NUCLEAR FREE SEAS CAMPAIGN

GREENPEACE

THE RISING COST OF TRIDENT

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INTRODUCTION

The first Greenpeace report in July 1991 on the Problems of the Trident Programme[1] began the process of a realistic audit of the hidden costs to the taxpayer of the UK Trident programme. In addition to the £9,863 million included in the official budget for Trident, the report identified £2,540 million of additional expenditure on construction and development work essential to the programme (such as construction work at AWE Aldermaston, Faslane and Rosyth, and the development of the PWR2 submarine propulsion unit) as well as £10,676 million of lifetime running and decommissioning costs. Added to the 1991 official cost of £9,863 million[2], these hidden extra costs brought the full bill for the Trident programme to £23,079 million over its lifetime of 30 years.[3]

A year later, this figure needs substantial revision. As well as changes in the official figures and the effect of inflation, there have been increases in both actual and projected costs of the various parts of the Trident programme's infrastructure. More important, some of the costings for Trident's share of the UK warhead programme, hitherto unavailable, have come to light. This report updates our first report and shows that the full lifetime cost of the UK Trident programme is now over three times the official figure.

THE COST OF TRIDENT

The 1991/92 Government estimate for the cost of the Trident programme is £10,518 million[4].

However, this figure underestimates the actual cost of the Trident programme by over £22,500 million. The official estimate does not include:

1. items essential to the continuation of the Trident programme that are excluded on the grounds that they may be used for other purposes at a future date;

2. the lifetime running costs of the Trident fleet, along with the necessary infrastructure;

3. the post-lifetime costs of the Trident fleet - the cost of submarine decommissioning and disposal.

For example, only £52 million of a £1 billion plus construction programme at the Atomic Weapons Establishment, Aldermaston is officially attributed to Trident[5]. Yet until this construction programme is completed, it will not be possible to produce the full complement of warheads for Trident's missiles[6].

On this particular area of the official budget the House of Commons Select Committee on Defence had this to say:

"Although the original construction programme was not embarked upon because of Trident, the Trident decision transformed that programme in terms of scale and complexity - and eventual cost. We are not convinced that the proportion of these capital works attributed to the Trident budget provides an adequate reflection of the true cost to the nation of this programme..."[7]

This report details the updated hidden costs of Trident. The basis of the report is that any expenditure that is necessary for the completion of the Trident programme and the continuing operation of the Trident system should be included if the true cost of Trident to the nation is to be shown. See Tables 1,2 and 3 for a detailed breakdown of Trident costs.

TABLE 1: **TRIDENT COSTS NOT INCLUDED IN GOVERNMENT ESTIMATES (1991/92 PRICES)**

	Not Included (£ million)
SUBMARINES (LESS WEAPON SYSTEMS EQUIPMENT)	
Development of PWR 2 Nuclear Propulsion Plant	535
Lifetime (30 years) Running Costs	11,415
12 Refits for the 4-boat Fleet at £158 Million Each	1,896
Decommissioning Costs	77
WEAPON SYSTEM EQUIPMENT INCLUDING TACTICAL SYSTEMS	
VLF Communications Improvements	33
SHORE CONSTRUCTION	
Faslane Works	397
Clyde Submarine Base Externals (Roads & Services)	3
Coulport Works	1
Rosyth Works	285
Works Elsewhere	2
WARHEAD, MISCELLANEOUS AND UNALLOCATED CONTINGENCY	
Aldermaston Works	1,431
Trident's Share of AWE Running Costs from 1980 to 2030	6,492
TOTAL	**22,567**

TABLE 2: **THE OFFICIAL BUDGET FOR TRIDENT (1991/92 PRICES)**

	(£ million)
Submarines (Less Weapon Systems Equipment)	3,786
Weapon System Equipment Including Tactical Systems	2,104
Shore Construction	1,157
Warhead, Miscellaneous and Unallocated Contingency	2,524
Missiles	947
TOTAL	**10,518**

If the totals in Tables 1 and 2 are added together, as in Table 3 below, the true total cost of Trident is £33,085 million.

TABLE 3: **THE TRUE COST OF TRIDENT - THE GREENPEACE TRIDENT BUDGET (1991/92 PRICES)**

	(£ million)
Submarines (Less Weapon Systems Equipment)	17,709
Weapon Systems Equipment Including Tactical Systems	2,137
Shore Construction	1,845
Warhead, Miscellaneous and Unallocated Contingency	10,447
Missiles	947
TOTAL	**33,085**

TRIDENT WARHEAD COSTS

Official costs

The Government's official figures bury the cost of producing the UK Trident warhead within the 'Warhead, Miscellaneous and Unallocated Contingency' budget heading.

In the 1990/91 estimate of Trident costs this item amounted to £2,441 million[8], roughly 24% of the official cost of the whole programme. Within this budget head Unallocated Contingency accounted for £437 million[9], and of the remaining £2004 million a further £494 million was also earmarked for contingency[10]. This left £1510 million in the official budget for 'Warhead & Miscellaneous'.

This sum covers nuclear warhead tests and a number of Trident- related purchases, including purchase of warhead and re-entry body components from the US and the purchase of "special nuclear materials" from British Nuclear Fuels in the UK. Also included in this part of the budget is a little over £50 million of the £1 billion plus capital works programme at AWE Aldermaston[11].

Not included under 'Warhead and Miscellaneous' are the "basic intramural costs" of the Trident warhead programme[12]. In other words the day-to-day running costs associated with the design, development and production of Trident warheads have been excluded from the Trident programme's official cost.

Aldermaston running costs

The Atomic Weapons Establishment at Aldermaston has 'cradle to grave' responsibility for all British nuclear weapons. It designs and develops them, produces vital fissile components for them, assists in their maintenance while in service, and helps dismantle them at the end of their life.

Aldermaston's budget was £607 million for the year 1988/89[13]. Of this total, £49 million was spent on research[14], £331 million on warhead development, production and in-service support[15], £177 million on support services at Aldermaston (including capital project)[16], and a further £50 million on support services (including capital projects) provided by Aldermaston to other AWE sites[17]. Projected forward to 1991/92 prices, these levels of expenditure would put Aldermaston's budget for the last year at £750 million. The Aldermaston budget is outlined in Table Four.

TABLE 4: ALDERMASTON'S RUNNING COSTS

	1988/89 PRICES (£ million)	1991/92 PRICES (£ million)
Development, Production and In-Service Support for British Nuclear Weapons	331	409
Research at AWE Aldermaston	49	60
Support Services at Aldermaston (Including Capital Project)	177	219
Support Services at Other AWE Sites (Including Capital Projects)	50	62
TOTAL	**607**	**750**

Aldermaston's role in Trident warhead production

The work of AWE Aldermaston is an essential part of the UK Trident programme. Aldermaston has designed and developed the Trident warhead itself and the buildings and equipment needed to do this. It produces plutonium and highly-enriched uranium for the warheads, and while they are in service Aldermaston will carry out much of the necessary warhead maintenance and repair work.

We know that from about 1981 to 1987 Aldermaston's weapons development effort was almost entirely devoted to work on the Trident warhead[18]. Warhead production commenced in 1988, and is likely to continue until the year 2000; during this 12-year period Aldermaston's warhead production effort will be largely devoted to Trident[19]. From then on Aldermaston will be involved in warhead repair, maintenance and research work until the system is phased out between 2024 and 2030.

Altogether, between 1980 and 2030, Aldermaston will have been involved in Trident-related work for a total of 49 years, and during the 12 years of actual warhead production will have been doing little work (other than R & D) apart from Trident.

The estimated proportion of Aldermaston's budget over this period which should be apportioned to the Trident programme is given below. The estimate does not include research costs. The AWE's research budget for several years before 1988/89 was £60 million at 1991/92 prices.[20] Research on Trident would have started in the late 1970s/early 1980s, and will continue throughout the system's in-service life. Clearly a significant proportion of the AWE research budget over four decades will be attributable to Trident. However, on current knowledge it is not possible to quantify this proportion.

The estimate also excludes Trident development costs. Although we know that for 7 years from 1981 to 1987 AWE Aldermaston's development work was almost entirely devoted to Trident (see footnote 19), it is not possible to isolate the cost of this work from the 'Development, Production and In-Service Support' budget head, and so again it is impossible to assign a figure to this item of expenditure.

However an estimate can be given for Trident's share of this part of AWE's budget for the 12 years while Aldermaston is actually producing Trident warheads. Between 1988 and 2000 Trident will account for most of the AWE's weapons production effort: at a conservative estimate 70% of the 'Development, Production and In-Service Support' budget for these 12 years should be allocated to Trident warhead production. Assuming that expenditure continues at 1988/89 levels, this amounts to £286 million per year at 1991/92 prices - a total of £3,432 million over 12 years.

For a further 30 years while the warheads are in service Trident will account for a major part of Aldermaston's 'In-Service Support' work[21]. Again a conservative estimate would allow 25% of the 'Development, Production and In-Service Support' budget for in-service support in each of these 30 years. That amounts to £102 million at 1991/92 prices for one year. Over 30 years that's £3,060 million.

Adding together these estimates of the elements of AWE Aldermaston's running costs which are clearly attributable to the Trident programme produces a total of £6,492 million. This figure does not include the substantial but unknown research and development costs of the Trident warhead, so it must be taken as a minimum for Aldermaston's Trident-related expenditure. This cost has been entirely excluded from the official Government figures for the cost of Trident.

Aldermaston capital costs

A major programme of new capital works, including a new facility for manufacturing warhead components and processing fissile material, is underway at AWE Aldermaston. However only a small part of the cost of these works is officially attributed to Trident.

In 1989 the MOD reported that the purpose of these new facilities was to "ensure a safe nuclear warhead production capability into the future... The early stages of Trident production are taking place in AWE's existing facilities. These cannot, however, meet the total Trident requirement in the necessary timescale, and they are in any case nearing the end of their useful life."[22] A clear inference from this is that the capital works programme at Aldermaston is essential for continued production of nuclear warheads for the Trident programme. Yet less than 5% of the cost of these capital works is included in the official Trident estimate - with £1,431 million of capital costs left out altogether[23].

Also not included is an unknown amount of additional expenditure resulting from problems and delays in the construction of the new facilities since 1988.

OTHER COSTS EXCLUDED FROM THE TRIDENT PROGRAMME BUDGET

PWR2

The development of PWR2, a new nuclear propulsion unit for the Royal Navy's submarines, was originally embarked upon to provide propulsion for a possible new class of hunter-killer submarines, and only taken up for the Trident programme when the Government announced the purchase of Trident in 1981.

Although the production cost of £86 million per Trident submarine[24] is included in the Trident programme's official cost, none of the development costs of PWR2 have been attributed to Trident - despite current doubts over whether a new class of hunter-killers will be ordered. PWR2's development costs are estimated to be at least £535 million[25].

Faslane works

At the Clyde Submarine Base (which comprises Faslane and the Royal Navy Armaments Depot at Coulport) some £398 million is described as "Trident-related expenditure", yet not included in the Government's estimate[26]. Another £3 million of Trident-related expenditure is not included in the Government's estimate for "Clyde Submarine Base Externals" (roads, services etc.).[27]

Rosyth works

In order to provide refit facilities for the Trident submarines a major building programme must be carried out at Rosyth. Some £285 million of this work is Trident-related, but not attributed to Trident in the Government's estimate.[28]

VLF communications improvements

The construction of an experimental Extremely Low Frequency (ELF) transmitter at Glen Garry in Scotland, which would allow communication with submarines submerged at great depth, was considered by the MoD but appears to have been abandoned. This gives increased importance to the programme of improvements to the existing Very Low Frequency (VLF) communications system for Trident. These improvements are estimated to cost £33 million at 1991-92 prices, none of which has been attributed to the Trident programme.[29]

Trident's running costs

The Government says it does not expect the Trident system to cost more than Polaris to run[30]. At 1984/85 prices the running costs of Polaris which covers items like staff costs, equipment maintenance and operating costs[31], were estimated to be £250 million a year. This would give an annual running cost of £380 million at 1991/92 prices. It is estimated that Trident will be in service for a total of 30 years.[32] Thus, assuming Trident's running costs are equal to those of Polaris the lifetime running cost of the Trident fleet will be £11,415 million.

Refit costs

The Government's figures for the running costs of the Polaris system cover items like staff costs, equipment maintenance and operating costs[33], but do not include the cost of refitting the submarines.

At 1984/85 prices a refit of a Polaris submarine cost £104 million[34]. This is £158 million at 1991/92 prices. Each submarine is expected to undergo at least 3 refits during its lifetime, which would make a total of 12 refits for the full four-submarine fleet. If it is assumed that a Trident refit will cost no more than that of a Polaris, this would cost £1,896 million at 1991/92 prices.

Decommissioning and disposal costs

The cost of decommissioning is difficult to calculate with any accuracy since the Navy has little experience of it. HMS Dreadnought is the only UK nuclear-powered submarine that has been decommissioned to date, and is currently being stored afloat at Rosyth, awaiting disposal. Other submarines are at present undergoing the same process.

The cost of defuelling a nuclear powered submarine, not including the cost of storage afloat, has been given as £10-12 million at 1990-91 prices, and a further £2 million at 1990-91 prices would be expected to be spent every 10 years to cover maintenance costs[35]. This gives a rough cost of up to £18 million for decommissioning and 30

years' of maintenance for every submarine stored afloat at 1990-91 prices. With four submarines in the Trident fleet, it would cost at least £77 million (1991-92 prices) to decommission and maintain all four Trident submarines afloat for the next thirty years.

But in the longer term, the costs of disposing of the radioactive hulks of the Trident submarines after decommissioning are impossible to calculate, since the Government has yet to decide how this is to be done. Also impossible to calculate on current knowledge is the cost of dismantling Trident's warheads and storing the radioactive materials from within them. Though both these costs will certainly be substantial, neither of them are taken account of here.

SAVINGS FROM CANCELLATION

1. If the fourth submarine is not ordered

If the Government were to decide not to order the fourth Trident submarine, SSBN 08, the savings listed in Table 5 could be made. Savings from reductions in support services and infrastructure would be minimal, as these would have to be maintained for three Trident submarines as much as for four.

If the fourth Trident submarine is cancelled, savings within the lifetime of the current Government would be the cost of its construction, some £250 million, plus another £150 million for the equipment to be installed in it - a total saving of £400 million[36].

What has not been included are savings in running costs, refits and decommissioning.

The annual cost of running one Trident submarine should be similar to that for a Polaris[37]. The annual cost of running one Polaris submarine has been given as approximately £11.7 million at 1989/90 prices. At 1991/92 prices that would be £13.6 million. Therefore, over the projected 30-year service life of the Trident system, the cost of running one Trident submarine would be £408 million[39] (at 1991/92 prices).

The cost of three refits planned for the fourth submarine could also be saved, a total of £474 million as well as a minimum of £19 million on decommissioning the submarine at the end of its life.

TABLE 5: POSSIBLE SAVINGS FROM CANCELLING THE FOURTH TRIDENT SUBMARINE (AT 1991/92 PRICES)

	(£ million)
Running Costs of SSBN 08	408
3 Refits at a £158 Million Each	474
Decommissioning Costs	19
Government Figure for Savings	400
TOTAL	**1,301**

If the fourth Trident submarine is cancelled, savings within the lifetime of the current Government would be the cost of its construction, some £250 million, plus another £150 million for the equipment to be installed in it - a total saving of £400 million[40]. There would be no savings from running or decommissioning costs during this period as the submarine will not have incurred any of these costs prior to April 1997 (the last possible date for the next general election).

2. If whole Trident programme is cancelled

If the Trident programme were cancelled now, Table 6 shows that almost £17,000 million could be saved over the projected lifetime of the Trident programme, over one and a half times as much as the current Government estimate of £10,518 million for the total cost of the Trident programme (at 1991/92 prices)[41].

TABLE 6: SAVINGS FROM CANCELLATION OF THE WHOLE TRIDENT PROGRAMME (1991/92 PRICES)

	(£ million)
Running Costs of a 4-submarine Fleet	11,415
Refit Costs	1,896
Decommissioning Costs	77
Contingencies Within Each Budget	2,649
Remainder Left in Missile Budget	553
Government savings from cancelling fourth Trident submarine	400
TOTAL	**16,990**

Explanation

The running costs of the four boat Trident force are an obvious saving. These amount to £380 million a year for the next thirty years, a total of £11,415 million.

Also saved would be the cost of refits which would be a minimum of £158 million for each one. With a total of twelve refits planned for the four boat force this would amount to £1,896 million.

Further, within each budget there are quite large elements of contingency to provide for any overspend on a particular budget heading. The total amount of contingencies within the Trident budget in 1991 was £1,220 million[43]. This money is not earmarked for any particular project, and could therefore all be recouped as soon as the Trident programme is cancelled.

The purchase of missiles from the United States is another area where all money not spent can be immediately recouped. This is because missile orders are placed on a yearly basis and there is no monetary penalty for not buying anymore[44]. As of last year there was £553 million remaining in the missile budget[45].

Even within the lifetime of the current Government, cancellation of the Trident programme could lead to savings of over £3,600 million, as Table 7 shows.

TABLE 7: **SAVINGS WITHIN THE LIFETIME OF THE CURRENT GOVERNMENT FROM CANCELLATION OF THE WHOLE TRIDENT PROGRAMME (1991/92 PRICES)**

	(£ million)
Running Costs of HMS Vanguard from 1995 to 1997	27
Contingencies Within Each Budget	2,649
Remainder Left in Missile Budget	553
Government savings from cancelling fourth Trident submarine	400
TOTAL	**3,629**

Explanation

HMS Vanguard is expected to enter service in 1995, and the latest date for the next general election is 1997. By this date HMS Vanguard will have been in operation for two or three years, if it has not already been cancelled. As we have said above, the

annual running costs of one Trident submarine are expected to be up to £13.6 million. Assuming two years of running costs, the saving from cancellation would be £27.2 million.

The amounts for contingency and missiles are explained above.

Possible savings that are difficult to estimate

There are some potential areas where money could be saved but which are difficult to quantify. For example, AWE Aldermaston will cost over £36 billion to keep in operation for the next 49 years (the lifetime of the Aldermastons involvement in the Trident programme). By cancelling Trident you automatically cancel the large bulk of Aldermastons work and it would be difficult to justify the continuation of a British nuclear weapons programme, therefore Aldermaston could close. However, there will be a large amount of work to be done in decommissioning warheads produced as well as decommissioning the highly radioactive buildings, the budget for the AWE's would not be as large as it is at present. There are therefore potentially large savings to be made out of this £36 billion budget which are difficult to quantify.

Another area for savings is in the cancellation of construction and equipment purchase contracts. Without knowing the exact details of cancellation clauses within each contract signed, it is again impossible to know how much, if anything, can be saved from this area of expenditure.

CONCLUSION

As in the previous Greenpeace report, "The Problems of the Trident Programme", our estimates of the costs of the Trident programme, and of potential savings from cancellation are if anything conservative - because information on some costs remains hidden from the public.

Despite this, Greenpeace has shown that:

- **The true cost of Trident is now over £33 billion;**
- **Cancelling Trident now could save the country almost £17 billion over the lifetime of the system;**
- **Cancelling Trident now could save the country over £3.6 billion during the lifetime of the current Government alone.**

References:

1 "Report on The Problems of the Trident Programme", Greenpeace UK, July 1991.

2 HC 286 of Session 1990-91, pv, paragraph 4.

3 "Report on Problems of the Trident Programme", Greenpeace UK, July 1991.

4 Report on Trident by the Ministry of Defence, February 1991, deposited in the House of Commons Library.

5 HC 374 of Session 1988-89, pxxii, paragraph 68.

6 HC 422 of Session 1987-88, pxxii, paragraphs 73-4.

7 ibid, pxx, paragraph 62.

8 HC 286 of Session 1990-91, p19, A1b.

9 ibid, p21, A7.

10 ibid. "contingency" differs from "Unallocated Contingency" in that "contingency" is a form of fund used to top up the three budget headings in this category i.e. Warhead, Miscellaneous and Unallocated Contingency if they require more money. Whereas "Unallocated Contingency" has no particular heading to which its money is allocated, it can be diverted to any budget at any time if that particular budget requires more funds.

11 HC 422 of Session 1987-88, pxix, paragraph 56.

12 HC 422 of Session 1987-88, p23, A26.

13 Memorandum from the Comptroller and Auditor General to the House of Commons Committee of Public Accounts.

14 ibid.

15 ibid.

16 ibid.

17 ibid.

18 Aldermastons capacity only allows it to develop and produce one nuclear warhead at a time, as outlined by the Director of Aldermaston in 1980 when discussing Chevaline "The only warhead production and development work we carry out here and have carried out here in recent times has been related to Chevaline..... which is now complete..... and..... in the future the only warhead development work we will be doing here will be Trident." [HC 36 of Session 1980-81, p171, Q941] As Chevaline development had ended by then it is reasonable to assume that Trident warhead development was started soon after. Trident warhead design was frozen in 1987 [HC 374 of Session 1988-89, pxxi, paragraph 61.

19 See previous reference regarding Aldermastons capacity to only work on one new nuclear warhead at a time.

20 Memorandum by the Comptroller and Auditor General to the House of Commons Committee of Public Accounts.

21 Trident warheads will account for the large majority of Britains nuclear weapons during this time and will therefore still account for a substantial proportion of Aldermastons workload. The only other work AWE could be doing during this period is dismant ling old Chevaline warheads, producing new Trident components to replace old ones, and developing, producing and servicing of a new TASM warhead. In light of these considerations we feel that 25% is a fair but conservative estimate.

22 MoD Consultation Document on the Future Organisation of the Atomic Weapons Establishment, House of Commons Deposited Paper 5452, 5 December 1989, p.1, paragrah 6, and p2, paragraph 7.

23 HC 422 of Session 1987-88, pxx, paragraph 62. Expenditure given as between £879 million and £1,133 million at 1987-88 pric es, of which £52 million is attributed to Trident.

24 HC 422 of Session 1987-88, pxv, paragraph 32. The price of one PWR is given as £70 million at 1987-88 prices.

25 HC 369 of Session 1990-91, p56, A2. This estimate does not include the costs of running the prototype PWR2 reactor at HMS Vulcan after 15 May 1991.

26 HC 286 of Session 1990-91, p24, A27. Given as £371 million Trident related expenditure at 1990-91 prices.

27 ibid. Given as £61 million Trident related expenditure at 1990-91 prices.

28 ibid. Given as £345 million Trident related expenditure and £75 million Trident attributed expenditure at 1990-91 prices.

29 HC 479 of Session 1984-85, pvii, paragraph 9. Given as £22 million at 1984-85 prices.

30 Official Report, 21 March 1990, col.638W.

31 HC 37-I of Session 1984-85, p159, Q935.

32 If HMS VANGUARD is launched in 1992 (entering service in 1995, assuming 7 years between refit, each refit lasting 2 years, the submarine would come out of service in 2025, a service life of 30 years.

33 HC 37-I of Session 1984-85, p159, Q935.

34 ibid, p184. The cost for the second refit of HMS Repulse was given as £104 million, and this was considered by the MoD to be the typical cost of a refit. However, prices of refits vary between £100 and £110 million at 1984-85 prices.

35 HC 369 of Session 1990-91, p64, "Declassified extracts from evidence previously submitted by the MoD".

36 Oral evidence by the Ministry of Deffence to the House of Commons Defence Select Committe, March 5 1992. Unpublished.

37 Official Report, 21 March 1990, col.638W.

38 Official Report, 21 March 1990, col.638W.

39 This figure does not include any savings in support services and infrastructure. These would have to be maintained at roughly the same level whether you have one, two, three or four submarines in operation.

40 Oral evidence by the Ministry of Deffence to the House of Commons Defence Select Committe, March 5 1992. Unpublished.

41 Report on Trident by the Ministry of Defence, February 1992, deposited in the House of Commons Library.

42 This figure covers support services and infrastructure as well as staff costs, equipment maintenance and operating costs.

43 HC 286 of Session 1990-91, p21, A7.

44 HC 371 of Session 1987-88, p54, Q3053.

45 For Fiscal Year 1992 the UK was reported by the United States Senate to have purchased 23 Trident II D5 missiles. Assuming the Royal Navy paid the same price as the US Navy, which was £17 million per missile, the cost to the Trident programme would be £3 91 million. When taken away from the total missile budget of £944 million, leaves £553 million.