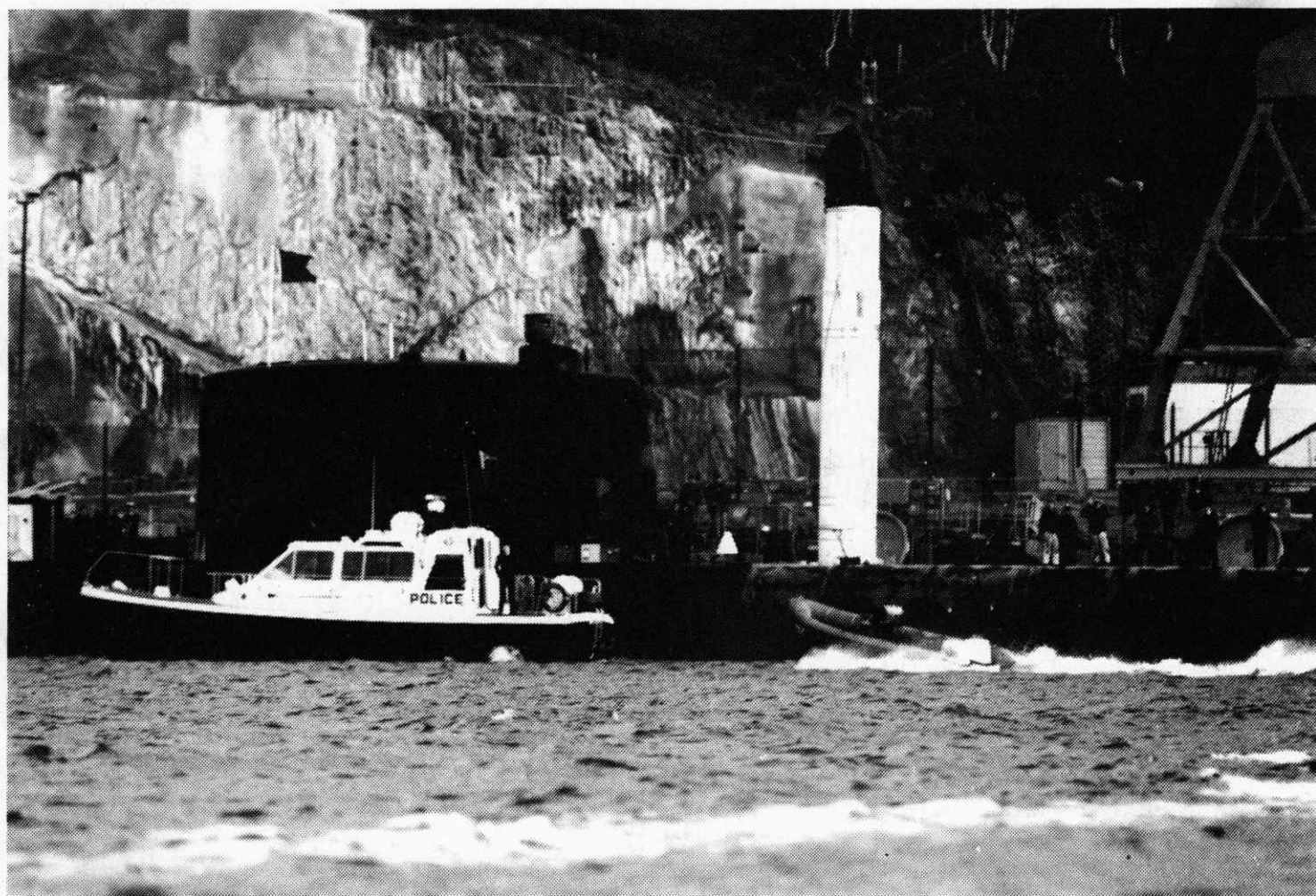


BRING POLARIS HOME

Report by Greenpeace

May 1991



Polaris submarine loading with nuclear missiles before going on patrol.

GREENPEACE

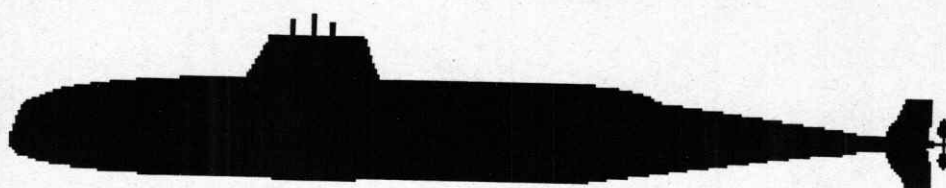
BRING POLARIS HOME

HMS Resolution

HMS Renown

HMS Repulse

HMS Revenge



A Report by Greenpeace UK

BRING POLARIS HOME

Summary

Careful study from informed sources including House of Commons Defence Committee reports and transcripts, have enabled Greenpeace to piece together the history of Polaris and its current operational status. Once assembled this jigsaw of information reveals that:

- * Polaris submarines, first launched in 1966, were designed and built to last for only 20 years. However policies and decisions on nuclear weapons, some made in the US, have forced its life span to be extended first to 25 years and now up to 30 years. This is despite evidence given to the House of Commons Defence Committee that this would "begin to look more like gambling than planning"
- * Virtually identical submarines in the Valiant/Churchill class, with exactly the same nuclear reactor, have been hurriedly paid off or berthed indefinitely because of the discovery of a serious reactor defect. The actual service life of these submarines, which are the same age as Polaris, has been between 19 and 23 years.
- * Coinciding with the discovery of the reactor defect on the Valiant/Churchill submarine, irregularities in Polaris patrol cycles and refit schedules have been noted. These indicate major problems with the operation of all four submarines of the Polaris fleet.
- * A detailed schedule of Polaris submarine refits at Rosyth reveals major problems including the current refit of HMS Renown, already extended by some 20 months. Overall a comparison with a projected timetable for the refits published by the House of Commons Defence Committee in 1980-81, shows a current lag of 3 1/2 years in refit schedules.
- * The nose-to-tail refit programme at Rosyth means that HMS Revenge, cannot enter refit until Renown comes out. Revenge is well overdue her intended third refit. She has now been in service since her second refit for a record breaking 8 1/2 years.
- * HMS Repulse, the most recent submarine out of refit has completed only one patrol in the past 16 months. Since July 1990 she seems to have been unavailable for service. The refit of Repulse took longer after discovery of 'stress corrosion cracks' in the submarines steam generator.

- * As a result of these problems and in order to maintain its practice of the theory of nuclear deterrence, by always keeping one boat at sea, HMS Resolution seems to have become the 'workhorse' boat. Over the past 16 months Resolution the oldest of the four polaris submarines, has spent around 10 months on patrol. Last year it completed one patrol of 16 weeks, twice the normal Polaris patrol of 8 weeks. Resolution has currently been on patrol for 12 weeks.
- * Overlaps between the patrols of HMS Resolution and HMS Revenge have been drastically reduced from the normal two weeks. In one case, in December 1990, it was a mere twelve hours. A further indication that the MoD is struggling to keep one boat at sea.
- * The reactor crack discovered on one of the Valiant/Churchill class submarines is design related and serious. It is a potential risk to all submarines of that reactor design including Polaris. Rolls Royce and Associates are currently attempting to developing techniques for the replacement of the reactor defect.
- * As present techniques currently stand, workers at the Royal Dockyards at Rosyth and Devonport, employed to carry out this work will receive high doses of radiation.
- * Continuing the operation of the ageing Polaris squadron heightens the risk of a nuclear accident. A serious accident could involve loss of crew and the submarine. Loss of a nuclear-powered submarine, with a full complement of nuclear weapons, also risks widespread radioactive contamination of the marine environment.

Greenpeace argues that the Ministry of Defence are operating a double standard in nuclear safety. Boats of the Valiant/Churchill class have been scrapped or berthed because of reactor defects. Yet it is the intention to operate Polaris submarines with identical nuclear reactors until Trident is in full operation in the mid to late 1990s.

Greenpeace considers that the risk of accident and the health of dockyard workers arising from the continued operation of Polaris to be unacceptable and, unreservedly, calls for the cessation of all Polaris submarine operations without further delay.

Greenpeace calls on the Government to "Bring Polaris Home".

Introduction

"It has long been the view of the MoD that the mid 1990s is stretching to the limit the effectiveness of the weapons system and in-service life of all Polaris SSBNs."

House of Commons Defence Committee 1984-85

The mainstay of Britain's nuclear weapons programme are the four nuclear-powered submarines of the Polaris fleet: HMS Resolution, Repulse, Renown and Revenge. The missiles are targeted on Moscow and other Soviet cities¹ and the submarines operate within a 4,660 km. range of this target.²

Britain also operates fourteen other nuclear powered hunter-killer attack submarines belonging to (in order of entering service) the Valiant/Churchill, Swiftsure and Trafalgar class. They do not carry nuclear weapons.

Polaris submarines were first introduced into service in the late 1960s. During the last two decades the boats operated a regular patrol pattern, so much so that the 1984 BBC documentary "Submarine" stated:

".....Polaris submarines, with their two crews and fixed pattern of patrols, allow the submariner to arrange summer holidays, know when he will be away for Christmas, and generally plan his life....."³.

Even though the Ministry of Defence maintain the utmost secrecy regarding Polaris patrol movements, the overall pattern of fleet operation and individual boat movements is not difficult to ascertain. When berthed the distinctive Polaris submarines are tied up alongside Faslane on the Clyde in full view of the public. Prior to patrol the embarking submarine arms with missiles at the nearby nuclear warhead store at Coulport. When withdrawn for extensive refitting and refuelling, each submarine has to be dry docked at Rosyth on the Firth of Forth. On a human scale, the presence and absence of each of the permanent crews of the submarines is noticeable within the small local communities. Local and regional newspapers regularly report the presence of Polaris submarines at the Faslane and Rosyth berths.

However, the almost completely predictable cycle of past Polaris patrols has been very irregular of late. The first significant disruption occurred early last year. On 14 January 1990, wives of the submariners on board HMS Resolution waved goodbye to their husbands as the submarine left its base at Faslane for regular 10 day pre-patrol sea trials. Just four days later the wives received telephone calls informing them that their husbands would be home sooner than expected. On January 19th HMS Resolution sailed back up the Clyde and docked at Faslane.⁴

Since that time there has been a collapse of the hitherto regular Polaris patrols. It is clear that the MoD have been struggling to keep one Polaris submarine at sea at all times. One submarine patrol was doubled in length to sixteen weeks, another has hardly put to sea at all, and the overlaps between patrol cycles appear to have been cut so fine that there is reason to doubt whether there has always been one Polaris submarine on regular operational station at all times. Not only are these patrol patterns highly irregular but the refit schedule at Rosyth seems to have "gone out of the window" with the current delays in the refitting of HMS Renown exceeding 18 months.

All of this has coincided with problems on nuclear powered submarines of similar age, belonging to the Valiant/Churchill class. In January 1990 a major defect was reported in the nuclear reactor system of one of these submarines, HMS Warspite. Shortly after this discovery all five submarines of the Valiant/Churchill squadron had returned to port. Since then none of these boats has put to sea under nuclear power. Three have been scrapped, the other two have remained at Faslane. In addition all nuclear-powered submarines have been undergoing a programme of inspection.⁵

The Polaris fleet share exactly the same P1 nuclear reactor as the Valiant/Churchill class and are at risk of, or have extant, the same defect. Warspite was the first of the P1 reactor boats to undergo a fourth refit. In this respect, she is a lead boat. Such a defect found on Warspite is, in all probability, likely to occur on other reactor systems of this type. ⁶

In December 1990 Greenpeace commissioned an independent firm of engineering consultants, Large & Associates, to assess the risks to the nuclear submarine fleet from the reactor defect found on Warspite. That report, "Reactor System Defects in Royal Navy Nuclear Powered Submarines" concluded that the greatest danger stemmed from the presence of developed cracks within the nuclear reactor which could lead to a failure of the reactor coolant circuit, placing the submarine at risk of loss at sea and radioactive contamination of the marine environment.⁷

This Greenpeace report "Bring Polaris Home", reveals the growing problems with the Polaris fleet. The irregular patrol cycles and refit problems have resulted in one submarine, HMS Resolution, doubling its patrol lengths. Another, HMS Revenge, is well overdue refit and has been in service since its last refit for a record breaking 81/2 years; overlaps between the patrols of these two submarines have been cut to a minimum. HMS Repulse, the most recent submarine out of refit, has hardly put to sea at all. HMS Renown is currently 20 months delayed in leaving refit at Rosyth.

The report also notes that Polaris is an ageing submarine fleet, hurriedly brought into service in the 1960s. It is being eked out further and further into the 1990s to meet changing political demands resulting from Britain's dependence on United States nuclear weapons technology. It is a weapons system incorporating 1963 technology and given a projected life-span of only twenty years.

Furthermore, keeping Polaris operational will require exceptional repairs to the reactor system; there will be high radiation doses to the dockyard workers involved in the repairs. Overall, there is a heightened risk of a nuclear accident at sea or in approaches to port. The report concludes that there is a double standard in nuclear safety: boats of the Valiant/Churchill class, with identical reactors to the Polaris fleet, have been scrapped or berthed as a result of the reactor defects. Yet it remains the intention of the Government to maintain the Polaris squadron until it is replaced by Trident in the mid to late 1990s.

History of Polaris

Britain's commitment to a submarine-launched nuclear weapons system commenced in the early 1960s. This followed the failure to develop and then procure satisfactory ground, and air launched nuclear warhead systems. In 1960 President Eisenhower agreed to sell US Skybolt air-launched missiles to Britain, but later in 1962, this plan was cancelled when the US unilaterally cancelled Skybolt. The decision to scrap Skybolt provoked a crisis at the 1962 Nassau Summit between Kennedy, the new president and the British Prime Minister Macmillan. There was grave doubt as to whether the US would continue the "special" nuclear relationship with the UK at all. Kennedy was eventually pressured into agreeing the sale of the US Polaris missile to the UK. This change in policy necessitated urgent design and development of both submarine launcher and nuclear warhead for this specific US Polaris missile system.⁸

Until that time the UK interest in nuclear-powered submarines was confined to developing a nuclear hunter-killer submarine fleet. The first Royal Navy nuclear powered submarine, HMS Dreadnought⁹, was followed by the Valiant/Churchill class of five submarines. When Polaris was adopted, an expedient decision was made to modify the Valiant/Churchill design to incorporate the launch tubes for Polaris missiles. Simply, the Valiant/Churchill hull was to be extended by inserting an additional compartment amidships for 16 Polaris missiles. This design rationale was explained by the then Managing Director of Vickers Shipbuilding, Mr Mott, to the House of Commons Defence Committee¹⁰:

" In the case of Polaris the simple view taken at the time was that we cut [a] Valiant submarine in half and then inserted the Polaris system. That was a quick answer to the problem at the time."

This somewhat hurried design approach eventually produced the four nuclear powered Polaris submarines HMS Resolution, Repulse, Renown and Revenge, which were commissioned during the period 1967 to 1969. In fact, the 1980-81 Defence Committee freely admitted:

" ..the Polaris boats were hastily designed with relatively untried plant" ¹¹

The relatively untried plant referred to here was the Valiant/Churchill class of submarine. It was at the advanced design and development (but not construction) stage when the Polaris adaption of design decision was made. In other words, not only was the Polaris class of submarine based on a submarine hull designed for the entirely different attack role, but this design had not then been proven in fleet operation.

In summary: apart from the Polaris missile compartment and the increased length, almost everything else about the Polaris and Valiant/Churchill classes of submarine are the same, including the nuclear reactor system.

Polaris Design Life

There are two factors which the MoD consider when determining the operational life of a Polaris submarine. First and foremost, there is the capability of the submarine hull, conventional equipment and nuclear reactor system to operate and perform satisfactorily and safely over a specified number of years. Second, the squadron of Polaris boats must be maintained in operation until the successor Trident nuclear weapons system is available and in operation.

Submarine Design Life

In 1973, five years after Polaris was fully operational, MPs were told that the submarines had been designed and built to last approximately 20 years¹². At that time, MPs were informed, it was intended to keep the oldest (Resolution) in operation until 1986 and the newest (Revenge) until around 1990. However, when considering replacement nuclear weapons systems for Polaris, particularly during the late 1970s and early 1980s, the House of Commons Expenditure Committee deemed that Polaris had a "better prognosis", modifying the life expectancy to around 25 years:

" ... the planning assumption must be that the existing British force will cease to constitute a reliable deterrent at a date, which for technical reasons, is likely to occur in about 1993."¹³

On this basis, the first Polaris submarine, Resolution, would come out of service sometime this year, 1991, with the final Polaris submarine, Revenge being paid off in 1993.

However, the submarine hull was originally designed for only 20 years life and so were the parts to go in it:

" the life of the plant is the same as the life of the submarine. The design of the plant itself is designed to be the same as the life of the submarine."¹⁴

Doubt about the five year extension was expressed by a board member involved in the general purpose Warship Building Committee :

" Of course, the present Polaris submarines do represent 1963 technology and materials. The life of those submarine has in fact been extended longer than one would have expected when one did the design."¹⁵

In other words, boats of the Polaris squadron were originally designed for a service life of 20 years but this was subsequently eked out to 25 years. Determination of Polaris life seems to have been drawn from considerations relating to the submarine hull durability, and reliability of the conventional once-in-a-lifetime installed plant, weighed against the timing of the successor nuclear weapons system.

On the other hand, the recent decision to scrap or berth the five Valiant/Churchill class of hunter-killer submarines most certainly relates to a serious defect in the nuclear reactor system. The scrapping, or berthing, of the Valiant/Churchill class boats sets their service lives at Warspite 23 years, Churchill 20 years and Conqueror 19 years. The same reactor system is installed in each of the Polaris boats.

Trident I and II Programmes

Strategic planning for the phased withdrawal of the Polaris squadron from the early 1990s was originally based on the **Trident I** missile system programme under the control of its US developers. Under this plan, withdrawal of Polaris conveniently dovetailed with the service introduction of **Trident I**. The first Royal Navy **Trident I** was to be commissioned in 1992 and the last in 1995, with HMS Resolution and Repulse being withdrawn from service between 1990 and 1992. This phasing enabled both Polaris and Trident to be deployed simultaneously, providing a comfortable overlap between Trident and Polaris, with HMS Revenge and Renown continuing the Polaris arm in service until around 1993.

However, in October 1981 President Reagan announced that the US **Trident I** system was to be curtailed and replaced by the multi-billion dollar **Trident II** system from 1995. Thus, just at the very time Britain would be introducing **Trident I** into service this system would be redundant in the United States. Not to be caught out as they had been with Skybolt, Britain promptly plumped for the **Trident II**.

This late decision in switching to **Trident II** caused major problems for defence contractors in Britain. **Trident II** missiles are not merely an update of **Trident I**. The missiles system requires a larger submarine launcher and each missile carries a greater complement of nuclear warheads. Both submarine and nuclear warhead design and development programmes have pushed back the anticipated in-service date for Trident from 1992 to at least the mid-1990s.¹⁶

Phasing Out Polaris

The Ministry of Defence intends to phase out the last Polaris submarine when the third Trident submarine enters operational service. If an optimistic date for this is taken as 1997, Polaris submarines will have been in service for between 28 and 30 years (depending which submarine(s) stay in service the longest). Any delays to this date would increase the amount of time Polaris spends in service even further.

In 1979 MPs were told that to base policy on the expectation of a life for Polaris of any longer than 25 years would

"... begin to look more like gambling than planning...."¹⁷

and in 1985 the Defence Committee Report stated:

" It has long been the view of the MoD that the mid 1990s is stretching to the limit the effectiveness of the weapons system and in service life of all Polaris SSBNS."¹⁸

So policies and decisions on nuclear weapons systems made in the United States, which were completely beyond the control of the UK Ministry of Defence, have set back the UK nuclear weapons programme. This has resulted in a continuing reliance upon the current Polaris system into future years, extending its life from an original design life span of 20 years to 25 years, and then as circumstances dictate possibly up to 30 years or more. On one hand, the virtually identical boats of the Valiant/Churchill class have been hurriedly paid off or berthed¹⁹ because of the discovery of a serious reactor defect - the actual service life of these boats has been between 19 and 23 years. On the other hand, the Polaris boats of similar age and with identical nuclear reactor systems are deemed fit for continuing service until the late 1990s.

The changing life expectancy of the Polaris squadron is best summarised as follows:

Name of Submarine	Date launched	Date withdrawn after 20 years	Date withdrawn after 25 years
Resolution	Sep. 1966	Sep. 1986	Sep. 1991
Repulse	Nov. 1967	Nov. 1987	Nov. 1992
Renown	Dec. 1967	Dec. 1987	Dec. 1992
Revenge	Mar. 1968	Mar. 1988	Mar. 1993

Troubles with the Polaris Squadron

During the past eighteen months major problems have arisen in the scheduled operation of the Polaris squadron. These problems relate to the extended periods during which individual boats have been held in refit and out of service.

Submarines are still undergoing a programme of inspection. The duration of operational patrols has been exceptionally extended on occasion from eight weeks to twelve weeks and even to sixteen weeks. One boat, Revenge, is operating well beyond her normal commission length, in service, between refits.

Problems with Refits

It is necessary that Polaris submarines are regularly refitted during their service life. During a refit the submarine hull is extensively overhauled, steam raising and reactor system equipment is refurbished and the reactor is refuelled. With improvements in the overall system design, and particularly the reactor fuel change, refits now occur at between five and seven years with each berthing and dry-docking occupying about two years before the boat re-enters active service.²⁰

All Polaris squadron refits take place at the Rosyth Naval Dockyard on the Firth of Forth, with each boat successively entering refit on a nose-to-tail basis.

In 1981 the Defence Committee published a projected timetable for the refitting of the Polaris squadron throughout the 1980s, which then included a fourth refit of Resolution. The extent of slippage that has occurred during the last decade is illustrated by comparison with the actual Polaris squadron refit programme²¹ to the earlier prediction:

The first serious slippage commences in 1984 with, thereafter, the projected and actual refits lagging out of step. Particularly serious problems arose in the late 1980s with Renown stuck in refit since October 1987. A normal refit would mean Renown leaving Rosyth in October 1989. To date the delay is nearing 20 months. It is rumoured that Renown will stay in refit for at least another year.

Dates of the actual refits for each submarine are as follows:

Name	Resolution	Repulse	Renown	Revenge
In service	Oct.'67	Sep'68	Nov'68	Dec'69
1st refit	May'70 - Jul'71 (1yr 3mth)	May'71 - Jul'72 (1yr 3mth)	Dec'72 - Jan'74 (1yr 2mth)	Jan'74 - Apr'75 (1yr 4m)
2nd refit	Apr'75 - Nov'76 (1yr 7mth)	Nov'76 - Jul'78 (1yr 9m)	Jul'78 - May'80 (1yr 11m)	Apr'80 - Sep'82 (2yr 6m)
3rd refit	Aug'82 - Sep'84 (2yr 2m)	Sep'84 - Sep'86 (2yr 2m)	Oct'87 - (3yr 6m)	

Originally, it was the MoD's intention to refit each Polaris submarine three times with an option for a fourth refit for HMS Resolution.²² Polaris squadron refits were originally scheduled to last approximately one year. By the second round of refits, the submarine underwent more substantial servicing and modification with, at about this time, extensive changes being implemented to the reactor fuel core assembly.²³

By 1980 the estimated length of the second refit had increased to twenty months.²⁴ Although the second refit of Revenge actually took 30 months, this delay was primarily due to an industrial dispute at Rosyth. The general trend is for the Polaris refits to take longer as the boats get older and more things go wrong. For example, the completion of the third refit of Repulse was delayed after a last minute discovery of 'stress corrosion cracking' in the steam generator.²⁵ Another example was Resolution returning to Rosyth at the end of 1986, after completing her third refit, for extra repairs. The problem here for the Ministry of Defence planners is that not until a particular boat is berthed for refitting are they able to assess the extent of refitting required and then, as with Renown, plans can go seriously wrong.

When the Rosyth Dockyard refit is completed the boat then has to undergo sea trials, crew training and missile firing tests. This programme of recommissioning occupies about nine months. If Renown is delayed for a further year at Rosyth then, with her working up trials, she will not be ready to re-enter operational service until early 1993.²⁶

Delays and interruptions in the overall Polaris squadron refit schedule have major implications for the commission length of each submarine, that is the amount of time each boat spends in sea service between refits. The commission lengths for each Polaris submarine to May 1991 have been as follows:

	Resolution	Repulse	Renown	Revenge
Commission to 1st refit	2yr 8mth	2yr 9mth	4yr 2mth	4yr 2mth
btw 1st & 2nd refit	3yr 9mth	4yr 4mth	4yr 6mth	5yr 1mth
btw 2nd & 3rd refit	5yr 10mth	6yr 1mth	7yr 6mth	8yr 7mth
from 3rd refit	6yr 7mth*	4yr 6mth	in refit	no 3rd refit

* Resolution was recalled back to Rosyth after the 3rd refit for special repairs.

It was originally envisaged that Polaris would stay in commission between refits for approximately 5 years.²⁷ The first refits took place a little sooner than that, particularly in the case of Resolution and Repulse. This is not unexpected for the first submarines of a new class.

In 1985 the Defence Committee were informed that both Polaris and hunter-killer submarines had been modified to extend the reactor core life, so that they could stay in commission between refits for longer than 5 years. Although the Ministry of Defence will not state the maximum length of commission, it indicated in 1985 its satisfaction that one submarine (Repulse) had been in commission for 6 years 1 month. Moreover, the intention then seemed to be to run Renown on for a longer period than that. In fact, Renown stayed in service for 7 years 6 months but her subsequent (current) refit has been very extensive.

In planning for the transfer to Trident, accurate predictions of maximum commission lengths between refits is essential. When this issue was reported on by the Defence Committee in 1985, it was clear from Ministry of Defence evidence that the maximum commission length between refits being considered was 6 - 7 years. Even then concerns were expressed:

"...clearly this is pushing the system life a bit."²⁸

The refit schedule aims at optimally working out the full commission length of the first Polaris boat before she is paid off, thus avoiding the boat entering a fourth £120+m refit. It is clear from Defence Committee reports that this was the objective for Resolution. It was intended to be paid off around the end of 1991, after 25 years in service. Under this scheme of things Resolution would have completed her final seven years commission length, leaving the remaining three boats to cover during the first stage transition to Trident.

In other words, the projected date of the Trident introduction into service, commission lengths of each Polaris boat, and the refit schedule are all intimately linked. If Trident is delayed then the final commission length of the retiring submarines must be extended. If one boat encounters difficulties and delays in refit with the refit period being extended, then the boat awaiting refit must stay in commission longer. And if one of the operational submarines is unreliable then the other two Polaris submarines must absorb the extra patrol burden.

Delays at Rosyth have meant that Revenge originally scheduled to enter refit at the end of 1989, later revised to 1990, has been in service since her second refit for a record breaking 8½ years. Revenge cannot go into refit until Renown leaves Rosyth. The longer Renown stays in Rosyth the longer Revenge will have to stay in commission.

Adding to the patrol burdens of these two submarines is evidence from the local MP John MacFall who claimed that Repulse had, in the past few years, only been on patrol for a limited period of time. (In the past sixteen months Repulse has completed only one patrol. Repulse is the latest submarine out of refit and if available for patrol it is hard to understand why it is not being used.) For as long as Repulse remains unreliable Revenge along with Resolution must continue to alternate on patrol.

This reasoning suggests that the Ministry of Defence is presently faced with a planning nightmare: Revenge is operating for a record period of time since her last refit. Having cancelled Resolution's fourth refit, she is rapidly approaching her retirement date. The MoD's ability to meet the political requirement of keeping one boat at sea at all times can only be met by getting Repulse and Renown out on operational patrol.

Patrol Cycles

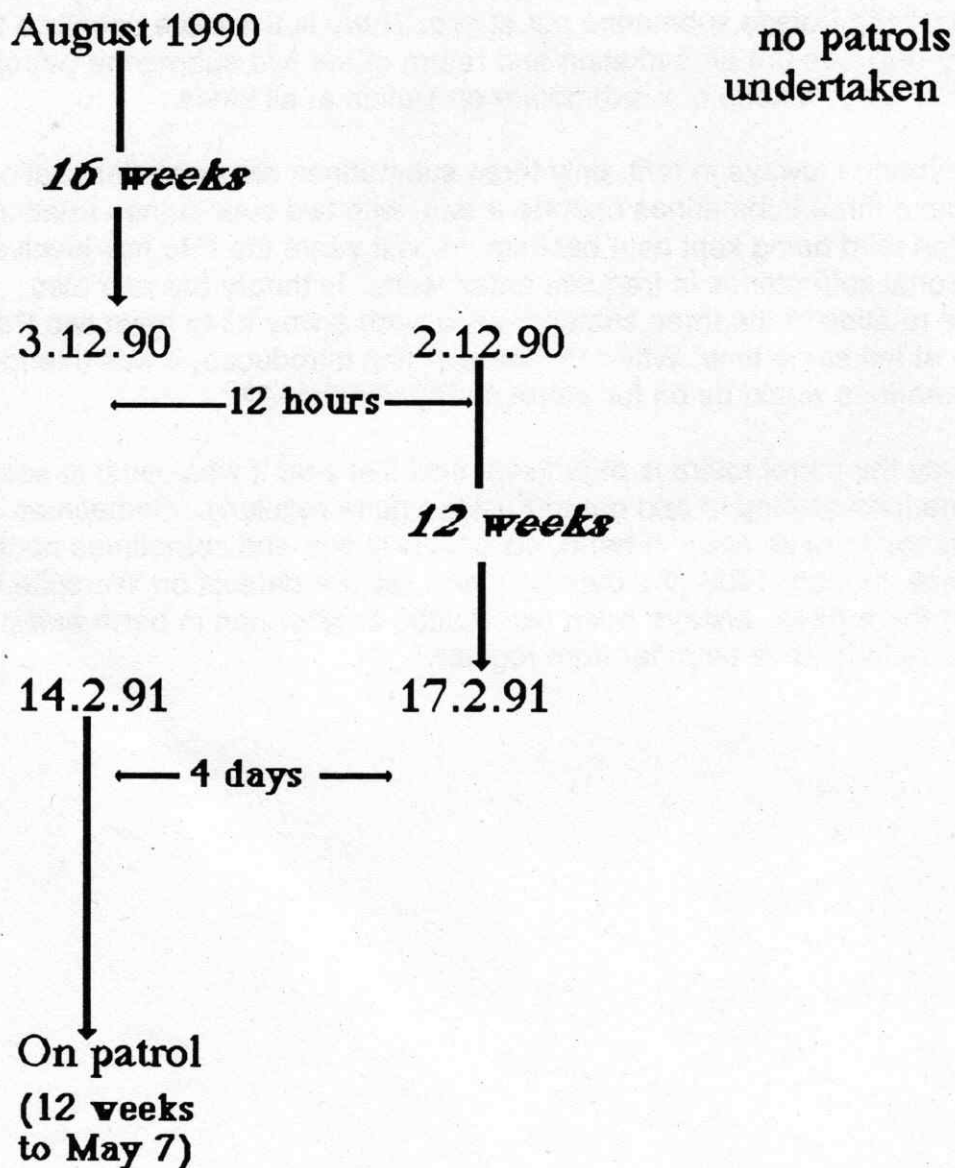
In 1984 a regular Polaris patrol was stated to be of approximately 8 weeks duration. Upon completion of the patrol the submarine would return to Faslane and spend around 4 to 5 weeks in berth for crew change and equipment checks. Then, before returning to patrol duties, the submarine undertook about 10 days of sea trials. Thereafter it loaded with missiles and embarked on the outward leg of the patrol to relieve the Polaris submarine out at sea. There is therefore usually a two week overlap between the embarkation and return of the two submarine patrols. This allows the MoD to keep one submarine on station at all times.

With one submarine always in refit, only three submarines are operational at any one time. These three submarines operate a rota, with two submarines rotating patrols and the third being kept as a back up. In past years the rota has involved all three operational submarines in frequent patrol work. In theory the rota also facilitates the rotation of the three submarines in such a way as to have two Polaris on full patrol at the same time. When Polaris was first introduced, it was intended that two submarines would be on full patrol at any one time.²⁹

Whichever way the patrol rota is organised, until last year it was usual to see Polaris submarines coming in and out of Faslane quite regularly. Sometimes there are two submarines to be seen in berth, occasionally one and sometimes none. However, since January 1990 (the date on which reactor defects on Warspite were made public) there have **always** been two Polaris submarines in berth and patrol cycles and durations have been far from regular.

The table gives an account of Polaris movements since early August 1990.³⁰ **Patrol** periods indicated by **vertical** lines. **Overlap** time between patrols by **horizontal** lines.

HMS Resolution HMS Revenge HMS Repulse



*HMS Renown in refit at Rosyth

In order to practice its theory of nuclear deterrence the Government must keep one Polaris submarine at sea at all times. Increases in patrol lengths of up to sixteen weeks and the reduction in the overlap between the patrols are both indicative of the operational problems being experienced by the Polaris fleet.

Between August and December 1990 HMS Resolution undertook a patrol of 16 weeks, twice the normal patrol length. In fact HMS Resolution, the oldest Polaris boat, has been on patrol for 10 months out of the past 16 months.³¹ It can only be assumed that a decision to keep 143 men cooped up in a submerged submarine, with no communication with the outside world for twice the normal period of time, would only be taken out of necessity. Although one submarine has always been at sea, the reduction in the overlap between patrols has been from two weeks to as little as 12 hours. This has given rise to speculation that there has not always been one Polaris submarine on normal operational station. If things were running smoothly and according to plan, past experience shows a more comfortable overlap of two weeks would have been allowed for.

Reactor System Defects

So far recent changes in Polaris patrol periods and individual commission lengths have indicated that operational problems are currently being encountered by the ageing fleet of Polaris submarines. That this should occur can be of no surprise since all four submarines are now operating well beyond their original design capabilities.

The departure from the regular patrol pattern of Polaris in January 1990 coincided with the discovery of the reactor system defect of HMS Warspite. Following the announcement of the Warspite defect whilst it was in refit at Devonport, the remaining three operational Valiant/Churchill class squadron (a fifth, Churchill, was in refit at Rosyth) were recalled to berth, where they have remained since that time. Thereafter, the nuclear reactors of all British nuclear submarines were subject to an inspection programme. In evidence to the 1990-91 Defence Committee, MoD witnesses stated that:³²

- * **The inspection for each submarine would involve a two stage process and that all submarines have been through the first stage but not all had completed the second stage inspection.**
- * **That certain but unspecified submarines have had some repairs.**
- * **That the Ministry is confident that they can repair the defects and that techniques are being devised for replacement and/or repairs.**
- * **Work on replacement/repairs will be carried out at the Royal Dockyards.**

Under examination the Ministry of Defence noted that the two-stage inspection process was lengthy because of the

".... inaccessibility of the inspection area..."

which suggests that the inspection process requires personnel working within the confines of the submarine reactor compartment **and subject to radiation exposure**. Greenpeace has received confirmation from informed sources that repairs to the reactor defect will entail significant radiation doses to the workers involved and that 'techniques for replacement' are being developed by Rolls Royce and Associates, the designers of the nuclear reactor.

The workers undertaking this job at either Rosyth or Devonport, or both, have just negotiated lower radiation dose limits with their respective managements in the

light of the Gardner report which linked paternal occupation to childhood leukaemia. It is understood that as the 'techniques for replacement' of the reactor defect now stand, these dose limits would be reached very quickly.³³

Conclusion

This report has demonstrated that something is seriously amiss with Britain's Polaris submarines. It has explained the troubled development and history of the Polaris squadron; that the design of the Polaris submarine was a hurried adaptation of the then fledgling Valiant/Churchill class of hunter killer nuclear-powered submarine; and that these boats were originally designed for a service life of twenty years.

It then examined the chequered procurement of Trident from the United States: first, the ordering of **Trident I** and then the change to **Trident II** which necessitated substantial design changes in both the Trident submarines and the nuclear warheads. These design revisions and ensuing development difficulties have added to the delays in the commissioning of Trident which, in turn, has prompted a Polaris management crisis for the Ministry of Defence. The dilemma for the MoD is that it now has to stretch out the commission lengths of the currently operational Polaris submarines, keep HMS Resolution in service past her planned paying off date and rejig the refit schedules because of troubles with Renown.

In the latest turn of events, the MoD suddenly announced the paying off and nuclear decommissioning of three Valiant/Churchill class nuclear-powered submarines. There can be no doubt that the reason for withdrawing these particular hunter-killer submarines had more to do with the substantial defect which had developed on Warspite, rather than the short term saving resulting from the Government's 'Options for Change' proposals. After considering the evidence the 1990-91 Defence Committee concluded:

".... we are not clear how far it (the decision to abandon refits on Churchill and Warspite) was taken as part of a programme of financial savings..... and lends some credence to speculation that the decision to decommission Warspite and Churchill resulted not from short-term financial constraints or from the Options for Change proposals, but from discovery of material defects in the submarines' reactor systems."³⁴

The Defence Committee went on further to conclude that it was likely that Valiant and Courageous would be decommissioned before very long ³⁵, as would the oldest Swiftsure class boats which have the same nuclear reactor system.

The Ministry of Defence acknowledges that the reactor systems of the Polaris

squadron boats are also prone to the same reactor defect that has beset and shortened the service life of the Valiant/Churchill squadron boats. Greenpeace notes that all of the Valiant/Churchill boats have been either scrapped or laid up. Although the Polaris submarines continue to go out to sea there are many indications of operational problems. The techniques to repair the reactor defect are being developed which could lead to workers receiving high doses of radiation. Thus, Greenpeace concludes that the political imperative to keep Polaris in service is raising the risk of an accident or radioactive leak at sea and the health of workers expected to carry out reactor repairs in port. Since the Cold War is over, this political imperative can no longer be used to justify the health and safety risks involved in the deployment of the ageing Polaris fleet.

Greenpeace calls for all Polaris submarines to be immediately withdrawn from service.

References

1. House of Commons Defence Committee Fourth Report Session 1980-81, HC36, Strategic Nuclear Weapons Policy HMSO pviii.
2. SIPRI Yearbook 1990 Oxford University Press, p.20 table 1.5 & Modern British Military Missiles, Paul Beaver & Terry Gander, pub. Patrick Stevens Ltd., 1986, p50.
3. Submarine by Jonathan Crane, BBC 1984 chapter 4 p.198
4. "Navy Wives Told Don't Panic" Daily Record 22 January 1990.
5. The Valiant/Churchill class of HMS, Valiant, Warspite, Churchill, Conqueror and Courageous were fully commissioned between 1966 and 1971, although the construction/commissioning programme was delayed by over a year because of the priority assumed for the Polaris programme. This class of hunter-killers or attack SSN boats is very different to the Dreadnought prototype, each being armed with torpedoes and, possibly with mine laying capability. Recently Warspite, Conqueror and Churchill were paid off and are now awaiting a decision on nuclear decommissioning. The two remaining boats, Valiant and Courageous, have not put to sea for more than a year. They are likely to be scrapped in the near future because of the same nuclear reactor system defect originally discovered in Warspite in 1989-90, although attempts do seem to be being made at Faslane by Rolls Royce and Associates to make them seaworthy. The first two boats of the following Swiftsure class, HMS Swiftsure and Sovereign are also potentially have the same reactor defect.
6. Reactor System Defects In Royal Navy Nuclear Powered Submarines, Report for Greenpeace UK, by Large & Associates, 4 December 1990 p.3, para 3,
7. Reactor System Defects In Royal Navy Nuclear Powered Submarines, Report for Greenpeace UK, by Large & Associates, 4 December 1990 p.4, para 2.
8. Following agreement over the supply of Polaris to Britain, in mid-December 1962, at Nassau, the decision to go-ahead with four Polaris submarines was announced in May 1963 and the option to build a fifth was cancelled in February 1965. At the time of the Nassau agreement the first British nuclear-powered submarine had just put to sea. The Royal Navy had little knowledge or experience of operating nuclear powered submarines.
9. HMS Dreadnought was the first Royal Navy nuclear-powered submarine. Launched in 1960, this one-off prototype had a much troubled service life, being paid off at Chatham in 1982, then being towed to Rosyth where the hulk remains in storage afloat.
10. House of Commons Defence Committee Fourth Report Session 1980-81 HC36 Strategic Nuclear Weapons Policy, HMSO, p123 Q649.

11. House of Commons Defence Committee Fourth Report Session 1980-81 HC36 HMSO p.x, para 16.
12. House of Commons Expenditure Committee, Session 1972-73, HC399, Nuclear Weapons Programme, HMSO px, para 10 -Equipment Life.
13. House of Commons Expenditure Committee, Sixth Report Session 1978-79 HC348 The Future of the United Kingdom's Nuclear Weapons Policy, HMSO, p. xiv, para. 6 -conclusions.
14. House of Commons Defence Committee, Fourth Report Session 1980-81, HC36 Strategic Nuclear Weapons Policy *ibid*, Evidence given by Mr P. Goodwin, former Managing Director of Rolls Royce & Associates December 2nd. 1980, p.201 Q.1084.
15. House of Commons Defence Committee Fourth Report Session 1980-81 HC36 *ibid* p7 Q29.
16. The MOD gives a vague in-service date of the mid 1990s. However, at a news conference after the March 1988 NATO Summit Mrs Thatcher, then Prime Minister, gave a date of 1994. Current production problems have led to some speculation that 1994 is optimistic, but the MOD are reported to feel more comfortable with this date than the alternative date used by Mrs Thatcher of 1993-94. See also House of Commons Defence Committee Sixth Report Session 1984-85 HC479, The Trident Programme. p.49 Q.1929.
17. House of Commons Expenditure Committee, Sixth Report Session 1978-79 HC348 The Future of the United Kingdom's Nuclear Weapons Policy, HMSO, p.19 para.5 -evidence
18. House of Commons Defence Committee Sixth Report Session 1984-85 HC479, The Trident Programme, HMSO, p.xxiv para.56 Polaris Refits.
19. The scrapping of the three Valiant/Churchill class submarines is intriguing. The MoD first publicly acknowledged the discovery of a serious defect in the reactor system in Warspite in late 1989 whilst the boat was in refit at Devonport, but then completed the refit at a cost of approximately £100m only to scrap it in mid-1990 before it had re-entered service. Churchill also followed the same route, being scrapped when it had almost completed a £65-70m refit. HMS Conqueror was scrapped only three years after completing its most recent refit. The intrigue here is why two refitted, refurbished and nuclear refuelled submarines were scrapped instead of the other Valiant/Churchill class boats, Courageous and Valiant, both of which are scheduled shortly for refit. Nuclear powered submarines incur costs of approximately £100m plus per refit as, against approximately £4.4m per year operational costs, with a refit required every six to seven years.
20. House of Commons Defence Committee Third Report Session 1984-85 HC 37-1 p.166 Q.992 & House of Commons Defence Committee Sixth Report Session 1984-85 p.45 Q.1897.

Q.992 & House of Commons Defence Committee Sixth Report Session 1984-85 p.45 Q.1897.

21. The refit dates of individual Polaris submarines have been tabulated with a number of references to the submarines whereabouts published in local newspapers in Rosyth and around Faslane. These have been cross referenced with statements about the Polaris boats in House of Commons proceedings, Parliamentary Questions, Annual Statements on the Defence Estimates and other reliable sources.

22. House of Commons Defence Committee Fifth Report Session 1988-89 HC374 The Progress of the Trident Programme HMSO p.xvi para.36 -conclusions.

23. Nuclear reactor refuelling is not the sole prescript necessitating refit berthing. The later Swiftsure and Trafalgar class SSN boats require refuelling at maximum intervals of twelve years but the refits are scheduled to occur at a nine year frequency.

24. House of Commons Defence Committee Fourth Report Session 1980-81 HC36 Strategic Nuclear Weapons Policy HMSO p.142, Q.740 -evidence 12.11.80

25. Spotlight, newspaper of H.M. Naval Base Rosyth Vol.18 No.209 November 1986.

26. House of Commons Defence Committee Fourth Report Session 1980-81 HC36 Strategic Nuclear Weapons Policy p.142 Q.744 -evidence 12.11.80

27. House of Commons Defence Committee Third Report Session 1984-85 HC37-1 p.166 Q.992.

28. The estimated extension to the core life of a Polaris submarine has not been publicly stated. However, in the course of discussion in the Defence Committee in 1985, it was stated that whichever way it was looked at, if Resolution was not given a fourth refit, there would be a three year gap between Resolution's third commission and the first Trident being on station. If it is assumed that the first Trident will be on station at the end of 1994 ,the three year gap would mean that Resolution would be out of service by 1991. Since Resolution came out of refit in September 1984, one can roughly calculate that the estimated extended commission length was of the order of 7 plus years. House of Commons Defence Committee Sixth Report Session 1984-85 HC479 p.45 Q.1897.

29. House of Commons Expenditure Committee Twelfth Report Session 1972-73 HC399 Nuclear Weapons Programme p.viii para.5.

30. Based on observations at Faslane submarine base.

31. Based on observation, Resolution patrols were February-May 1990, (approximately 12 weeks); August-December, (approximately 16 weeks); 14th February to 9th May (12

weeks).

32. House of Commons Defence Committee First Report Session 1990-91 HC69 Royal navy Short Term Savings: HMS Challenger and the Decommissioning of Nuclear Fleet Submarines p.18-20. -evidence

33. House of Commons Defence Committee Twelfth Report Session 1989-90 Radiological Protection of Service and Civilian Personnel p.57

34. House of Commons Defence Committee First report Session 1990-91 HC69 Royal navy Short Term Savings: HMS Challenger and the Decommissioning of Nuclear Fleet Submarines p.xvi para.37

35. Although attempts seem to be made at Faslane by Rolls Royce and Associates to make Valiant and Courageous seaworthy.