EVALUATION OF THE RESPONSE BY SPECIALISED FOREIGN VESSELS TO THE RELEASE OF OIL FROM PRESTIGE

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Following the spill of oil from PRESTIGE, Spain and Portugal called for resources to assist in the response. Over the following month, a major fleet was assembled with sixteen vessels from eight nations. Although a significant volume of oil was subsequently collected at sea the vessels experienced varying degrees of success.

This paper looks at the operations of each vessel and considers the reasons for their different performance. Consideration is given to the behaviour and spread of the oil and how this affected operations. The capabilities of the vessels to recover oil in Atlantic waters and to store and subsequently discharge this oil are considered. The containment and recovery systems used are analysed to determine their suitability in the circumstances. The command and control of the fleet by the authorities is discussed. The paper concludes by comparing the effectiveness of this fleet of specialised vessels with that of the fleet of fishing vessels which contributed to the overall volume of oil collected at sea.

INTRODUCTION

On 13 November, 2002 tanker PRESTIGE (81,564 DWT), carrying 76,972 tonnes of IFO650 fuel oil, began listing in bad weather and leaking oil while 30 nautical miles off Cabo Fisterra (Galicia, Spain). The vessel finally broke in two on 19 November releasing a significant amount of oil and sank some 140 nautical miles west of Vigo (Spain). Oil continued to leak from the wreck at a slowly declining rate. The Spanish government subsequently estimated the wreck contained 13,800 tonnes of cargo.

The amount and persistent nature of the oil, together with the prevailing currents, indicated that significant quantities of oil may remain at sea for some time and that Spanish resources would be inadequate to respond. The lead government agency for spill response in Spain, Sociedad de Salvamento y Seguridad Marítima (SASEMAR) therefore requested assistance from neighbouring states via bilateral agreements and from states further afield through the Civil Protection Co-operation Mechanism of the European Commission (EC). As the oil approached the northern Portuguese coast, the Portuguese Navy made a similar request through the EC. Over the following month, sixteen vessels from eight nations arrived in Spain and Portugal as listed in Table 1.

French navy vessels remained under the control of the French authorities throughout the response. NORTHERN CORONA was chartered to the Portuguese authorities. SASEMAR chartered the remaining specialised foreign vessels for the initial period of the response. As oil entered French waters several of these vessels were transferred to French control to assist with recovery.

DISCUSSION

Analysis of Vessel Performance

The volumes of oil/water emulsion collected by each vessel are shown in Figure 1, totaling 17,350 tonnes. AZTI, a non-profit-making organisation based in Pais Vasco, Spain equates this to between 7,850 and 9,595 tonnes of pure oil. Volumes for individual vessels have been obtained from vessel operators or are otherwise estimated from reports.

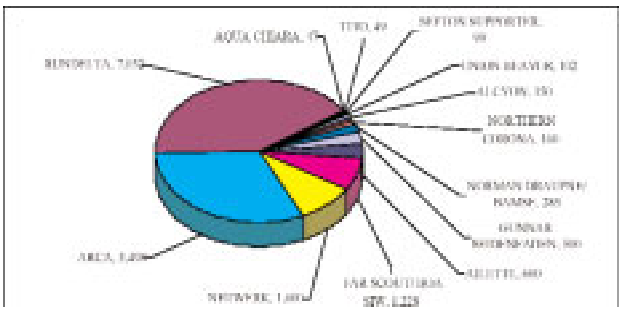

FIGURE 1: VOLUMES OF EMULSION COLLECTED BY SPECIALISED FOREIGN RECOVERY VESSELS (IN TONNES)

It is readily apparent that the efficiency of the individual vessels varied considerably. This is due to a combination of factors: oil behaviour, weather, sea state, vessel characteristics, skimmer design and command & control of the vessels.

Oil Behaviour

The crucial factor in the performance of the specialised recovery vessels was the nature of the oil and its behaviour over time. The large release of oil from the break-up of the casualty formed a series of homogeneous slicks, hundreds of metres in diameter and tens of centimeters thick. Whilst the oil remained in a similar state for a week or so, the action of wind and waves gradually fragmented these slicks with a dramatic increase in the viscosity. By mid to late December the oil was present in smaller and thinner patches <5m in diameter. By January, the oil had weathered to small plates and tarballs.

Figure 2 displays the cumulative volume of oil collected by the vessels with a readily apparent decrease in the rate collected over time. Following an initial delay in mobilising resources, com-

Table 1: Fleet of foreign recovery vessels

Country of home port	Vessel	Port of departure
Belgium	UNION BEAVER	Antwerpen
Denmark	GUNNAR SEIDENFADEN	Korsør
France	AILETTE	Brest
	ALCYON	Brest
Germany	NEUWERK	Cuxhaven
Italy	AQUA CHIARA	Porto Tórres
	TITO	Livorno
Netherlands	ARCA	Scheveningen
	RIJNDELTA	Rotterdam
Norway	FAR SCOUT/BOA SIW*	Mongstad/Trondheim
	NORMAN DRAUPNE/BAMSE*	Trondheim/Stavanger
	NORTHERN CORONA	Aberdeen, U.K.
United Kingdom	BRITISH SHIELD	Annaba, Algeria
	SEFTON SUPPORTER	Liverpool

* FAR SCOUT and NORMAN DRAUPNE were accompanied by BOA SIW and BAMSE to facilitate deployment of boom.

pounded by poor weather, significant volumes of oil were recovered in a relatively short period. In particular, the rate of collection of oil and oil/water emulsion rapidly increased from late November to early December with approximately 10–12,000 tonnes recovered in this period. From the second week in December, the rate of collection began to slow until 11 February when the last reported recovery operation terminated in French waters.

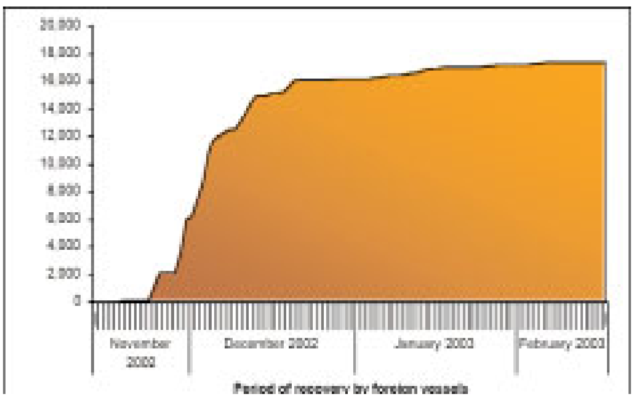

FIGURE 2: CUMULATIVE VOLUMES OF OIL RECOVERED BY FOREIGN VESSELS

Weather

Weather conditions over the period of the response varied widely with winds reported up to force 7 and swells up to five metres. The effect of these conditions was to accelerate weathering of the oil and to severely hamper vessel activity. The sea state was less of a concern for response vessels such as RIJNDELTA, FAR SCOUT and SEFTON SUPPORTER since their construction and size allowed them to ride out the weather to a greater extent than other vessels.

Deployment of equipment in such conditions was hazardous irrespective of the vessel as demonstrated by damage to the recovery equipment of a number of vessels. Heavy seas meant recovery skimmers took on large amounts of water in relation to recovered volumes of oil. In part this was beneficial to aid in reducing friction in hoses and pipes but caused available on-board storage tanks to be rapidly filled.

Vessel Characteristics

The size and design of vessels was an important factor in their ability to recover oil.

Overall design

ACQUA CHIARA, AILETTE, ALCYON, FAR SCOUT, NORMAND DRAUPNE, NORTHERN CORONA and TITO are of the Anchor Handling Tug Supply (AHTS) design, having the accommodation and wheelhouse towards the bow and a large free aft deck. These vessels have the ability to serve as pollution response vessels as a secondary characteristic beyond their original AHTS duties. GUNNAR SEIDENFADEN is of a similar design but was built with oil pollution response as a primary role.

The AHTS design allows ready deployment of long lengths of boom and free floating skimmers placed on the rear deck either in free-standing containers or exposed as was the case with the Frank Mohn Transrec systems and open reels of boom of the Norwegian and French systems. Placement on-deck facilitated operation of equipment and basic maintenance, repairs and cleaning of equipment while at sea but introduced hazards from the presence of hoses, cables and ancillary equipment.

The open stern on these vessels meant little shelter was afforded from wind and rain to crew and equipment, during operation of equipment. The heavy swells experienced meant that once the vessels were in operation, oil was regularly washed over the stern onto the free deck, making the area slippery. The decks also became very oily once equipment was hauled in from operations at sea.

UNION BEAVER has the accommodation and wheelhouse aft of the open deck allowing deployment of equipment over the side. The very low freeboard of the open deck and its forward position severely limited deployment even in moderately high seas resulting in the low recovery volume. Whilst successful deployment of equipment was undertaken in the relatively sheltered bays of Ría de Arosa and Ría de Muros e Noia, very little oil actually entered into these areas to allow collection by UNION BEAVER.

NEUWERK is of a similar design to the supply type vessels except that the rear of the aft deck is taken up with a large crane, and storage areas for equipment and recovered oil. A pair of 15m sweeping arms is deployed from the central deck. The arms' power systems are in-built allowing the deck to be kept relatively clear during operations.

NEUWERK's freeboard is lower than that the standard supply type vessels. Consequently, considerable amounts of floating oil were washed onto the deck of the vessel and deployment of equipment in even moderately rough seas was hazardous.

ARCA was designed primarily for oil pollution duties. The accommodation and wheelhouse block is located centrally with an open rear deck for storage of equipment containers and reels and for deployment of containment and recovery equipment. A pair of 13.5m sweeping arms is stored forward of the accommodation and wheelhouse block, to the side of the recovered oil storage tanks and deployed by cranes. The work area in this forepart is limited but since power systems are in-built to the vessel, there is little requirement for large areas of free space.

RIJNDELTA was constructed solely as a dredger with a pollution response capability added at a later date. There is minimal free deck area with available space taken up by the open storage hopper and dredging equipment. Oil recovery equipment in the form of two 15m sweeping arms is stored on the sides of the vessel and deployed using davits. As with ARCA, power is provided by in-built supplies negating the need for a large free work area.

The higher freeboard of ARCA and RIJNDELTA allowed deployment of containment and recovery equipment in rougher conditions from the leeward side and were positive factors in their ability to recover the large volumes of oil reported. In calm conditions the vessels were able to safely deploy sweeping arms from both sides simultaneously.

SEFTON SUPPORTER was originally constructed as a product tanker. Oil recovery is achieved through the use of two 15m sweeping arms deployed by cranes. Power for this system was provided from in-built supplies again negating the need for a large free work area. This vessel was notable for the relatively small volume of oil/water emulsion recovered, due in part to deployment of the vessel away from the main concentrations of PRESTIGE oil.

Storage capacity

A limiting factor for all vessels involved in the response was the ability to store recovered oil. On-board storage capacities varied significantly as shown in table 2.

Vessels with a greater storage capacity were able to remain on site, "in oil", for longer periods without the need to return to port to discharge allowing prolonged periods of recovery. Vessels that had to return to port more often not only expended time hauling in and redeploying equipment and traveling to and from port but also had repeatedly to locate patches of oil suitable for recovery. Weathering of the oil meant time spent recovering oil was at a premium in the early stages of the response. In a bid to alleviate the problems of discharge and the time required to sail from the main area of oil to the Repsol refinery, BRITISH SHIELD was chartered to act as a reception vessel. This was initially stationed at Villagarcia, close to the main areas of oil and successfully received recovered oil/water from a number of recovery vessels and from on-shore storage.

With the exception of RIJNDELTA, recovered oil was stored in enclosed tanks with hatches for access and visual observation. On RIJNDELTA, recovered oil was stored in the open hopper usually employed to hold dredge spoil allowing simple visual observation of the flow of oil so facilitating immediate action to remedy problems.

Most vessels had some ability to decant water taken on board with recovered oil.

Discharge pumps and heating capability

The ability to readily discharge recovered oil further limited the time vessels could spend at sea. This was dependent on the capabilities of discharge pumps and the ability to readily heat the oil. The need for high capacity and high viscosity pumps together with heating coils increased with the viscosity of the oil. For example, RIJNDELTA was able to pump at an average rate of 1.25m3 per minute during discharge in the period 26 to 28 November decreasing to an average of 0.2m3 per minute in the period 22 to 25 December. FAR SCOUT and NORMAND DRAUPNE were considerably delayed by the inability to empty tanks. To alleviate this problem on NORTHERN CORONA, a portable boiler and heating apparatus were loaded prior to departure to Portugal. ARCA was equipped with sufficient heating and double-skinned tanks for insulation so ensuring a comparatively straightforward discharge.

Containment and Recovery Systems

Vessels' containment and recovery systems broadly fell into four types; disc skimmers, weir skimmers, sweeping arms and brush skimmers as listed in Table 3. Generally speaking, those vessels operating disc and weir skimmers also carried lengths of containment boom of varying description.

Disc skimmers

The disc skimmers offered on ACQUIA CHIARA and TITO were the least effective of the skimmers available from vessels in the response. It is understood that only 8m^3 of oil/water emulsion was

Table 2: Storage capacities of foreign recovery vessels (m3)

Vessel	Storage capacity (m3)	Vessel	Storage capacity (m3)
TITO	290	NEUWERK	1,000
UNION BEAVER	~300	NORTHERN CORONA	1,000
G. SEIDENFADEN	310	ARCA	1,060
AILETTE	500	ACQUIA CHIARA	1,084
ALCYON	500	SEFTON SUPPORTER	1,350
NORMAND DRAUPNE	798	RIJNDELTA	3,548
FAR SCOUT	1,000	BRITISH SHIELD	3,835

Table 3: Skimmer types available on foreign recovery vessels

Type	Vessel	Skimmer description
Disc	ACQUIA CHIARA/ TITO	OCS disc skimmer & 400m of Mannesmann Offshore Boom.
Weir	AILETTE/ ALCYON	Transrec 250 weir skimmer with Hi-Wax adapter, Foilex 250 weir skimmer & 300m high-sea boom
	FAR SCOUT/ NORMAND DRAUPNE	Transrec 250 weir skimmer with Hi-Wax adapter & 400m of Ro-Boom 3500 boom
	GUNNAR SEIDENFADEN	DESMI Terminator weir skimmer & 1,000m of Ro-Boom 2000 boom
Sweeping Arm	ARCA	2 x 13.5m sweeping arms
	NEUWERK/ RIJNDELTA/ SEFTON SUPPORTER	2 x 15m sweeping arms
Brush	UNION BEAVER	2 x Lori brush skimmers

collected by ACQUIA CHIARA by disc skimmer prior to collection continuing by use of a grab and trawl nets. The nature of the oil and subsequent water-in-oil emulsion meant the discs were limited in their ability to remove oil from the sea surface.

Weir skimmers

Vessels equipped with the Transrec skimmer that were on-site in the early stages of the response experienced good recovery rates as a result of the concentration and fluidity of the oil. Once the oil viscosity increased and the oil fragmented, their efficiency decreased.

The Transrec system comprises a weir-skimmer head with in-built pump attached to the vessel by a hose of five inches internal diameter and 80m in length. The viscosity of the oil impeded its flow into the weir and a 'Hi-Wax' adapter was thus attached. This utilised two sets of rotating paddles to force the oil into the skimmer head allowing recovery of oil that would otherwise have proved difficult. However, the viscosity and tenacity of the oil on the paddles limited the throughput and required frequent stoppages of the paddles to "clear" the system. Furthermore, the viscosity of the recovered oil caused a severe pressure drop along the discharge hose from the skimmer pump to the vessel. This problem was partially alleviated by lubrication by water injection into the discharge hose. Despite this adaptation, operators reported that the equipment was running at full capacity with prime movers unable to cope comfortably with the loading placed on them. The drop in efficiency of the Transrec skimmers led the French vessels to change to the Foilex system in mid-December as the larger diameter and shorter length of the discharge hose allowed for more efficient pumping.

In the early stages of the incident, the oil was of sufficient concentration that use of boom was not necessary and only as the oil fragmented and spread was boom deployed to assist. However, deployment was often frustrated by poor weather and heavy swells with delays experienced while the boom was unwound from the reel, inflated and towed out to encircle the oil. At the end of December, the oil had fragmented and spread to the extent that French vessels halted recovery and switched to acting in a support capacity to French trawlers assisting in the recovery. The Norwegian vessels continued to attempt on-water recovery of oil up to the second week of February with progressively lower recovery rates.

GUNNAR SEIDENFADEN employed a Desmi Terminator weir skimmer with an added belt module on top of the weir was to allow dynamic recovery of the oil in a similar manner to the Transrec Hi-Wax adapter. Whilst the Desmi system was effective in recovering oil, the recovery rate was again severely limited by the nature of the oil.

Sweeping arms

The sweeping arm skimmers operated by ARCA, NEUWERK, RIJNDELTA and SEFTON SUPPORTER were deployed from the vessel by davits or hydraulic rams such that the arm was held at an optimum angle to the side of the vessel. Each arm comprises a steel barrier supported by a lattice frame and floats with a weir and integral pump at the apex of the arm and vessel hull. Forward motion of the vessel imparts a flow over the weir. Large volumes of water were collected with the oil serving to assist lubrication along hoses and pipes, later augmented by water injection, but requiring suitable decanting procedures.

On RIJNDELTA and ARCA, the skimming arms were deployed such that they could readily follow waves allowing the weir to remain in the optimum position at the oil/water interface. The hydraulic rams of NEUWERK held the sweeping arms in a more rigid arrangement against the vessel limiting the ability of the arms to follow movement of the waves and allowing oil to splash over or pass beneath.

Placing the arm directly alongside the vessels' hull meant recovered oil was pumped over a short distance to on-board storage reducing the effect of internal friction and allowing a faster pumping and recovery rate. However internal friction did hinder the ability of the skimming units to work at optimum efficiency.

Brush skimmer

The Lori brush system employed by UNION BEAVER utilises a rotating bristle belt to selectively recover oil from the water surface. The system was primarily deployed in sheltered Rias and encountered little oil allowing no opportunity for proper evaluation.

Mobilisation of vessels

Upon receipt of the request to make vessels available to the Spanish and Portuguese authorities, countries who responded did so voluntarily and rapidly.

AILETTE was the first foreign vessel to arrive, on 14 November soon after the initial loss of oil from PRESTIGE and was able to recover a limited amount of oil before weather conditions deteriorated. RIJNDELTA then mobilised from the Netherlands on 16 November to arrive in Spain on 19 November. Although bad weather again initially prevented recovery, this prompt mobilisation was an important factor in the ability of RIJNDELTA to collect large volumes of oil/water emulsion. The remaining vessels arrived over the following month with NORMAND DRAUPNE the last to arrive on 29 December. It is apparent that those vessels arriving in the first weeks of the response were able to recover greater volumes of oil than vessels arriving after the oil had commenced to fragment and spread.

The difference in the volumes collected by the two similar vessels FAR SCOUT and NORMAND DRAUPNE is noteworthy. FAR SCOUT recovered the majority of oil in the initial five days of activity when the oil remained relatively coherent and concentrated allowing ready detection and collection. By the time NORMAND DRAUPNE arrived, the oil had weathered with associated difficulties for recovery. GUNNAR SEIDENFADEN had a similar experience of relatively poor recovery rates for similar reasons.

Mobilisation of NORTHERN CORONA occurred only when the Portuguese authorities felt the coastline was under sufficient threat to warrant placing the vessel on hire. Oil remained in Portuguese waters for a short period only, limiting the need to respond.

Command & Control

The response to the PRESTIGE involved the deployment of vessels from a larger number of states than had previously been involved together in an incident. While some vessels' crews had considerable experience of working with vessels from other states, mainly via regional agreements, this was the first occasion that a significant number of vessels from both northern and southern Europe had worked together.

Command of the specialised vessels in Spanish waters was led by SASEMAR from their control centre in La Coruña. Control in French waters was led from Brest with on-scene command delegated to the French oceanographic research vessel D'ENTRECASTEAUX.

Once on-scene, SASEMAR directed vessels to locations around the Spanish coast where oil had been observed or predicted. With the exception of UNION BEAVER, the vessels arriving on scene by end of November were directed to the main area of oil off the Galician west coast and, with the further exception of SEFTON SUPPORTER, successfully recovered significant volumes of oil/water emulsion in these early stages of the response.

As the oil fragmented and spread, a significant proportion of vessel time was spent searching for, rather than collecting oil, a task that is notoriously difficult to achieve from the low platform a vessel affords particularly as the oil became partially submerged, highly fragmented and scattered over large areas.

Demobilisation

The oil eventually emulsified, fragmented and spread to such an extent that the specialised vessels were unable to encounter sufficient oil to warrant recovery and local fishing vessels were more suitable. Despite this, a number of specialised vessels continued to attempt recovery for a considerable period beyond this point. From mid-December onwards, increasing amounts of time were spent searching for sufficient quantities of oil to warrant deployment of recovery equipment and recovery rates fell to very low levels.

Fishing Vessels

To assist in the recovery efforts, local fishermen mobilised in significant numbers. AZTI report a total of 35,523 tonnes oil/water emulsion were collected by Spanish and French fishing boats, estimated to contain between 12,433 and 15,885 tonnes of pure oil. This is approximately twice the figure for oil collected by the specialised recovery vessels. The success of the fishing vessels was a result of their sheer number, their ability to manoeuvre very close to the shore to recover oil and to recover plates of oil too small and too spread out for the larger specialised vessels. The low freeboard of the fishing vessels allowed manual collection of oil by long-handled scoops, and mechanically by use of nets and trawls and by grabs attached to vessel cranes.

CONCLUSIONS

On notification of the release of oil from PRESTIGE, eight countries mobilised vessels to assist with significant volumes of oil/water emulsion recovered. Of the thirteen recovery vessels mobilised, four recovered some 90% of this volume and one single vessel recovered 41% of the total. A number of lessons can be derived from analysis of the relative success of each vessel:

- Vessels that were mobilised promptly and arrived on-scene early in the response were able to recover significant volumes of oil. The coherent nature of the slicks meant the oil was more easily observed and was encountered in large volumes.
- Gradual emulsification, fragmentation and spreading of the oil led to reduced recovery efficiencies of vessels. The decreasing ability of vessels to encounter oil and increasing problems with pumping resulted in lower daily recovery rates.
- The supply-type vessel provided a suitable platform from which to deploy boom and skimmers into the oil. The large free deck area allowed for storage of equipment and for maintenance and cleaning. However, the exposed nature of this deck made conditions hazardous for the crew in heavy sea conditions.
- The low freeboard to the working deck area severely restricted the ability of several vessels to work in the open ocean where the large swells encountered washed significant amounts of floating oil on deck.
- Overall, vessels employing sweeping arm skimmers achieved significantly higher recovery rates and volumes than other skimmers employed. The comparative ease of deployment of the sweeping arm in comparison to boom and the more straightforward design of the sweeping arm compared to adapted weir skimmers were factors.
- Vessels with a large storage capacity were able to remain at sea for longer periods before discharge was required.
- Vessels with heating coils and pumps of sufficient capacity were able to discharge oil from their tanks more rapidly, so minimising time in port.

Although the specialised vessels recovered a significant volume of oil, local fishermen recovered double this volume using non-specialised boats and gear. It should also be borne in mind that despite the success of both the large vessels and the fishermen, shoreline contamination extended from the northern Portuguese border along the entire northern coast of Spain, and along the west and north coasts of France.

BIOGRAPHY

Tim Wadsworth is a senior coordinator at ITOPF with involvement in many spills internationally. His primary role is to provide advice on spill response equipment and to assist in the assessment of claims for compensation for clean-up activities. He has degrees in Engineering and in Law.

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