition to presenting the broad outline, he gave the Salvage Master's reasons why it had been decided not to take the casualty to sea.
- D.2.12 Despite the inspection of the casualty by the salvors, which showed that the damage was not as previously reported, the general consensus throughout was that the casualty must be lightened before it would be allowed to proceed to Herbrandston Jetty. The maximum draught for a passage to this jetty, allowing for a 10% safety margin which is required by MHPA, was being taken as 18.3 metres. It is apparent that this figure was based simply on the minimum charted depth alongside the jetty and did not take into account other factors such as height of low water that would have been expected alongside the jetty. To achieve this draught it was accepted that some cargo at least must be lightened before passage to the jetty could be undertaken.
- D.2.13 Between 0300 hrs and 0500 hrs on Saturday locally obtained equipment and that supplied by MPCU, including an inert gas generator, a power pack and two compressors, were delivered on board SEA EMPRESS. At about 0600 hrs the Assistant Salvage Master went to the Milford Haven Dry Dock, where work had been undertaken throughout the night manufacturing the blanks and gas connections, to check on progress and present a further list of requirements. Shortly afterwards the Salvage Master updated the Assistant Salvage Master by telephone of the progress on board during the previous night. This information was conveyed to the Harbour Master and MPCU at the

morning meeting held in the Coastguard Station. At a subsequent meeting that morning the Harbour Master agreed to the casualty being brought into the Haven after the draught was reduced. This would involve transferring between 25,000 and 30,000 tonnes of cargo into STAR BERGEN whilst the casualty remained in the 'pool'.

- D.2.14 Concern was expressed about controlling the casualty in the predicted wind and sea and the strong northeast/southwest tidal stream with the available tugs. However, the salvors gave the assurance that with two further tugs due to arrive on scene on Saturday morning (ANGLIAN EARL (84 tbp) and ESKGARTH (50 tbp)) they would have a total nominal bollard pull of 417 tonnes available and they considered this was enough for their purpose.
- D.2.15 Some difficulty had been experienced in controlling the casualty in the wind, sea and tidal conditions that existed during the night. In the early hours of Saturday a suggestion evolved between an MPCU adviser, a representative of Cory's and a pilot on board SEA EMPRESS that the casualty should be turned around to face the gale that was predicted for later that day. It was generally considered to be good seamanship to turn the bows of the casualty into the weather and at about 0800 hrs this suggestion was put to the Salvage Master. The matter was also discussed with the relief pilots and Cory's Fleet Manager. Nobody was opposed to the idea and it was collectively agreed that the turn should take place during slack water on the high tide that afternoon.
- D.2.16 By 0900 hrs the water level in the pump room had been lowered sufficiently to permit the use of the compartment's own ventilation system. Pumping to lower the water level continued, the pumps being regularly adjusted to avoid discharging any oil that was on the surface of the water, until about 1345 hrs when the water was level with the floor plates on the starboard side.
- D.2.17 At about 1100 hrs a meeting was convened on board by Cory's Fleet Manager and attended by Smit Tak's Salvage Master and Naval Architect, the Masters of THORNGARTH (45 tbp) and TITO NERI (50 tbp), two Acomarit representatives, the Master and Chief Officer of SEA EMPRESS, an MPCU adviser and two pilots. The discussion was based on how and when the proposed turn would be executed, not whether it should be undertaken. There was no disagreement regarding the requirement to turn the vessel, either from those concerned on board or from the authorities ashore. One of the pilots had taken it upon himself to compile a sequence of events for the turn and this was presented to the meeting. The subsequent discussion was on an ad hoc basis, however all those present agreed on how the operation was to be undertaken.
- D.2.18 At 1300 hrs SMIT ORCA arrived and within an hour had off-loaded an inert gas plant. She was then designated to provide an operational base close to the casualty for the salvors.

- D.2.19 At 1402 hrs, three hours and six minutes before predicted high water, with seven tugs connected (ANGLIAN DUKE (100 tbp), ANGLIAN EARL (84 tbp), TITO NERI (50 tbp), ESKGARTH (50 tbp), STACKGARTH (43 tbp), DALEGARTH (45 tbp) and THORNGARTH (45 tbp)), the turning operation commenced by starting to weigh the starboard anchor. At about 1406 hrs with one shackle remaining on the starboard cable, the heaving of the port anchor commenced. At 1429 hrs it was realised that the anchor cables were fouling each other and efforts to free them were unsuccessful. Mindful of the limited time before slack water it was decided to continue the operation despite the anchors possibly still touching the bottom.
- D.2.20 The turning manoeuvre continued until the casualty was heading towards the entrance to the Haven and moving towards the southwest corner of the 'pool'. It is reported that at this time the more experienced pilot, without prior consultation with the Salvage Master, telephoned the Harbour Master advising that the casualty was in a position to be taken to sea, presumably inferring that he wanted instructions to this effect. The Harbour Master agreed with the pilot that he too would like to see the casualty taken to sea. However, the Harbour Master's view was that it would be unsafe to do so and taking into consideration the advice of members of the Marine Team he stated that the casualty should not be taken out to sea. It should be noted that the salvors had already expressed their reluctance to take such action.
- D.2.21 Having turned the casualty the pilot positioned her, as he had planned, in the extreme southwest corner of the 'pool'. Once in position the anchors, which were still crossed, were paid out to 11 shackles each. This operation was aided by the seven attending tugs, although THORNGARTH (45 tbp) was now pushing on the starboard quarter, having parted her line earlier.
- D.2.22 The intention had been for the casualty to lie in the centre of the 'pool' with the forecasted gale force wind just on the starboard bow. As the anchor cables were walked back the tugs, assisted by the casualty's main engine, moved the casualty astern and into position. When the anchor cables had been paid out to 11 shackles which was completed by 1636 hrs, the process of redeploying the tugs against the forecast bad weather commenced (see Figure 3). Thereafter followed a sequence of events which dramatically changed the course of the salvage operation.
- D.2.23 At about 1705 hrs DALEGARTH (45 tbp) was ordered to reposition on the port quarter in accordance with the predetermined plan for holding the casualty in the forthcoming gale. However DALEGARTH (45 tbp) had a problem in making fast and was set down onto ANGLIAN DUKE (100 tbp) resulting in minor structural damage to DALEGARTH (45 tbp) and the loss of her tow line. At the same time THORNGARTH (45 tbp) was dispatched to pick up a replacement towing rope thus for a short time leaving five tugs to attend the casualty. At 1735 hrs after receiving a new rope THORNGARTH (45 tbp) made fast on the starboard quarter.

- D.2.24 At 1745 hrs the pilot who was plotting the casualty's position detected that she was drifting out of position by which time the ebb tide had begun to take effect. The main engine and steering gear were employed in an attempt to arrest the casualty's drift. The change in the tide put it in opposition to the wind, creating a short sea which made it difficult for the tugs to maintain station and caused the tow lines to snatch. As the ebb tide strengthened the casualty began to drift towards the west. At 1755 hrs, following the shortening of the tow line prior to its repositioning, ANGLIAN DUKE (100 tbp) was instructed to apply full power. Compliance with this order resulted in the tow line parting, to be followed by that of TITO NERI (50 tbp). At 1800 hrs DALEGARTH (45 tbp) made fast on the port quarter but the tugs were unable to arrest the bodily drift of the casualty as she moved to the west, on a southerly heading, into shallower water. The movement of the casualty seemed to surprise everybody; it had been thought that the direction of the tidal stream was in line with the channel, not across it, and the strength of the tidal stream at that time was far greater than anticipated. The casualty had been positioned, inadvertently, with the force of the ebb tidal stream acting on her port side.
- D.2.25 In a preceding section of this Report (Section 4) reference is made to a numerical model which describes the tidal streams in the 'pool'. It is apparent, from this model, that the ebb tidal stream runs in a westerly direction across the major part of the 'pool'.
- D.2.26 The computer generated model of the tidal streams at the entrance to Milford Haven suggest that, following the turn, the velocity of the ebb tidal stream in the vicinity of the casualty was nearly 50% greater than before. This difference was due mainly to the increasing strength of the tides as they approached springs and partly to the casualty having been repositioned slightly further south and west. The effect of this increase in tidal velocity would have been to approximately double the tidal forces exerted on the casualty. It has been calculated that the maximum force on the casualty's underwater hull form, due to the tidal stream on the beam, had increased to a figure in the order of 570 tonnes. This force would have increased still further as the casualty was carried into shallower waters and probably exceeded 700 tonnes before the casualty grounded. It is clear that even if the assembled tugs had been deployed against this unexpected tidal stream, their combined nominal bollard pull of 417 tonnes was inadequate for the circumstances which actually prevailed.
- D.2.27 As SEA EMPRESS drifted out of control she had become beam on to the tidal stream. She grounded on Saint Ann's Head Shoal at 1805 hrs. It was concluded that the anchors, which were leading out on the port bow, were affecting the ability of the after tugs to turn the stern of the casualty into the tidal stream, so lessening the forces on the hull. A decision was made, principally by the more experienced pilot, to slip the anchors so that the stern could be towed to the east and allow the bows to fall off to the west. This was agreed by the Master and the Salvage Master.

D.2.28 The Smit Tak salvage crew under the Salvage Master's instructions released the bitter ends of the anchor cables at 1812 hrs. However, with the anchor cables slipped, the casualty did not behave as had been predicted and the tugs were unable to refloat her. The casualty was fast aground with the stern about 2.5 cables southwest of Saint Ann's Head Lighthouse on a falling tide (see Figure 3).

Conclusions

D.2.29 With the arrival of the Smit Tak team and their re-assessment of the damage to the casualty consideration was given by them to the various options for the salvage of the casualty. However, discussions with the Marine Team resulted in the decision being taken to leave the casualty in the 'pool' and lighten her as agreed earlier.

D.2.30 The decision by all parties to turn the casualty was understandable and based on good seamanship practice and the available information. However, the principal reason for the loss of control of the casualty after the turn on Saturday was that not enough consideration was given to the effect of the tidal stream and she was positioned further south and across the direction of the ebb tide.

D.2.31 The most important factor in the loss of control of the casualty was that the exact nature of the tidal pattern in the vicinity of the southern area of the 'pool' was not fully understood by all concerned.

D.2.32 The decision to slip the anchor cables, which with hindsight may be shown to have been unfortunate, was an operational decision that had to be made rapidly and was taken in good faith with the expectation that it would resolve the immediate problem.

D.2.33 The decision not to take the casualty to sea, because it was considered too dangerous, was correct.

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 become 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).

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 tdp) 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 tpb) 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).
- 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). 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 tpb) 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 tpb) was not used to best advantage.

SALVAGE STRATEGY AND EXECUTION - PERIOD 5

General

D.5.1 Period 5 covers the time from 0900 hrs to 2245 hrs on Monday 19 February.

The wind veered to the north during this period, mainly force 6/7 which generated a moderate sea. There were occasional periods of poor visibility due to snow.

The weather forecasts issued at 0815 hrs, 0825 hrs and 2054 hrs on Monday 19 February, predicted a northerly wind of force 5/6 gusting to force 8/9 but easing slightly after midnight.

The two morning extended forecasts predicted that the wind would veer overnight towards the northeast, force 5/6 with gusts to force 8. Over the rest of Tuesday the wind would continue to ease to force 4/5 with gusts of force 8 and would be mainly force 4 by Wednesday morning.

Predicted low water at Milford Haven was at 1243 hrs with high water at 1839 hrs.

Sunset on Monday was at 1742 hrs.

Narrative and Discussion

D.5.2 Two of the MPCU advisers had been airlifted to the casualty at about 0830 hrs. There had been a misunderstanding between the salvors, MPCU and the helicopter pilot, and eight salvors had to travel to the casualty by boat. They arrived on board at 0900 hrs, at which time the casualty was reported as having grounded to the north of Middle Channel Rocks Light with ANGLIAN DUKE (100 tbp) and ANGLIAN EARL (84 tbp) attached. Not long after this the Acomarit superintendents and four of SEA EMPRESS's engineering staff boarded the casualty. At this stage it was the salvors' intention, as stated at the meeting the previous evening, to hold the casualty in position whilst preparing for a planned refloating which would enable it to be taken to the position where it was proposed to moor the casualty with ground tackle.

D.5.3 It was the salvors' intention upon returning to the casualty on Monday morning to restore the main electrical supply and the boilers, thus permitting the use of the inert gas plant and the deck machinery. Having experienced difficulties with activating the generators the previous day, the salvors requested and received the services of SEA EMPRESS's engineers to carry out this work.

- D.5.4 At a meeting convened by the Marine Team at 1030 hrs, the senior MPCU adviser, acting on behalf of MPCU, made a point of officially expressing concern about the late arrival on site of the salvors and what he perceived as a lack of overall control. Further, the salvors were criticised for not preparing a list of the mooring equipment required from the Admiralty Salvage and Mooring Depot, and for not having a formal salvage plan readily available. Questions were also raised as to who in the salvage consortium was in charge, and who was the responsible person.
- D.5.5 The Senior Salvage Master vigorously defended the salvors' position by explaining that MPCU had advised the salvors that there was a problem with helicopter transport, and that this was why they had travelled to the casualty by boat. Further they were, at the time of the meeting, still considering their requirements for mooring equipment before making a formal request. He concluded by stating that Smit Tak were in charge both ashore (his role) and on board the casualty through the Salvage Master. This position was confirmed by the representative from Cory's.
- D.5.6 Once the electrical supply was restored on board the casualty the salvors once again commenced pumping out the water from the pump room. They then commenced to prepare the cargo and ballast tanks ready for pressurisation. However an assessment of the damage indicated that any eventual transfer of cargo would have to be over the top. Meanwhile with the aid of the MoD Chinook helicopter the salvage equipment, including two compressors and an inert gas plant, was transferred to, or moved around the casualty. Simultaneously measurements were taken of the oil remaining on board.
- D.5.7 During the morning the MPCU advisers continued to express their concern about the low priority given to controlling the movement of the casualty. There was no pilot on board and moreover the main engine was not being made ready at this time despite the possibility that the casualty might float off on the afternoon's high tide. These concerns were communicated to those ashore, to the Salvage Master on board, and to the Acomarit superintendents. In reply it was stated by the Salvage Master that he did not wish to use the main engine because of the possibility that the shaft might be out of alignment due to previous groundings and that further damage might be sustained by its use.
- D.5.8 There is conflicting evidence concerning the preparation of the main engine for use during Monday. Once the main generators and the boiler had been restarted SEA EMPRESS's engineers commenced warming through the fuel lines of the main engine, which contained heavy fuel oil. The heavy fuel oil had been cooling for about eighteen hours and thus was increasing in viscosity. This procedure could be seen as a preliminary measure to starting the main engine, and the conflict in the evidence makes it unclear whether this procedure was undertaken on the initiative of the casualty's engineers or at the request of the salvors.

- D.5.9 At about 1228 hrs with the casualty still aground on an easterly heading, to the north of the Middle Channel Rocks Light, ANGLIAN DUKE (100 tbp) disconnected to change the Dyneema rope for her wire pennant. At 1352 hrs she reconnected the tow line through the centre lead aft while ANGLIAN EARL (84 tbp) was still fast forward. Consideration was given by the Salvage Master to using DE YUE (200 tbp), which was still at anchor, but he dismissed the idea as he considered she was not manoeuvrable enough. TITO NERI (50 tbp) had been standing by the casualty since about 0900 hrs that morning. Small local craft were being utilised to ferry personnel and equipment to the casualty. Repairs to STACKGARTH's (43 tbp) engines had been completed at 1315 hrs and she was ordered to the casualty, arriving at 1415 hrs. She stood by awaiting orders and at 1700 hrs was instructed to ferry stores and equipment from ashore to the casualty.
- D.5.10 ESKGARTH (50 tbp) was ordered to proceed to the casualty at 1445 hrs where she arrived at about 1600 hrs. However, the port was still open and immediately after connecting the tow line the tug was given fresh instructions to assist in berthing another vessel which had arrived at the port.
- D.5.11 At 1500 hrs the Salvage Master on board SEA EMPRESS advised the Senior Salvage Master ashore that he intended to hold the casualty in place overnight using additional tugs to those already on scene. At 1530 hrs THORNGARTH (45 tbp) and VANGUARD (23 tbp) respectively connected their forward tow lines immediately forward and aft of the casualty's port side manifold. Later TITO NERI (50 tbp), which was unable to maintain station due to her bow slipping on oil on the casualty's side, was repositioned to push on the port quarter.
- D.5.12 At 1540 hrs ANGLIAN DUKE (100 tbp) and ANGLIAN EARL (84 tbp) were ordered to tow on the casualty's starboard quarter and bow respectively. VANGUARD (23 tbp), TITO NERI (50 tbp) and THORNGARTH (45 tbp) were simultaneously instructed to push on the port side of the casualty to keep her against the north side of the Middle Channel Rocks. However their combined power was insufficient to control the vessel when she refloated.
- D.5.13 At 1630 hrs the Marine Team convened a meeting to discuss, amongst other topics, the outline proposals for the mooring of SEA EMPRESS. The senior MPCU adviser confirmed that a list of the equipment required had been received from Smit Tak and that rapid progress was being made to collect the various items together. The Senior Salvage Master estimated that the moorings would be laid by Wednesday.
- D.5.14 In reply to a question from the Harbour Master on whether seven tugs, the number stated earlier in the meeting, were enough to hold SEA EMPRESS, the Senior Salvage Master said that they would be sufficient. The meeting was later interrupted and adjourned for an hour by news that the casualty was moving up the channel.

- D.5.15 Despite the efforts of the five tugs that were trying to hold the casualty at the time, at about 1700 hrs, approximately 1 hour 40 minutes before the predicted high water, driven by the tidal stream the casualty began to move in a northerly direction into the channel. Clearly, the salvors had not anticipated that the casualty would refloat as they were not on the bridge at the time. As the casualty moved northward she turned to port until she was on the line of the 040/220 leading lights, with the bows heading 070° and the stern pointing towards the entrance to the Haven.
- D.5.16 At this stage one of the MPCU advisers on board contacted MPCU ashore and requested permission for the casualty to be taken to sea. This request was passed to the Overall Commander (The Coastguard Agency's Chief Executive) in the MEOR in Southampton. It was apparent that a decision was needed very rapidly and he granted permission for SEA EMPRESS to proceed to sea on the basis that; the request had come from the salvors, the Harbour Master was in agreement, the tugs were confident of success, and that the main engine started. The MPCU adviser on board recalled receiving a negative response to this request but this is not supported by the overwhelming evidence from those making the decisions ashore. The Overall Commander was not in possession of all the facts and what he had been told was misleading. He was unaware that there was not a pilot on board and unaware that the vessel would be taken out stern first and it had been inferred that the request had originated from the salvors. This indicated a weakness in the communications between the Overall Commander in Southampton and his advisers on board. The Harbour Master had agreed to the request but there had been a misunderstanding in the communication as the salvors had not initiated it. In any case the question became academic when the engine was reported as unready to start. The Salvage Master apparently was unaware at the time of the above mentioned events.
- D.5.17 The Salvage Master recalled that with SEA EMPRESS afloat, in the channel and heading towards the port, he requested the use of the casualty's main engine, fully expecting it to be ready for starting. However, the SEA EMPRESS's engineers were still heating the heavy fuel oil to clear it from the system and the main engine could not be started. The Salvage Master has stated that, had the main engine started, his intention was to either try to hold the casualty in the 'pool' or run her into the channel towards the port until she grounded. Had he been able to take advantage of this opportunity the outcome of the incident may have been significantly altered.
- D.5.18 Despite the efforts of the tugs SEA EMPRESS drifted under the influence of the tidal stream north and then west towards the rocks off the southeast corner of Saint Ann's Head so that the tugs on the port side were working in increasingly shallow water. Eventually they had to be released, leaving ANGLIAN DUKE (100 tpb) and ANGLIAN EARL (84 tpb) to work on the casualty from the starboard side.

- D.5.19 By the time the 1630 hrs Marine Team meeting was reconvened SEA EMPRESS was once again aground. Under the influence of the tidal stream she had been swept aground at 1815 hrs and she lay, heading 040°, 3.3 cables south-southwest of Saint Ann's Head (see Figure 4). On this occasion the casualty had grounded at the top of high water and in effect the situation had therefore been stabilised by default, albeit in a very exposed location.
- D.5.20 The tow line of ANGLIAN DUKE (100 tbp) was fouled on the bottom and after it was cleared she extended it to 400 metres and, in company with ANGLIAN EARL (84 tbp) which was secured at the bow of the casualty, awaited instructions. TITO NERI (50 tbp) was instructed to return to Milford Haven to collect a new tow line.
- D.5.21 As the tide dropped the casualty grounded along her entire length, and the list reduced from 10° to 7°. The explosive level was high in all the damaged tanks and the salvors commenced to purge all tanks with inert gas to reduce the risk of explosion in the event that the casualty started to break up.
- D.5.22 A further meeting of the Marine Team took place at about 2100 hrs. The salvors who had moved out of the Coastguard Station into offices in Milford Haven did not attend this meeting. From this point onward the salvors' principal contact with the Marine Team was through the Harbour Master who passed on their plans and views to the meeting. A broad outline salvage plan, that had been formulated by the Senior Salvage Master in conjunction with the Salvage Master, was presented to the meeting by the Harbour Master. This indicated that all the damaged tanks would be air locked at low water to provide the necessary buoyancy to float the vessel on the high water at 0703 hrs the following morning. The main engine would be prepared for manoeuvring and at the next high water, with the assistance of one of the additional tugs which was due to arrive imminently, the casualty would be refloated. Thereafter the casualty would be beached in a position south of the Angle Buoy (see Figure 5). Apparently the meeting went on to discuss amongst other topics the prerequisites for towing the casualty free, namely that the casualty should be on an even keel, upright and at a draught to ensure a good chance of success; also that the engine and steering gear were to be operational. The matter of where to place the casualty after it was refloated was mooted and it was generally agreed that the target area for beaching was to be south of the Angle Buoy. The proposition that the casualty should be taken directly to Herbrandston Jetty was rejected because this would entail proceeding along the main channel. If the casualty foundered during transit she would block the channel and close the port for an indefinite period. The meeting was adjourned indefinitely when it was advised that loud noises were emanating from the casualty, and that the salvors had been evacuated.

- D.5.23 At about 2115 hrs the casualty had started to pound against the sea bed, and the decks were seen to flex. By 2155 hrs she was pounding heavily and as all the damaged tanks were still at explosive levels the Salvage Master ordered that nobody was to proceed forward of amidships. At 2200 hrs there were reports of heavy cracking/banging sounds in way of amidships and the Salvage Master decided that the casualty should be evacuated. At 2215 hrs THORNGARTH (45 tbp) was ordered alongside the casualty to evacuate the 21 people on board.
- D.5.24 By 2245 hrs all those on board had been evacuated and THORNGARTH (45 tbp) then proceeded to anchor. ANGLIAN DUKE (100 tbp) and ANGLIAN EARL (84 tbp) remained connected to the casualty on extended tow lines with instructions to act as necessary in the event of an emergency. By 2257 hrs the wind was north-northeasterly 20 knots, gusting 30 knots.

Conclusions

- D.5.25 Whilst tugs were available they were deployed in insufficient numbers. This is considered to be indicative of an underestimation of the tug power needed to hold the casualty in position aground which was a consequence of a lack of understanding of the effects of the tidal streams in the area.
- D.5.26 There should have been better communications between the salvors and Acomarit representatives concerning the preparations necessary to run the main engine.
- D.5.27 The suggestion from the MPCU adviser that the casualty should be taken to sea stern first through a narrow entrance, without a pilot on board, was ill conceived and little more than a desperate measure.

SALVAGE STRATEGY AND EXECUTION - PERIOD 6

General

D.6.1 Period 6 covers the time from 2245 hrs on Monday 19 February to 2000 hrs on Tuesday 20 February.

The wind remained from the north, or north-northeast, force 6 but reducing to force 4 towards the end of the period.

The weather forecast at 0817 hrs on Tuesday, predicted a north-to-northeasterly wind of between force 5/7 gusting force 8/9. For the second half of the period, the forecast issued at 2050 hrs predicted the wind to decrease to force 3/4 with gusts to force 6 at first.

The Tuesday morning extended forecast predicted that the wind would decrease to force 4 by midday on Wednesday from the northwest.

Predicted low water at Milford Haven on Tuesday was at 0103 hrs, followed by high water at 0659 hrs, then low water again at 1326 hrs and finally high water at 1922 hrs.

Sunrise on Tuesday was at 0724 hrs, and sunset at 1744 hrs.

SERS was activated at 0940 hrs and remained operational until stood down at 2335 hrs. During this time they provided information on longitudinal bending moments and shear forces, refloating draughts and angles of list for the casualty.

Narrative and Discussion

D.6.2 At about 0840 hrs the Smit Tak salvage team comprising 11 people, together with the MPCU advisers, returned on board the casualty, to be joined at 1015 hrs by some of SEA EMPRESS's engineers. Whilst the casualty's staff prepared the generators, boilers and main engine for use, the salvors assessed the condition of the tanks, together with the damage that had been sustained during the night. They also assessed the work to be undertaken to prepare the casualty for refloating and beaching her in the target area previously specified.

D.6.3 At a meeting of the Marine Team at 1100 hrs the Harbour Master reiterated the plan which had been made the previous evening for refloating the casualty on high water on Tuesday evening and beaching her in the previously specified area. No one from MPCU, their advisers or the salvors was present, however an experienced pilot was. He expressed concern about a lightening operation in the specified beaching area due to its exposed location. It was suggested that the

"Explosives" mooring should be used but it was rejected as it would involve use of the main channel with subsequent risk to the port. The pilot then suggested that the operation should have a proposed ultimate goal but with options to proceed to other areas if, in the event, it proved necessary or sensible. This was accepted in theory so long as it did not involve moving the casualty in the combined part of the channel. As it was felt that there might be communication problems with the tug masters who were unfamiliar with the port it was agreed to place a pilot on each of these tugs.

- D.6.4 On board the casualty the salvors intended to establish which tanks were damaged and then pressurise the ullage spaces of a selection of these tanks with inert gas at low water. Thereafter they proposed to seal these tanks so that the rising tide would increase the pressure within the tanks producing sufficient buoyancy to raise the casualty. The salvors were aiming to attempt a refloating on the evening high water, which involved an extremely intensive work schedule if preparations were to be completed in time. Further salvage equipment was ordered from ashore to assist in achieving this aim.
- D.6.5 Electrical power was restored at 1040 hrs and pumping out of the pump room resumed. Despite the ebbing tide the casualty continued to work against the rocky bottom and was occasionally noted to pound. At about 1045 hrs, after one particularly severe movement, copious quantities of oil were seen flowing from the forward starboard side of the hull. A further eight salvors from Smit Tak joined the vessel at 1230 hrs.
- D.6.6 In the early afternoon the Overall Commander reminded the MPCU Local Commander that he needed to formally approve all salvage plans. A copy of the plan that had been tabled and discussed at the Marine Meeting held on the previous evening was faxed to the MEOR. After discussing this plan, as updated by subsequent events, with the Harbour Master and MPCU Local Commander it was formally approved by the Overall Commander. The plan was explained to the Secretary of State for Transport who was content, as was the Secretary of State for Wales. A letter was drafted and a faxed copy was passed to Cory Towage indicating the formal acceptance of the general plan.
- D.6.7 With the approach of low water, and the condition of the casualty rapidly deteriorating, the Salvage Master decided that, if there was going to be a realistic chance of refloating the casualty on the next high water, the ballast tanks would have to be pressurised with air, notwithstanding the safety factor, and not the slower process of using inert gas. By low water, the Fore Peak and No 4 Starboard Ballast tank had been closed off ready for pressurisation. However due to lack of time pressurisation with compressed air was not commenced and in the latter stages pressure was generated by the rise of the tide. By 1400 hrs No 1 Centre Cargo tank and Nos 1, 5 and 6 Starboard Cargo tanks were similarly prepared but at 1610 hrs pressurising of the ullage spaces with inert gas was stopped.

- D.6.8 In the interim the main engine had been prepared and, together with the steering gear, were tested and found to be satisfactory and an experienced pilot was on board. The tugs ANGLIAN DUKE (100 tbp), ANGLIAN EARL (84 tbp), DALEGARTH (45 tbp), THORNGARTH (45 tbp) and the newly arrived VIKINGBANK (62 tbp) were made fast to the casualty. The tugs STACKGARTH (43 tbp), ESKGARTH (50 tbp) and TITO NERI (50 tbp) were in attendance to push where and when required. By 1615 hrs they were ready for the attempt to refloat SEA EMPRESS.
- D.6.9 Prior to attempting to refloat the casualty there was a disagreement between the salvors on board about the plans for the casualty. This was settled by the Salvage Master who stated that the agreed plan was to beach the casualty to the south of Angle Buoy. In a separate incident the pilot suggested that he had in mind an alternative plan for the casualty. Concern about this was relayed back to MPCU ashore by their adviser on board. As a result the MPCU Local Commander and the senior MPCU adviser went to the Signal Station armed with an Intervention Order to prevent any deviation from the agreed plan. The Signal Station had been locked so that those within would not be disturbed during the float-off attempt. They were eventually let in to see the Harbour Master who instructed the pilot on board that he was to comply with the agreed plan.
- D.6.10 However, the agreed plan was changed at the last moment with the agreement of MPCU. Soon after the visit to the Signal Station by the MPCU Local Commander and the MPCU's senior adviser, the MHPA General Manager contacted MPCU concerning the possibility that the casualty could go directly to Herbrandston Jetty should the float-off attempt prove successful. This plan was verbally agreed by MPCU under certain conditions. During the initial stages of the float-off attempt the Harbour Master passed this permission to the Senior Salvage Master in the Signal Station who in turn passed it to those on the casualty.
- D.6.11 Although the casualty was probably afloat at an observed mean draught of about 16.6 metres, despite all the tugs' efforts and the use of the main engine, she could not be pulled clear of the bank on the high water. Whilst the casualty's heading could be changed about 15° to port and starboard, she could not be moved bodily from the location. The assumption at the time was that the vessel was pivoting about a pinnacle of rock at some point near the midsection of the hull. However from a subsequent examination of the circumstances it is more probable that it was the force of the tidal stream on the casualty's beam which kept her pinned in position. By 1945 hrs when the tide was falling, it was realised that the operation to refloat the casualty had failed.

D.6.12 Again the casualty grounded, probably over the greater part of her length (see Figure 4). There were creaking sounds from low down in the area of amidships and it was decided to evacuate her for the night. Prior to departure the salvors depressurised the cargo tanks in order to reduce the buoyancy in the hull. The tugs which had been pushing were dismissed but ANGLIAN DUKE (100 tbp), ANGLIAN EARL (84 tbp) and VIKINGBANK (62 tbp) remained made fast to the bow of SEA EMPRESS by their tow lines, though they extended the length of them and also anchored. Plans were then made to obtain more salvage equipment for the following day's operations.

Conclusions

- D.6.13 The salvors had insufficient time to allow an adequate number of tanks to be closed down and pressurised enough before the attempt to refloat her.
- D.6.14 The casualty was not pivoting about a pinnacle of rock but was being held against Saint Ann's Head Shoal by the strength of the tidal stream. (See Figure 9.)
- D.6.15 The available tug power was insufficient to overcome the forces of the tidal stream acting on the beam of the casualty.
- D.6.16 As the tide increased in height that afternoon and after the casualty refloated, the strong tidal stream on the beam moved her to the west and into shallower waters.

SALVAGE STRATEGY AND EXECUTION - PERIOD 7

General

D.7.1 Period 7 covers the time from 2000 hrs on Tuesday 20 February to 2400 hrs on Wednesday 21 February.

The wind abated on the night of the 20/21 February but remained northerly. For the period of the salvage operation on Wednesday the conditions were calm with a few snow showers.

The weather forecast issued at 0817 hrs predicted the wind to be northerly force 3/4 gradually backing to westerly for later that evening.

Predicted low water at Milford Haven on Wednesday was at 0145 hrs, followed by high water at 0742 hrs, then low water again at 1408 hrs and finally high water at 2003 hrs.

Sunrise on Wednesday was at 0722 hrs, and sunset at 1746 hrs.

SERS was activated at 1045 hrs and stood down at 2200 hrs. During this period they again provided detailed naval architecture support to the on board salvage operations. In addition a prediction of the refloating condition was calculated.

Narrative and Discussion

D.7.2 Immediately following the unsuccessful attempt to refloat SEA EMPRESS on the high water of Tuesday evening, a meeting was convened in the MHPA General Manager's office. Those present included the MHPA General Manager, the Senior Salvage Master, the Harbour Master and the senior MPCU adviser. The senior MPCU adviser chaired the meeting, which he opened by indicating that the Government were considering taking a more active role and as a consequence the salvors were to prepare a new salvage plan and assume no financial limitations; the cost for radical solutions would be considered for Government funding. The salvors returned to their offices in order to prepare a revised salvage plan. It was about this time that they heard that the casualty was going to be evacuated for the night.

D.7.3 Immediately after the meeting the Harbour Master warned other members of the Marine Team that it looked as though the Government were about to take over the salvage. The Surveyor representing the Owner's P & I interests, having been advised that the salvors had been told by the senior MPCU adviser to prepare a new salvage plan

regardless of cost implications, placed the salvors on notice that if they took unreasonable action he would not recommend compensation, if he considered it to be appropriate.

- D.7.4 The salvors submitted a written plan to a further meeting of the Marine Team at 2340 hrs that evening. MPCU, through the senior MPCU adviser, restated the Government's position, in that all innovative solutions were to be considered and that the Government would consider providing indemnity where necessary. The salvors stated that for the implementation of their latest salvage plan they would require all the available tug power in the port. The Harbour Master agreed to declare the port closed in order to concentrate on the salvage operation, thereby releasing three extra tugs. It was agreed that SEA EMPRESS should be taken to Herbrandston Jetty should the refloating attempt be successful. There followed a brainstorming session on possible actions if the attempt proved to be unsuccessful. The possibilities raised and briefly discussed included burning the remaining oil, destroying the casualty, and lightening her off Saint Ann's Head.
- D.7.5 In parallel, a meeting was held at the hotel being used by the salvors, between the salvors and the Acomarit representatives to resolve problems between the parties. Following the salvors' relocation of their office from the Coastguard Station there had been a lack of ready communication between the two organisations. The outcome of this meeting was a better understanding of their respective points of view, and it was resolved to hold regular meetings to improve communications.
- D.7.6 During the night some salvage equipment was prepared on board SMIT ORCA, and at about 0710 hrs all the Smit Tak salvage team returned to the casualty. A little later they were joined by the MPCU advisers, the Acomarit Superintendents and some of SEA EMPRESS's crew.
- D.7.7 The salvage plan followed the same pattern as that of Tuesday, with the addition of deballasting the Aft Peak and No 2 Port Ballast tank. However, the salvors did not contemplate an attempt to refloat the casualty on the high water in the morning as they needed more equipment and time for the necessary preparation work. A heavy-lift helicopter chartered by the salvors arrived at about 0715 hrs and was employed in air lifting large amounts of equipment during the daylight hours.
- D.7.8 During the morning Cory personnel and the pilots discussed the disposition of the tugs for the attempted refloating operation. In addition to the tugs used for the operation on Tuesday the additional Cory tugs in the port, ELDERGARTH (42 tbp), YEWGARTH (50 tbp) and PORTGARTH (50 tbp), together with VANGUARD (23 tbp) and the latest tug organised by Smit Tak, ARILD VIKING (145 tbp), would be available. In total 13 tugs were to be used, giving a combined total nominal bollard pull of 789 tonnes.

- D.7.9 The basis of the tug plan was to make an initial rotation of the casualty on to a northwesterly heading, with enough tug power to manoeuvre the casualty astern away from Saint Ann's Head, and swing her into the main channel. It was calculated that the casualty would not float until predicted high water at Milford Haven, by which time the tidal stream would be flowing in the ebb direction. Therefore it was important for ARILD VIKING (145 tbp), the tug with the greatest bollard pull, to hold the starboard quarter of the casualty up to the tide.
- D.7.10 The above plan was put to the Marine Team who approved it. It was also agreed that if the refloating was successful each phase of the passage of the casualty, with the attendant tugs, towards Herbrandston Jetty would be closely monitored. A number of contingencies were agreed should the passage not follow the agreed plan. Additionally it was agreed that if the casualty did not refloat and remained fast on the rocks then a lightening operation would commence the following day.
- D.7.11 The Overall Commander, Chief Executive of The Coastguard Agency, who had been based at the MEOR in Southampton throughout the incident, arrived in Milford Haven early on Wednesday morning. He had meetings with MPCU, MHPA and the salvors and was brought up-to-date on the latest developments.
- D.7.12 On board the casualty deballasting the Aft Peak, pressurising the damaged ballast tanks with air and cargo tanks with inert gas continued. This process was completed by 1607 hrs when the inert plant was closed down.
- D.7.13 By about 1630 hrs the salvage team had prepared the casualty for refloating, with the exception of the pump room which was too badly damaged to be pumped out. Despite minor difficulties, caused by a temporary lack of manpower, the tugs were eventually secured in their designated locations. The tugs ANGLIAN EARL (84 tbp), VIKINGBANK (62 tbp), ANGLIAN DUKE (100 tbp), ARILD VIKING (145 tbp), THORNGARTH (45 tbp) and DALEGARTH (45 tbp) were fast fore and aft, while TITO NERI (50 tbp), YEWGARTH (50 tbp), ESKGARTH (50 tbp), STACKGARTH (43 tbp), PORTGARTH (50 tbp) and ELDERGARTH (42 tbp) were all pushing on the port side of the casualty. The tug VANGUARD (23 tbp) was in attendance. Two pilots were on board the casualty. The Senior Salvage Master took charge of the salvage operations on deck, the Salvage Master had charge of the bridge, Cory's local Fleet Manager co-ordinated control of the tugs and the more experienced pilot had control of the manoeuvring of the casualty.
- D.7.14 At 1700 hrs the tugs commenced to take the weight on their tow lines. Despite the parting of at least one of the tugs' lines the casualty began to show signs of movement at about 1735 hrs. Problems were experienced in starting the casualty's main engine but at 1814 hrs these were overcome and the engine was then used. At 1900 hrs the

casualty began to float and at 1915 hrs she was towed into the channel at an observed mean draught of 11.95 metres (see Figure 4).

- D.7.15 SEA EMPRESS then proceeded under her own power and with the aid of the tugs without further incident directly to Herbrandston Jetty. The first lines were ashore at 2155 hrs and she was all fast alongside by 2400 hrs.

Conclusions

- D.7.16 The salvors, whilst under a great deal of pressure to produce results, were methodical and experienced workers who set about sealing and pressurising the tanks until the job of refloating the casualty was completed.
- D.7.17 On Tuesday night there was confusion amongst a number of the parties concerned as to whether the Government was going to take over the salvage operation.
- D.7.18 The successful outcome of the refloating attempt was due in the main to the greatly reduced draught of the casualty which allowed her to float over all obstructions. It is noteworthy that the draught of the casualty was such that she would have floated free at high water, and if not restrained by the tugs, would on a westerly flowing tide have cleared Saint Ann's Head Shoal and drifted out to sea. (See Figure 9.)

BEAUFORT WIND SCALE

(For an effective height of 10 metres above sea level)

Beaufort Number	Descriptive Term	Mean wind speed equivalent		Probably mean wave height* in metres
		Knots	m/sec	
0	Calm	<1	0-0.2	-
1	Light air	1-3	0.3-1.5	0.1 (0.1)
2	Light breeze	4-6	1.6-3.3	0.2 (0.3)
3	Gentle breeze	7-10	3.4-5.4	0.6 (1)
4	Moderate breeze	11-16	5.5-7.9	1 (1.5)
5	Fresh breeze	17-21	8.0-10.7	2 (2.5)
6	Strong breeze	22-27	10.8-13.8	3 (4)
7	Near gale	28-33	13.9-17.1	4 (5.5)
8	Gale	34-40	17.2-20.7	5.5 (7.5)
9	Strong gale	41-47	20.8-24.4	7 (10)
10	Storm	48-55	24.5-28.4	9 (12.5)
11	Violent storm	56-63	28.5-32.6	11.5 (16)
12	Hurricane	64 and over	32.7 and over	14 (-)

* This table is only intended as a guide to show roughly what may be expected in the open sea, remote from land. In enclosed waters, or when near land, with an off-shore wind, wave heights will be smaller and the waves steeper. Figures in brackets indicate the probable maximum height of waves.

DATED 29 AUGUST 1995

**MOD(N) SALVAGE AND MOORING OFFICERS (SALMOs)
TERMS OF REFERENCE FOR SECONDMENT TO MPCU**

PREAMBLE

1. SALMOs are seconded to the Marine Pollution Control Unit (MPCU) of the Coastguard Agency to provide specialist salvage advice and expertise. During the period of secondment the SALMO will be considered to be in effect an employee of the MPCU and will be empowered to act/undertake duties on behalf of the MPCU.

PRIMARY PURPOSE - THE ADVISORY ROLE

2. A SALMO's primary purpose is to:
- a. Provide specialist salvage advice and expertise to MPCU's designated overall On-Scene or Local Commanders, as appropriate.

SECONDARY PURPOSE - THE EXECUTIVE ROLE

3. A SALMO's secondary purpose is to:
- a. Provide support to MPCU's designated On-Scene or Local Commanders, as appropriate.
 - b. Deputise for MPCU's designated On-Scene or Local Commanders, as appropriate.

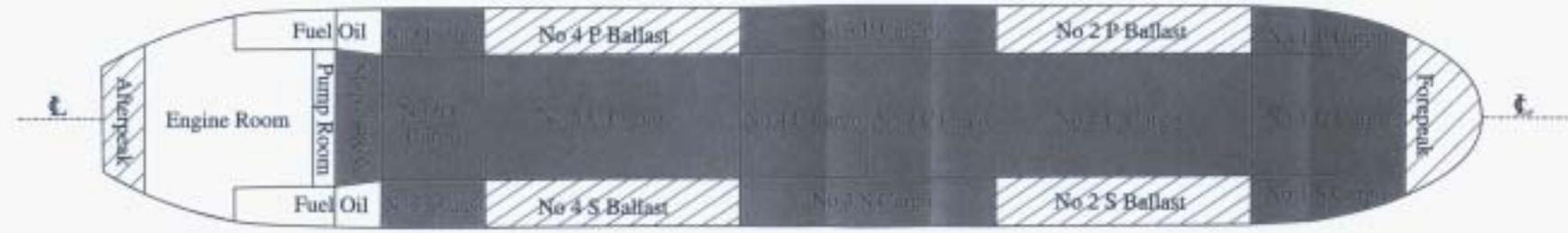
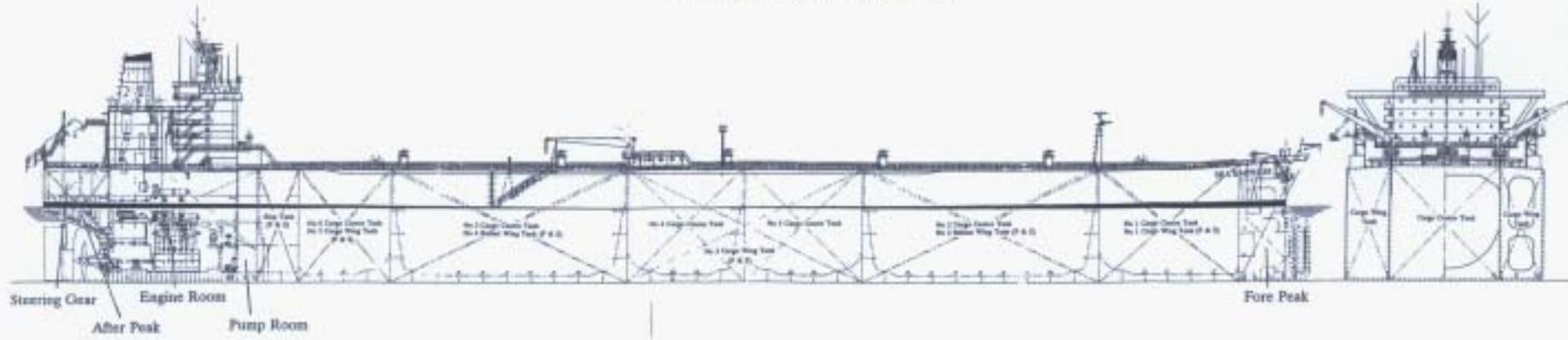
SUPERIORS

4. Whilst on secondment to MPCU, SALMOs will be accountable to the Overall Commander through the On-Scene or Local Commanders, as appropriate.

AUTHORITY

5. SALMOs on secondment to MPCU are authorised to:
- a. Supervise operations as directed.
 - b. Undertake operations using MPCU resources or MPCU contracted resources under the control of the On-Scene or Local Commanders.
 - c. Ensure, as far as reasonably practicable, that salvage operations are carried out in a safe manner.

SEA EMPRESS
General Arrangement and Tank Layout



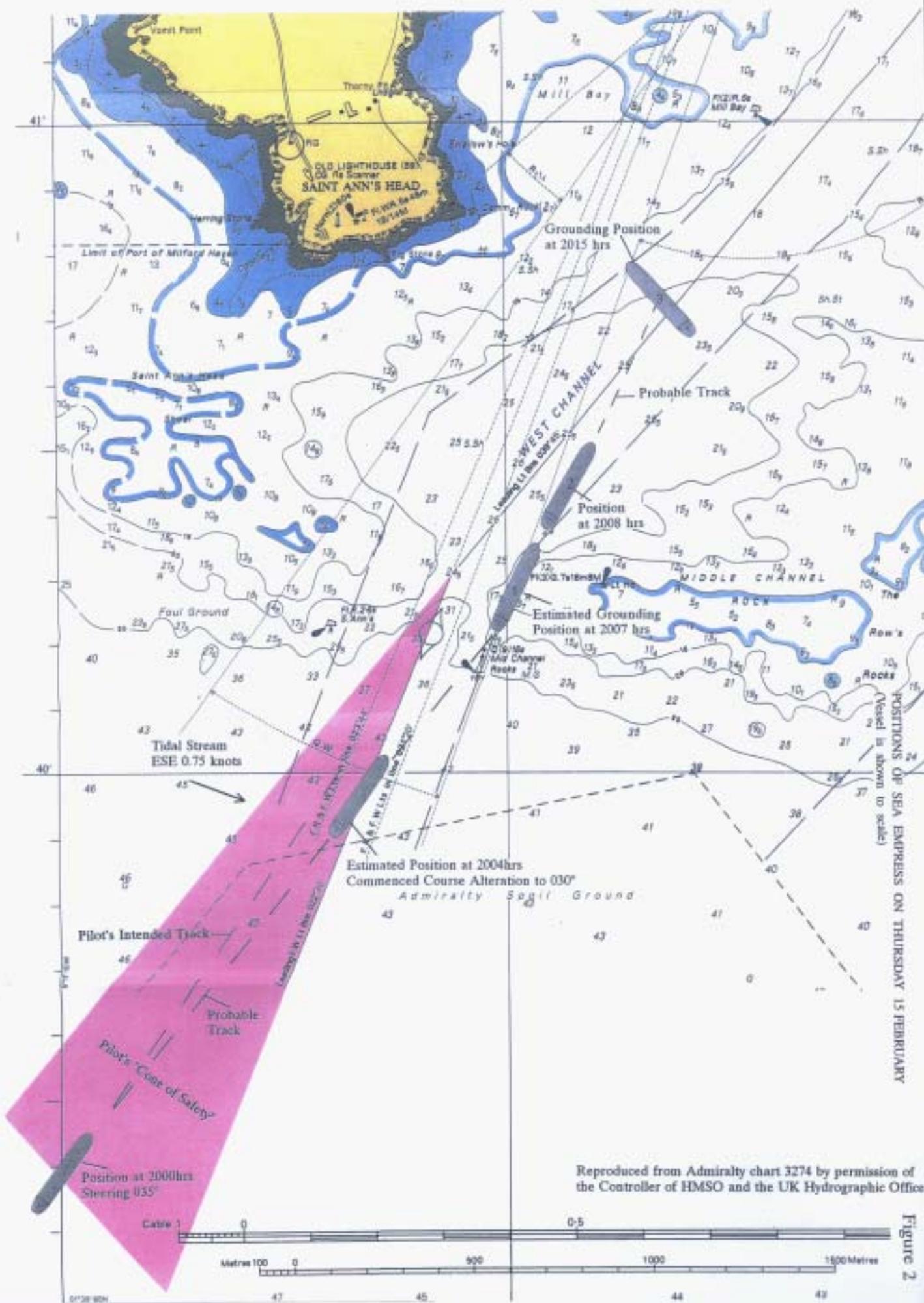
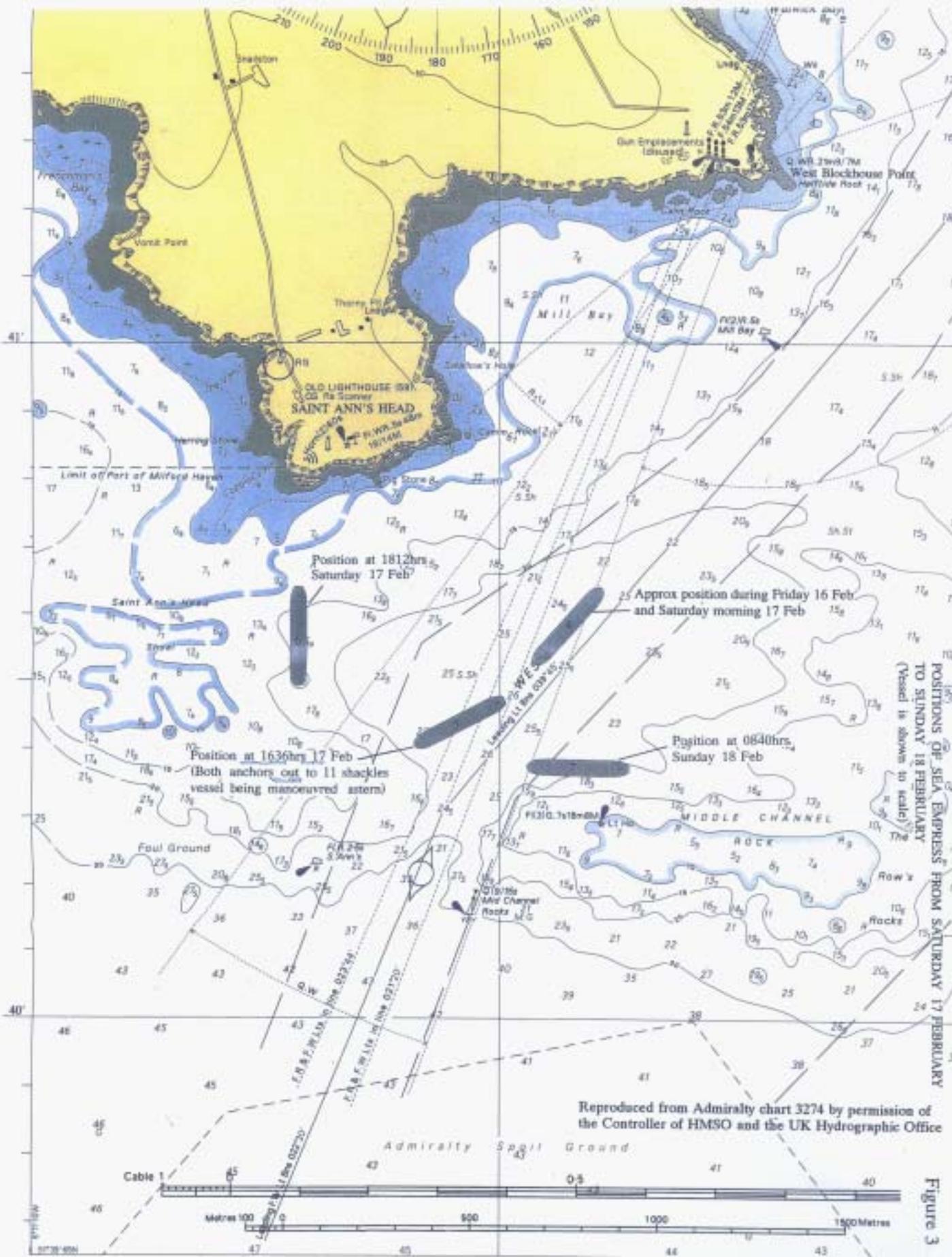


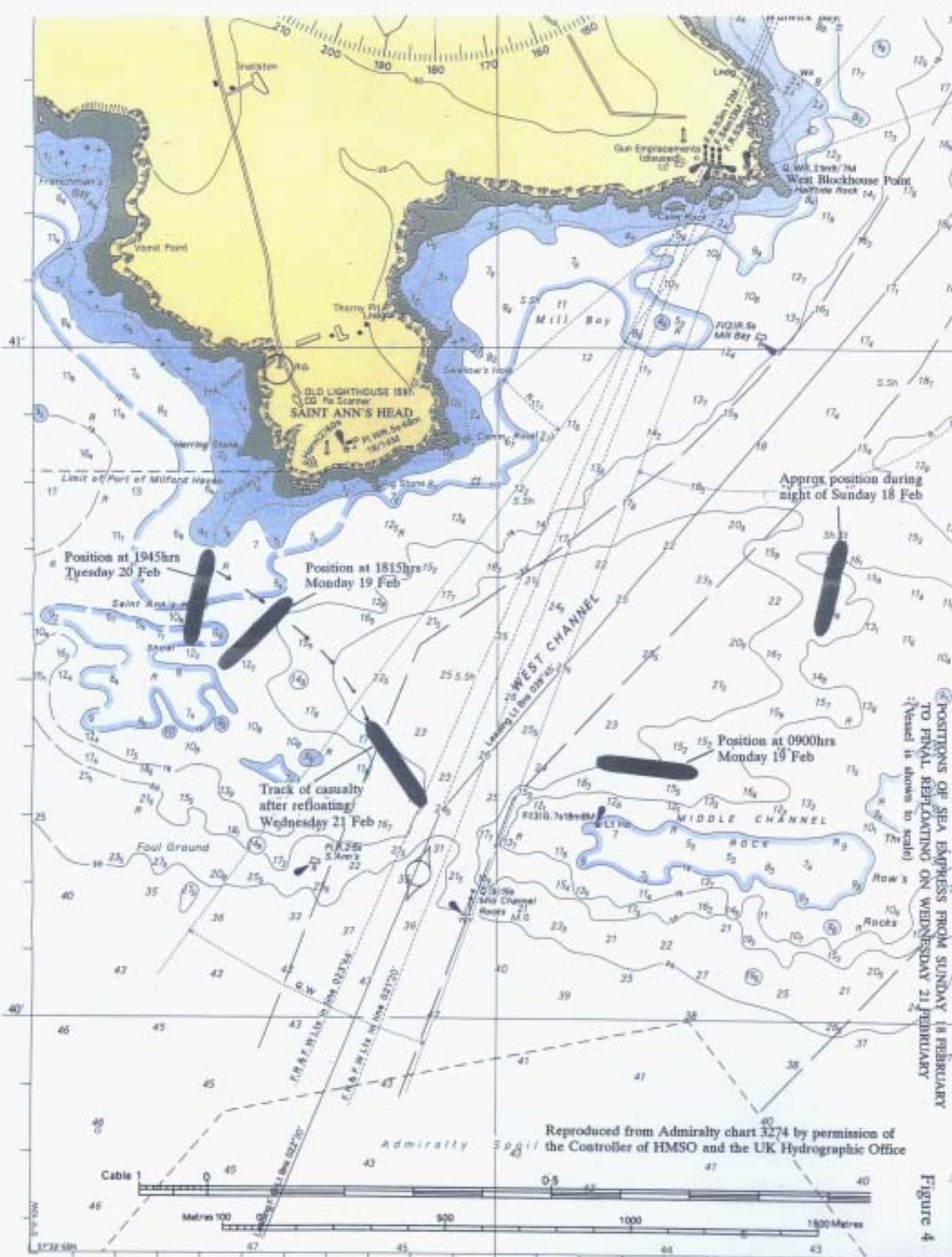
Figure 2

Reproduced from Admiralty chart 3274 by permission of the Controller of HMSO and the UK Hydrographic Office



POSITIONS OF SEA EMPRESS FROM SATURDAY 17 FEBRUARY TO SUNDAY 18 FEBRUARY (Vessel is shown to scale)

Figure 3

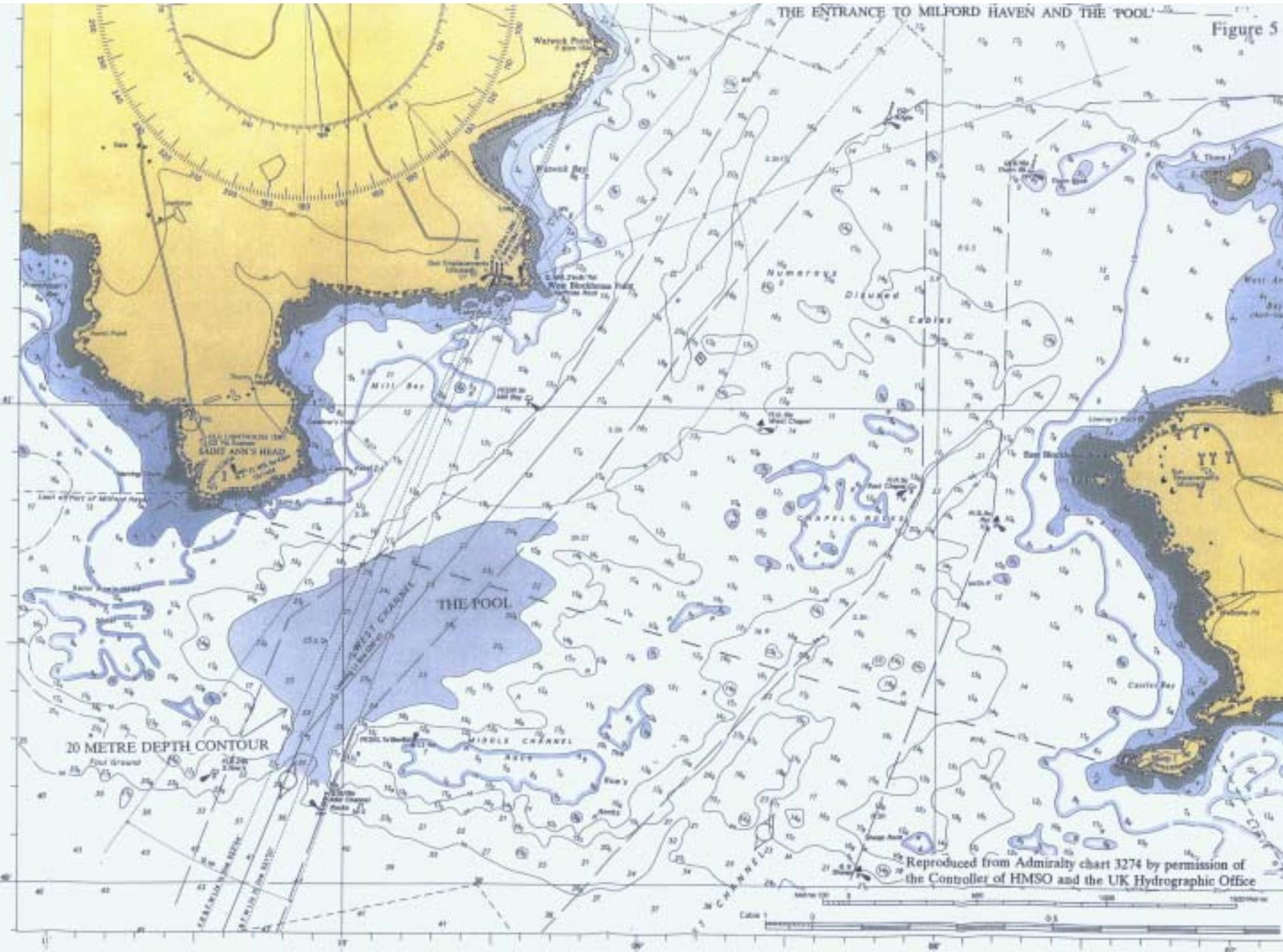


POSITIONS OF SEA EXPRESS FROM SUNDAY 18 FEBRUARY TO FINAL REFLOATING ON WEDNESDAY 21 FEBRUARY (Vessel is shown to scale)

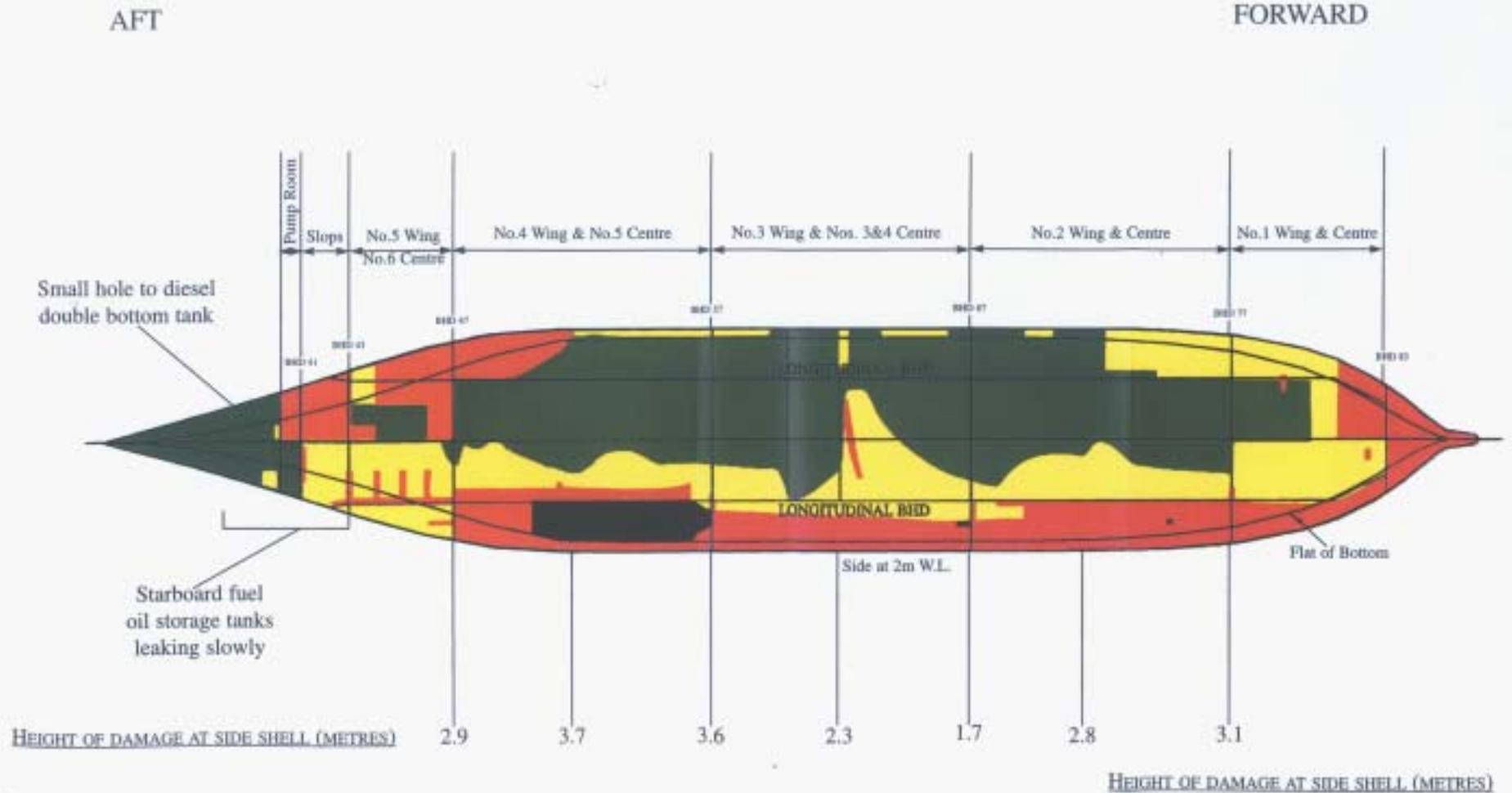
Reproduced from Admiralty chart 3274 by permission of the Controller of HMSO and the UK Hydrographic Office

Figure 4

Figure 5



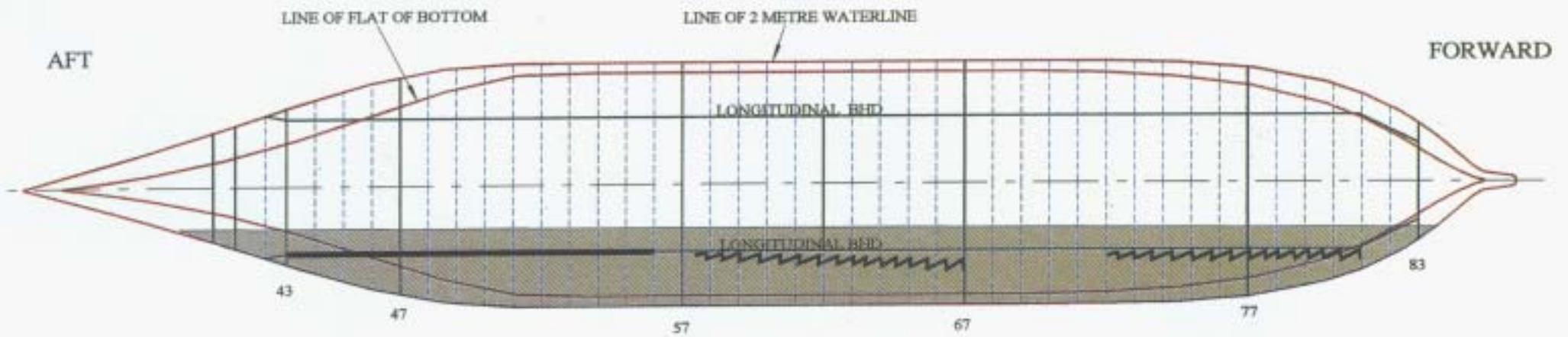
Reproduced from Admiralty chart 3274 by permission of the Controller of HMSO and the UK Hydrographic Office



Key

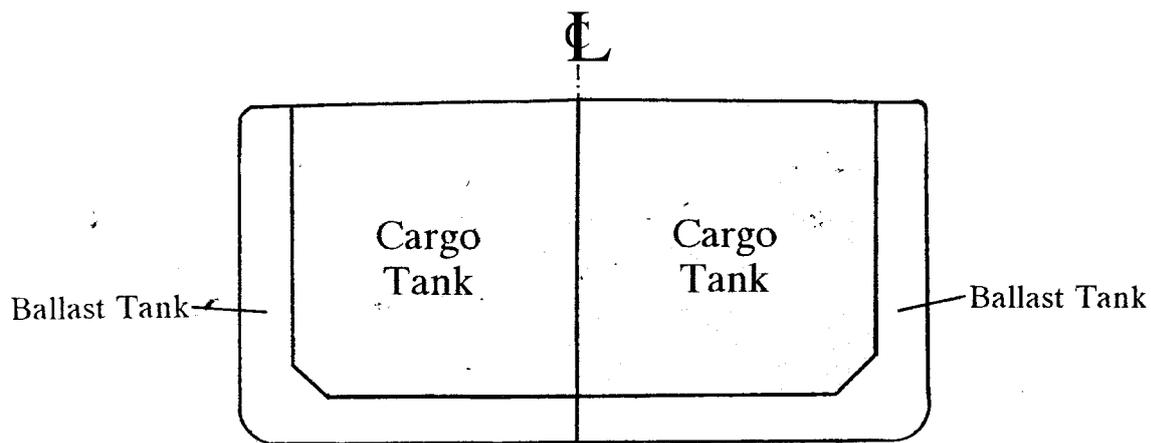
- | | | | |
|--|--|--|--|
| <p>Bottom Plating Missing</p> <div style="width: 20px; height: 20px; background-color: black; margin: 5px 0;"></div> | <p>Area generally holed</p> <div style="width: 20px; height: 20px; background-color: red; margin: 5px 0;"></div> | <p>Area deformed but not holed</p> <div style="width: 20px; height: 20px; background-color: yellow; margin: 5px 0;"></div> | <p>Area largely undamaged</p> <div style="width: 20px; height: 20px; background-color: darkgreen; margin: 5px 0;"></div> |
|--|--|--|--|

AN ESTIMATION OF THE EXTENT OF THE INITIAL DAMAGE TO SEA EMPRESS

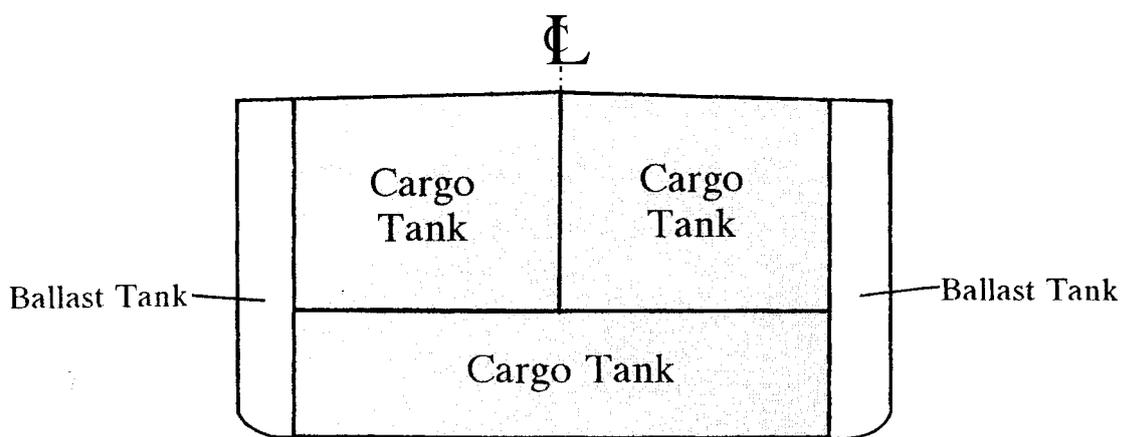


-  Continuous Longitudinal Fracture Lines
-  Continuous Longitudinal Furrows in Bottom Shell
-  Area Over Which Longitudinal Scratching And Damage Is Discernable

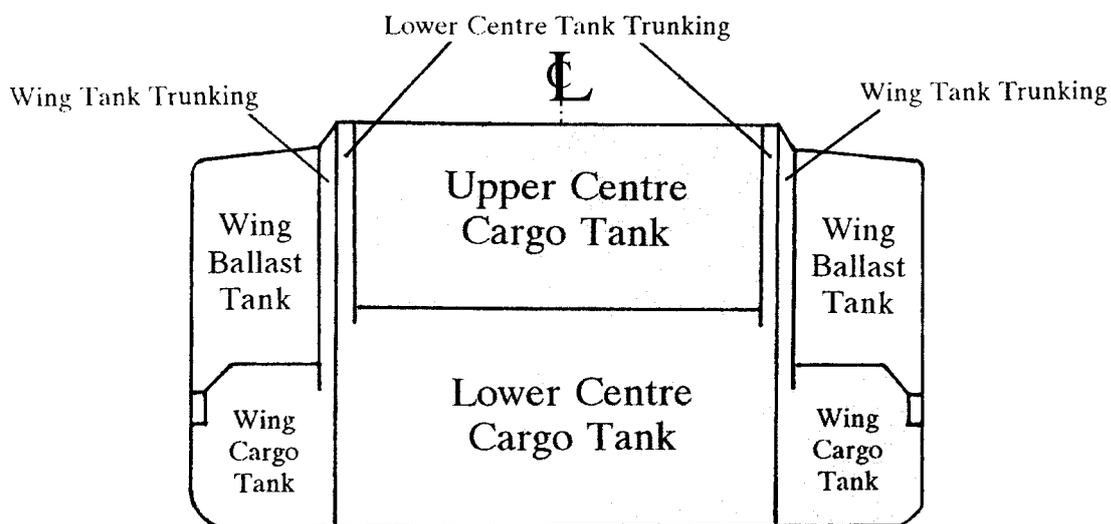
TYPICAL CROSS SECTIONS OF VARIOUS TANKER TYPES



General layout of Double Hull Tanker



General layout of Mid Deck Tanker



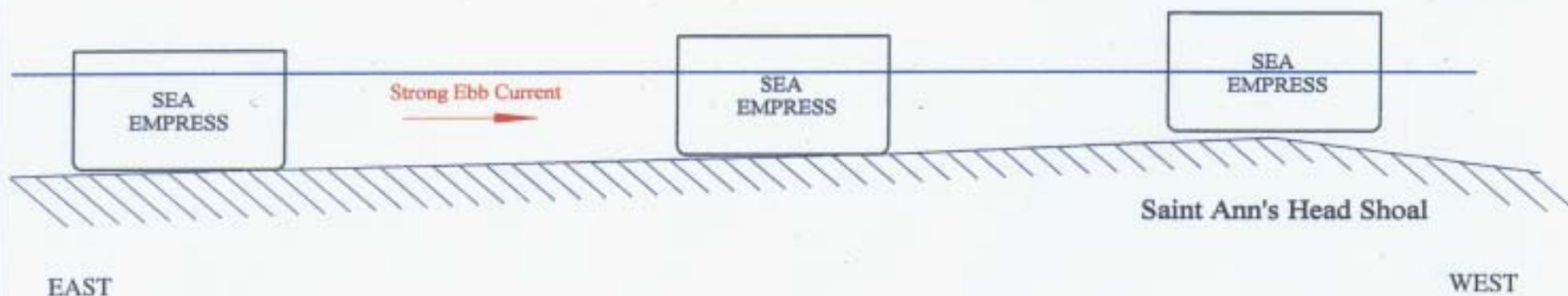
General layout of Coulombi Egg Tanker

AN ILLUSTRATION OF THE FACTORS INVOLVED IN THE FAILED
REFLOATING ATTEMPT OF TUESDAY 20 FEBRUARY AND THE SUCCESSFUL
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 20/02 - 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 vessel's mean draught, at about 12 metres, has been reduced to such an extent that she now floats clear over the shoal and can be turned by the tugs so that she is end on to the ebb current, greatly reducing the current force and allowing the tugs to pull her away.



Reproduced with permission of Huw Evans



SEA EMPRESS on Sunday 18 February

Reproduced with permission of Huw Evans



SEA EMPRESS and tugs on Wednesday 21 February



General View of Bottom Damage to SEA EMPRESS



General View of Bottom Damage to SEA EMPRESS



General View of Bottom Damage to SEA EMPRESS

Photograph courtesy of Harland and Wolff



General View of Bottom Damage to SEA EMPRESS