

## Assessment of the Cost and Benefit of ETV Provision

### Introduction

- 1.1 The financial implications of the ETV Review, are explored in this annex, with the results of the cost benefit analysis being used as an aid to decision making. The study was invited to report on the implications of ETV provision over the next five to ten years. In addition to examining the costs and benefits over a ten year period the implications over five year intervals to 25 years (equivalent to the expected working life of a new ETV) have also been evaluated to ensure that options under a longer term commitment did not offer any significantly different options.
- 1.2 The remainder of the annex is split into sections dealing with cost and benefits. The final section makes a comparison between cost and benefits. Only the 10 and 25 year implications are detailed in this chapter, the intermediate positions have been omitted for clarity.
- 1.3 The contents of this annex and methodology used for the cost comparisons has been discussed and agreed with our colleagues from the centre of the Department.

### Cost

- 2.1 Disclosure of the estimates of the various cost implications would be inappropriate prior to the letting of any contracts for the future provision of ETVs resulting from this review. The costs are therefore expressed as a range of values for the provision of the four ETVs recommended in this report. The option of placing an ETV in the Irish Sea has also been assessed.
- 2.2 The review has reassessed the costs of ETV provision in light of current figures. All the provision methods involve some element of tendering costs. These are included and are based on our experience of letting contracts. The seven methods of ETV provision, as detailed in Chapter 4 Part C have been separately assessed.
- 2.3 The cost of fuel and Port dues has been included in the assumptions for all the provision types. The levels are based on our experience of operating the vessels

### Option 1 Contract Charter

- 2.4 The cost of contract chartering is the sum of the daily charter fee and in-house contract management. It has been assumed that five or ten-year charters will be possible. The daily contract charter rates for anchor handling vessels of the type most suitable for use as an ETV have fluctuated recently between £3.5k and £10k. The principle reason for the rate varying is the demand in the off-shore industry for the vessels. The rate will also vary depending on the length of charter required. It is likely that the rate for all year round cover could be less than for winter only cover. Vessel owners find it more attractive to have all year round charters in place.

### Option 2 Harbour Partnership

- 2.5 The harbour partnership concept has been assumed to involve the building of a new hybrid design to combine the attributes of an ETV and harbour tug. The vessel undertaking the role of ETV during the winter months and during the summer as a back-up tug (while other harbour tugs are maintained) for the harbour authority. MCA would have access to the vessel during the summer months on a cost recovery basis for ETV duties. It is assumed that this could average ten days per annum. MCA will have a set-up cost for establishing the partnership.
- 2.6 The set up arrangements for a partnership have to be taken into consideration. These cover the technical and legal assistance necessary to form the partnership. MCA does not have in-house experience in this type of arrangement and therefore the set-up costs have been assumed to be a higher percentage of the total capital investment than the figure estimated by the MOD in their RoRo procurement project.
- 2.7 It has been assumed that the building and operating costs will be split equally between MCA and the harbour authority. The sharing of risk would expose MCA to a commercial risk of at least 50% of any liability resulting from salvage operations, and any damage or loss of the ETV.
- 2.8 During the summer period (six months) when the vessel is working for the harbour authority but available for ETV duties, it is assumed to be available for release from harbour duties in type of arrangement. This poses a political risk; exposure to criticism of paying for a facility and then not being able to use it.
- 2.9 This exposure to risk in both commercial and political terms of this option is unacceptable.

### Option 3 MCA as ship-owner

- 2.10 The option involves MCA meeting all responsibilities and expenses from running a fleet of ETVs. These include:
- Capital cost (plus charge on capital at the standard rate of 6% per annum)
  - Repairs and maintenance
  - Crew costs (salaries, travelling expenses),
  - Insurance (Salvage liability, P&I Club, Hull and machinery)
  - Vessel Management
- 2.11 This option is seen as unattractive for the following reasons
- High capital investment required
  - Ship owning is not a core MCA activity
  - The specialist knowledge required is currently not available internally
  - MCA has the whole of the risk exposure
  - The conflict of interest between Secretary of State's Representative (SOSREP) and the commercial interests of MCA as a ship owner.

Option 4 Build Partnership (MCA with Private Company)

- 2.12 The build partnership is a Private Public Partnership (PPP) package assumed to involve MCA and the private company equally sharing the capital and residual costs, with MCA paying a lease back fee. The exact details of the partnership arrangements would form part of the negotiation process with the private company. This could be a complex process. If no capital were invested the arrangement would be very similar to Option 1. The set-up costs have been assumed to have a similar to percentage of capital investment figure as option 2.
- 2.13 The structure of this option requires a long term commitment from both MCA and its commercial partner to ensure its financial viability. In addition to sharing the capital costs, such a partnership would also involve MCA sharing the risks involved and rewards of any salvage operation on a 50/50 basis. The conflict of interest between SOSREP on the one hand and the commercial interests of MCA as a ship owner on the other is an area that is difficult to reconcile. All these factors make this option unattractive.

Option 5 MCA as ship-owner with second hand vessel

- 2.14 Although the purchase of a second hand vessel would require less initial capital than purchasing a new build, there would be the requirement to replace the vessel at shorter intervals. Over a 25 year period the total capital requirement is expected to be approximately twice that for a new build. The annual operating costs are the same as Option 3, however a premium on the maintenance costs has been estimated due to the increased age of the vessel. These disadvantages coupled with those identified for option 3 make this option unattractive.

Option 6. Third Party Management

- 2.15 This option is similar to Option 3 except the management is contracted out to an independent ship-manager instead of being undertaken in-house. It has been assumed that the ship management contract would be market tested every five years. The disadvantages identified in option 3 also apply.

Option 7. Joint Arrangements with Foreign Administration

- 2.16 The sharing arrangement for the ETV in Dover Straits presently takes the form of contract chartering of an ETV. This effectively halves the cost of Option 1. In this arrangement one Administration holds the contract and enters into an operational agreement with another Administration. A second variant of this option is for a PPP build partnership to be initiated by one Administration and to enter into an operational agreement with another Administration; however the UK has discounted initiating PPP build partnership on its own accord.
- 2.17 This type of joint arrangement between two national Maritime Administrations makes for improved Inter-national liason and co-operation and should be considered wherever possible. It is clearly beneficial where adjacent countries can enter into such a partnership supported by a sound operational protocol. It could

also be of value when the benefits accrue to each Administration but the overall Cost Benefit Analysis is weak. By sharing the costs in a partnership, the benefits may then exceed the costs, making the provision of an ETV more viable.

### Summary of Cost of Provision of ETVs

- 2.18 Table 1 shows the range of values for the positioning of ETVs at the four locations recommended in this report. The concept of Net Present Value (NPV) is used in table 1 so that different spend profiles over the study period can be compared on a like for like basis. NPV is the sum of the annual costs or benefits discounted (at 6%) to the base year (2000). The lower figures are derived from the assessment of the optimum methods of provision. The higher figures are derived from the least cost-effective methods of provision.

Summary of Range of NPV for ETV Provision		
Period	4 ETVs	Inc Irish sea
10 Years	£70.2M - £85.2M	£90.2M – £106.8M
25 Years	£122.0M - £136.5M	£153.8M - £171.1M

Table 1

### **Benefit**

- 3.1 The primary benefit gained from stationing ETVs is the protection of the environment. This benefit is calculated by estimating the amount of oil pollution saved by ETV intervention. Safety benefits and receipts, are the other benefits gained from having an ETV in place. Safety benefits are lives saved and injuries prevented by an ETV, and receipts derive from a proportion of any awards received and refunds of hire charge while the ETV is performing salvage operations. The benefit data provided in previous reports has been updated to take account of inflation.

### Quantity of Oil Discharged Into UK Waters

- 3.2 The base case for the quantity of oil discharged into UK waters follows previous studies and is based on two studies undertaken by DNV Technica in 1994 and 1995 which conducted a risk analysis on the probability of an oil spill in UK Waters (by drift grounding and by other factors), the risk of a drift grounding in each region and the reduction in risk arising from the central case provision of ETVs. The main findings of these reports are in table 3.
- 3.3 The annual probability of an oil tanker grounding around the UK coastline was, in conjunction with historical data that had been updated since the Sea Empress incident, to calculate the base case results, which are shown in Table 2.

The Average oil spilt per annum in UK waters	
Average Oil Spilt per annum	11,127 t
Of which by drifting grounding	4,786 t

Table 2

- 3.4 The average oil spill per annum was calculated by multiplying the DNV annual probability of an oil spill (0.8662) by the historic average size of a spill (12,260 tonnes) and adding the estimated average amount of bunker fuel that is spilt each year. The annual amount caused by drift grounding is calculated using a similar method.
- 3.5 The distribution of the annual (drift) grounding total is based on the DNV probabilities of an oil grounding in each region around the UK. The total annual spill in each region is calculated from the estimates of grounding as a percentage of total spills in each region. This reflected a higher percentage of grounding as the cause of a spill in the Scottish regions than on the South Coast of England, where collisions are the cause of a larger percentage of the oil spill.

<b>The Main Results found by the DNV Technica Risk Analyses</b>		
<b>The size distribution of the annual probability of an oil spill</b>		
500 - 999 tonnes	0.1022	i.e. once every 10 years
1,000 - 1,999 tonnes	0.0740	i.e. once every 14 years
2,000 – 3,999 tonnes	0.1300	i.e. once every 8 years
4,000 – 5,999 tonnes	0.1000	i.e. once every 10 years
6,000 – 9,999 tonnes	0.1200	i.e. once every 8 years
10,000 – 23,999 tonnes	0.1800	i.e. once every 5.5 years
24,000 – 99,000 tonnes	0.1020	i.e. once every 10 years
100,000 – 200,00 tonnes	0.0580	i.e. once every 17 years
Total	0.8622	i.e. once every 14 months
<b>The Annual Probability of an oil tanker Grounding in each operating area</b>		
Dover Strait	0.0186	i.e. once every 54 years
The Minches	0.0546	i.e. once every 18 years
South West Approaches	0.0181	i.e. once every 55 years
Fair Isle	0.0367	i.e. once every 27 years
North Channel (Irish Sea)	0.0280	i.e. once every 35 years
UK	0.1714	i.e. once every 6 years
For vessels other than an oil tanker the annual probability of a grounding around the UK is 4.006 i.e. four times very year, which also varies between the regions.		
The probabilities shown above take into account the number of harbour tugs and other rescue vessels available around the UK coast. The addition of three ETVs in Thames & Kent, NW Scotland and the West Country is estimated to reduce the total UK probability of an oil tanker grounding by 0.048, equivalent to a 50% reduction in risk in these operating areas.		

Table 3

- 3.6 The reduction in risk from the central case provision of three ETVs, estimated by the DNV analysis, equated to a 50% reduction in the amount of oil spilt by drift grounding in each of the regions covered by an ETV's operating area. In previous studies the provision of additional tugs in Fair Isle and South West Scotland slightly overlapped with the patrol area of the North West Scotland tug, so it was assumed

that they would only reduce the oil spill by 45% within their operating areas. Table 4 shows the assumed reduction in the amount of oil spill from the provision of each ETV.

- 3.7 The sinking of the Erika in December 1999 highlighted the difficulty in cleaning bunker oils. Sensitivity testing of the quantity of pollution has involved splitting the 'all oils' total (on a pro rata basis) into crude and bunker oils this is also shown in table 4, with a revised estimate of the amount of bunker oil pollution prevented by the stationing of ETVs.
- 3.8 It is difficult to estimate the ratio between bunker and crude clean up costs, depending on circumstances the ratio can be as high as 9:1 or 10:1. The clean up costs for bunker fuel oil in European waters are quoted the International Oil Pollution Compensation (IOPC) Fund as averaging £5,767 per tonne. Sensitivity tests using a ratio of 9:1 when combined with the revised estimate for bunker spills prevented results in a 4.1% increase of total benefit

The annual amount of oil spilt (tonnes) in each of the considered areas and the reduction (tonnes) resulting from the provision of an ETV					
	Dover Strait	The Minches	SW Approach	Fair Isle	Irish Sea
Oil spill pa in region	1,341	1,838	1,912	328	438
Of which drift grounding	254	1,531	362	273	365
Reduction from ETV	129	776	183	123	164
Reduction in wider operating area	142	0	90	340	194
<b>Total reduction from ETV (all oils)</b>	<b>271</b>	<b>776</b>	<b>273</b>	<b>463</b>	<b>358</b>
Pro rata Crude Oil estimate	259	740	261	442	342
Pro rata Bunker Oil estimate	12	36	12	21	16

Table 4

### Spill Prevention Benefits

- 3.9 To maintain consistency and permit comparison of results, this study applies the parameters incurred directly from oil spill on areas including Fishing, Agriculture, Tourism and Property used in previous studies. Such costs have a direct impact on the local economy which may be more widely dispersed should a significant spill occur. These costs were noted in a report into the Sea Empress Spill.

*"Income losses in the fishing and tourism industries of Brittany could be directly attributed to oil from the Amoco Cadiz, but these effects were compounded by what was referred to at the time as "consumer psychosis". Media attention and publicity led consumers to believe that anything and everything from Brittany was polluted. Sales of all fish from all parts of Brittany decreased, including fish taken from unaffected waters. Households stopped buying vegetables grown in Brittany; and, above all; holidaymakers stayed away from the area, not only from the Finisterre and Cotes du Nord regions immediately affected by the spillage but also from other areas."*

- 3.10 An additional cost experienced not evaluated in previous studies, is loss of recreational amenity. Methods of valuing amenity areas are based upon peoples Willingness to Pay (WTP) for the public goods or benefits they provide or

Willingness to Accept (WTA) compensation for their loss. It is considered outside the scope of this study to commission the research necessary to place a monetary value on loss of amenity value.

- 3.11 The costs to the UK economy of spilling one tonne of crude oil are detailed in tables 5. They have been calculated by applying the retail price index to the previous study.

<b>Breakdown of Costs Incurred UK Economy by the Spilling of One Tonne of Oil</b>					
	<b>Common Costs to crude and bunker oils</b>				
	Fishing	Agriculture	Tourism	Property	Total
Dover Strait	£237	£41	£59	£12	£349
SW Approaches	£416	£41	£59	£12	£528
The Minches	£594	£59	£36	£12	£701
Fair Isle	£475	£59	£29	£12	£575
Irish Sea	£475	£53	£36	£12	£576
	<b>Crude Oil</b>				
	Common Cost Total	Cleanup costs	Value of Oil	Damage to vessel	Cost per tonne
Dover Strait	£349	£594	£71	£119	£1,133
SW Approaches	£528	£594	£71	£119	£1,312
The Minches	£701	£1187	£71	£119	£2,078
Fair Isle	£575	£890	£71	£119	£1,655
Irish Sea	£576	£890	£97	£119	£1,682

Table 5

- 3.12 The value of the crude oil cargo saved is difficult to estimate due to the volatile nature of oil prices, which for Brent Crude has ranged from \$21 to \$35 per barrel over the last year (2000 average price = approximately \$29 per barrel). An estimate of the long term oil price has been placed lower at \$19 per barrel and is used in the base case. Sensitivity testing between the two prices has a marginal effect on the total benefit (0.45%) as the price of crude oil accounts for between 4.5% and 6.1% of the cost saved by preventing crude oil being spilt.
- 3.13 The annual benefits for each operating area resulting from the prevention of oil pollution are calculated by multiplying the cost to the economy of cleaning up a tonne of oil by the tonnage of oil spills prevented by the operations of an ETV. The results (1997 CBA updated for inflation) are detailed in table 6.

	<b>Base Case Annual Pollution Prevention Benefit</b>		
	Cost per tonne spilt	Saved by ETV	Prevention Benefit <sup>1</sup>
Dover Strait	£1,133	271t	£307,281
SW Approaches	£1,312	273t	£358,165
The Minches	£2,078	776t	£1,612,559
Fair Isle	£1,655	463t	£766,635
<b>Total 4 ETVs</b>		<b>1,783t</b>	<b>£3,044,640</b>
Irish Sea	£1,682	358t	£602,084

Table 6

<sup>1</sup> Results from spreadsheet, rounding off of figures has occurred in previous totals.

### Future Levels of Oil Pollution

- 3.14 Based on recent trends in world trade we have assumed a 3% rise in seaborne oil trade. The rise in the amount of oil being transported has to be balanced against the efforts of IMO in continuing to strive for safer and more environmentally friendly shipping. Further measures to improve marine safety will undoubtedly be devised during the period of the study. Although industry states that there has been a fall in the amount of oil spilt from ships despite an increase in trade, there are no nationally produced figures available.
- 3.15 It has been assumed for the purposes of this study that the amount of oil spilt will remain constant, i.e. the increase in the amount of oil transported will be balanced by safety and environmental improvements. A sensitivity test of reducing the amount of pollution by 1% year on year was conducted which decreased the total benefit by 1.17%.

### Safety Benefits

- 3.16 Previous CBA studies have used a valuation for a life lost and injuries that corresponds to that used by the DETR for trunk roads. These values now stand (2000) as £1,139,775 for death, £128,071 for serious injuries and £9,879 for minor injuries. In previous studies these values were increased in line with projections for Gross National Product. This study does not use this multiplier.
- 3.17 Previous studies estimated that the southern ETVs would save an average of just under two lives per annum, with an equal number of major injuries and double the number of minor injuries. The safety benefit of the northern ETVs was estimated at approximately a third of the southern ETVs (0.7 lives).
- 3.18 An examination of MCA's search and rescue records revealed the average number of people aboard vessels towed to safety by ETVs during the six winter months (1997/1998 – 1999/2000). These are detailed in table 7. The way the statistics are compiled mean that even though the ETV is credited with the lives saved, had the ETV not been available other effective live saving measures could possibly have been taken.

Lives Saved by ETVs per Annum		
Location	Belton Estimation	Average Achieved
Dover Strait	1.78	13.67
SW Approaches	1.78	13.00
The Minches	0.63	97.33 <sup>2</sup>
Fair Isle	0.63	10.00

Table 7

- 3.19 Despite this higher assessment of actual lives saved over those predicted by the Belton Report, this study has decided to continue to use the previous conservative figures when assessing safety benefits. The annual safety benefits are shown in table 8.

<sup>2</sup> Includes 200 persons aboard 1 vessel, excluding this vessel results in an average of 30.66

Receipts

- 3.20 Examination of receipts from salvage and off hire charges over the ETV contracts shows that receipts lag two or three years behind the salvage operation. For the purposes of this study early receipts are assumed to come from the present ETV contracts. Similarly those generated towards the end of the study period are assumed to be carried forward into the next contract period.
- 3.21 Examination of the total receipts from the commencement of ETV provision to the end of FY99/00 show £81,372 for salvage and £119,473 for return of hire charges has been raised. These receipts are paid in arrears and when averaged the actual receipts represent a benefit of £50K per ETV during a six-month winter contract or £100k per annum.
- 3.22 The Belton Report made assumptions regarding the benefit assumed to come from receipts, these figures have been increased in line with inflation, and the figures represent 10% of the estimated salvage awarded to an ETV. Although the Belton figures are approximately double those quoted in the above paragraph, the Belton figure has been used. This is due to the short time scale (three years) of MCA's receipts. Table 8 also shows the estimated values of receipts.

Annual Values		
	Safety Benefits	Receipts
Dover Strait	£2,292,034	£285,648
SW Approaches	£2,150,299	£285,648
The Minches	£811,092	£228,516
Fair Isle	£888,447	£228,516
<b>Total 4 ETVs</b>	<b>£6,141,872</b>	<b>£1,028,328</b>
Irish Sea	£1,261,852	£228,516

Table 8

Total Benefits

- 3.23 Total benefits are detailed in table 9.

Base Case NPV of Benefit over 10 Years				
	Pollution Prevention	Safety Benefits	Receipts	Total Benefit
Dover Strait	£2,397,349	£17,881,990	£2,228,569	£22,507,907
SW Approaches	£2,794,332	£16,776,200	£2,228,569	£21,799,101
The Minches	£12,580,863	£6,327,975	£1,782,836	£20,691,675
Fair Isle	£5,981,136	£6,931,484	£1,782,836	£14,695,456
<b>Total 4 ETVs</b>	<b>£23,753,680</b>	<b>£47,917,650</b>	<b>£8,022,809</b>	<b>£79,694,139</b>
Irish Sea	£4,697,342	£9,844,716	£1,782,836	£16,324,895

Table 9.

## Comparison of Costs and Benefits

- 4.1 The comparison of costs and benefits of ETV provision are summarised in Tables 10. Stationing ETVs at the four locations recommended in the report results benefits exceeding the cost of provision in both the medium and longer term. The cost is expressed as a range.

Comparison of NPV of Provision and Benefit over 10 years			
	Preferred Provision Option	Benefit	Cost
Dover Strait	Contract Charter with French	£22.5M	
SW Approaches	Contract Charter	£21.8M	
The Minches	Contract Charter	£20.7M	
Fair Isle	Contract Charter	£14.7M	
<b>Total 4 ETVs</b>		<b>£79.7M</b>	<b>£68.6M-£85.2M</b>
Irish Sea	Contract Charter with Irish	£16.3M	
<b>Total 5 ETVs</b>		<b>£96.0M</b>	

Table 10

## Sensitivity Testing of benefits

- 4.2 Summary data for the sensitivity tests completed on the pollution prevention benefits are detailed in table 12. The worst case scenario is a 1% decrease in total benefits while the best case scenario is an 4% increase.

Sensitivity Testing of Benefit NPV over 10 Years for 4 ETVs				
		Pollution Prevention	Total Benefit	% Change
1	Base Case	£23,753,680	£79,694,139	0.00%
2	Crude oil @ \$29/bbl	£24,115,356	£80,055,815	0.45%
3	1% year on year pollution decrease	£22,821,965	£78,762,425	-1.17%
4	Bunker clean up ratio 9:1 (revised figs)	£27,018,255	£82,958,714	4.10%

Table 12

- 4.3 Additional sensitivity testing was conducted using the base case but over a 25-year period. The two extreme period lengths resulted in differing provision methods being more economic. For the shorter ten year period contract charter proved to be more cost effective. For the longer 25 year period a build partnership shows a marginally better performance than contract charter. However this has to be balanced against the exposure to risk which goes with this method of provision.

Base Case NPV of Benefit for 4 ETVs over 25 Years				
	Pollution Prevention	Safety Benefits	Receipts	Total Benefit
Dover Strait	£4,169,963	£31,104,046	£3,876,386	£39,150,396
SW Approaches	£4,860,479	£29,180,628	£3,876,386	£37,917,494
The Minches	£21,883,232	£11,006,920	£3,101,076	£35,991,229
Fair Isle	£10,403,626	£12,056,667	£3,101,076	£25,561,369
<b>Total</b>	<b>£41,317,301</b>	<b>£83,348,261</b>	<b>£13,954,925</b>	<b>£138,620,487</b>

Table 13.