HOUSE OF COMMONS SESSION 1990–91

DEFENCE COMMITTEE

Sixth Report

ROYAL NAVY SUBMARINES

Report, together with the
Proceedings of
the Committee
relating to the Report,
Minutes of Evidence and
Memoranda

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TABLE OF CONTENTS

SIXTH REPORT

The Defence Committee has agreed to the following Report:

ROYAL NAVY SUBMARINES

I. INTRODUCTION

Inquiry

1. In our Third Report of this Session, we announced that —

> "We are concerned by a number of aspects of the Government's proposals for the future size and shape of the Royal Navy's submarine fleet. We have therefore decided to undertake a separate inquiry into Royal Navy submarines in the context of the Options for Change proposals, and will be reporting to the House in due course".[1]

These proposals were for a future submarine force of "about 16 boats of which three quarters would be nuclear-powered", compared to a force then consisting of 17 SSNs and 10 SSKs. 3 SSNs and 4 SSKs have since been paid off,[2] leaving a current fleet of 14 SSNs and 7 SSKs.[3] We have inquired into a number of matters relating to the Royal Navy submarine fleet and its shore support. Since Options for Change proposes no change in the deployment of the strategic nuclear deterrent, we have not inquired in any detail into the four current Polaris-equipped or the four forthcoming Trident-equipped SSBNs; the results of our annual inquiry into the Trident programme will be published separately.[4]

2. We have been briefed at the submarine bases at Gosport and Devonport, visiting HMS SWIFTSURE, TIRELESS and UPHOLDER, as well as touring the nuclear submarine refitting facility at Devonport. Flag Officer Submarines and his staff gave us an informative briefing at Fleet Headquarters at Northwood. We spent a day at VSEL's shipyard at Barrow-in-Furness, where nuclear-powered submarines are constructed, and we were briefed in London by Rolls Royce Associates, the designated design authority for submarine nuclear propulsion systems. In the course of our visit to the United States of America, we visited the US nuclear-powered submarine USS HYMAN G RICKOVER, and were subsequently briefed by the Supreme Allied Commander Atlantic (SACLANT) and the Commander, Submarines Allied Command, Atlantic (COMSUBACLANT). We held an informal discussion with three distinguished retired naval officers: Admiral Sir John Woodward, Vice Admiral Sir Ian McGeoch and Rear Admiral Hill, who submitted brief memoranda, and received both memoranda and informal advice from Commander Richard Compton-Hall, RN retd, Director of the RN Submarine Museum. These discussions and papers have been of great assistance to the Committee, as have the other memoranda printed with this Report.[5] We heard oral evidence from MoD officials on 17 April 1991, to add to the evidence heard on 5 December 1990, which is reprinted here, and that on the naval threat heard on 30 January 1991.[6]

3. **We concluded in February 1991 that a broad decision had been made to halve the submarine fleet;[7] nothing we have heard in the course of this inquiry has**

[1] HC 266 of Session 1990-91, para 37.
[2] CONQUEROR, WARSPITE, CHURCHILL; ODIN, ONSLAUGHT, OTUS, ONYX.
[3] The latter figure includes UPHOLDER; the former excludes TRIUMPH, which will join the fleet shortly.
[4] HC 286 of 1990-91.
[5] Evidence, pp 65-94.
[6] Qq. 464-781 on pp 1-30 of Evidence.
[7] HC 266, para 36.

caused us to alter that conclusion. In theory, the proposals put forward in July 1990 remain just that: officials assured us in April 1991 that they were still being "worked through".[1] Ministers have told the House, and officials have repeated in evidence to us, that the Government would be taking stock of developments over the past 12 months, including those in the Soviet Union, before coming to final conclusions.[2] We have been told that nothing over the past 12 months had led MoD to change its assessment of the future Soviet threat,[3] and specifically that —

> "We do not think anything has happened since July or even December which calls into question the overall size of the submarine fleet or the balance within it between SSKs and SSNs".[4]

Nor have the reactions of our Allies to the proposals changed over the last few months;[5] their original reaction to the cut in submarine numbers may of course in some cases have been less than favourable.[6] We heard the views of SACLANT and COMSUBACLANT in the course of our visit to the United States. While events in the Gulf have limited relevance for submarine force levels, beyond the importance of having flexible and rapidly deployable forces, the growing instability in the Soviet Union might be thought to give grounds at least for reconsideration. There is still time for Ministers to undertake a measured re-appraisal of their 1990 proposals, not only in the light of subsequent events, but also of comments on those proposals, from NATO allies and others. In practice, we fear that Ministers are now more concerned with implementation of the original proposals than with any fundamental reconsideration.[7] **It is essential that the Options for Change proposals are regarded as the first, not the last, word on future force levels.**

Secrecy

4. Much of what we have learned is classified, and for good reason. Submarine warfare is by its nature unusually secretive. For example, although submarines have names, they carry no external identifying marks, so that hostile intelligence is hindered from plotting deployment patterns from the movements of individual submarines. We consider that some more openness could be of advantage. Potential enemies probably have a clear enough idea of what submarines do and why, if not where, when or how. The Submarine Service is an elite and somewhat self-contained world: as a result, the role of submarines can be misunderstood, underestimated or neglected. **We consider that one priority task for Flag Officer Submarines and for MoD is to look at ways of increasing professional, parliamentary and public understanding of the Submarine Service.**

Threat

5. In our Third Report, we indicated in brief the best available assessment of Soviet naval strengths.[8] We concluded that by the year 2000 there would be a Northern Fleet submarine force of between 30 and 50 Akula class SSNs, a dozen or more Oscar class SSGNs and around 20 Delta IV or Typhoon SSBNs.[9] This is the principal threat to which RN submarines are a response. Hostile SSNs are a threat to the survival of the United Kingdom's independent strategic nuclear deterrent carried in SSBNs; a principal task of RN SSNs is to defend Polaris submarines against this threat. The safest defence available against submarine launched cruise missiles is to attack them at source: that is, to find and hold at risk the submarines from which they are launched.[10] While there are various means of defence of naval or merchant surface vessels against hostile submarines, a submarine is perhaps the most potent autonomous anti-submarine weapon

[1] Q663.
[2] eg Q609.
[3] Qq 571-2.
[4] Q662.
[5] Q628.
[6] eg Q516ff.
[7] Q523ff.
[8] HC 266 of 1990-91, paras 5-10.
[9] *ibid*, para 9.
[10] Q491.

platform. The Soviet surface fleet includes new aircraft carriers, ASW frigates and AAW and ASUW destroyers; submarines are a powerful and cost-effective deterrent against deployment of such surface ships on hostile missions. They provide valuable and covert intelligence and surveillance in peacetime. Finally, only submarines could ever hope to hold Soviet SSBNs at risk, and so provide a riposte to any attempt at nuclear blackmail. These, in deliberately simple terms, are the reasons for which the United Kingdom maintains a submarine fleet.

6. There are also potential threats from a growing number of nations which are developing relatively advanced submarine forces, and which could conceivably have some hostile intent against the United Kingdom and its interests. Nations of every political complexion now operate submarines, in every part of the world. The threat they present is principally to surface ships, whether by torpedo or mine-laying. In the years ahead, it may become increasingly necessary to measure our submarine force levels against non-Soviet forces. While the Soviet Union may be the "most demanding" case,[1] the potential threat from other navies is growing.

Arms Control

7. Of the many factors which may influence future perceptions of the threat, and of the force levels necessary to meet that threat, one of the most imponderable is the possibility of future naval arms control agreements. Some analysts consider submarine operations the most destabilising of all because of their covert nature. Submarine sanctuaries — areas of sea where submarines of one nation could be guaranteed not be to hunted by any ASW — and also submarine exclusion zones, where no submarine activity would be permitted, have been put forward, principally but not exclusively by the Soviet Union. The West has barely reacted to these ideas; that is not to say that we may not be obliged to do so. Until such time comes, however, the United Kingdom would be well advised to retain at least enough submarine capability to ensure that it has sufficient bargaining strength in any negotiations to ensure that our national interests and concerns were reflected in any agreements.[2]

Defect

8. By chance, our inquiries into RN submarines following the Options for Change proposals have coincided with the discovery of a technical defect in some SSNs. This has naturally been a significant topic in discussions with officials, Service personnel and industry. We have made extensive inquiries about the implications of the defect, found in WARSPITE and announced in February 1990, and have been engaged in lengthy discussions with MoD on how far information on it can be declassified and published. As a result of these discussions, we can now report to the House that —

(a) "The Ministry of Defence has confirmed that one other submarine (HMS CHURCHILL) has been found to have a technical defect comparable to that discovered in HMS WARSPITE; neither submarine was beyond economic repair"; and

(b) "The Royal Navy's nuclear submarines are being inspected and cleared for operations as required to meet military commitments".

We can also report that we have been satisfied that no submarine will put to sea in peacetime unless it has been declared safe for it to do so by the Nuclear Powered Warships Safety Committee; and that very stringent safety standards are being applied. We cannot, however, report to the House on:

— the extent to which the technical defect has or has not been found in other individual submarines or classes of operational submarines or those under construction;

— the nature, location and mechanism of the technical defect;

— any steps which may or may not have been taken to rectify it;

— any operational implications.

[1] Q503.
[2] See eg Evidence, p 68, para 20; Q443, HC 266 of Session 1990–91.

9. MoD has reassured us on two recent occasions that the operation of the strategic deterrent has continued uninterrupted with at least one SSBN remaining on patrol.[1] It is however readily apparent that HMS RENOWN, one of the RESOLUTION class submarines, has been in refit for considerably longer than anticipated. Despite requests for information about the present situation with regard to SSBNs, MoD have not been forthcoming to us in private or in public. **In view of the concerns that have been expressed in public, we believe that it would be in the general interest, including that of MoD, to be more candid.**

10. It is obvious to any observer that the process of thorough inspection described by MoD has had and will continue to have some effect on the operating patterns of the submarine fleet. Submarines are quite visible and relatively identifiable when secured alongside or in dock. The process of inspection and, were it to be necessary, rectification is difficult and time-consuming. We consider that Parliament is also entitled to know that the process is expensive and technically complex. MoD indeed told us in February 1990 that the inspection process was likely to be protracted, given the general inaccessibility of the working areas.[2] **We have been impressed with the competent and determined way in which the defect has been and is being handled by the Royal Navy, and by industry. We regret that security considerations prevent us from reporting in any greater detail. When matters are concluded, we shall resume discussions with the Ministry on how best we can fulfil our duty of ensuring that the House is informed on such matters.**

General

11. **Some of what we have learned has given us cause for concern: in particular, the balance and size of the proposed future submarine force, and the delays in procuring a new class of nuclear-powered submarines. But in general terms we have found much to admire in RN submarines, in personnel, equipment, operation and support. We shall of course continue to keep developments in RN submarines under scrutiny in the years ahead.**

II. ROLES, TASKS AND NUMBERS

Characteristics

12. Submarines have some unique qualities as weapons platforms. Among their *strengths* are:

- They can deploy covertly, independently, rapidly and non-provocatively to many parts of the world.
- They can operate autonomously at high states of readiness for long periods, and at long ranges, from their bases.
- Their advertised but unidentified deployment can have a deterrent effect on maritime forces on occasions out of all proportion to their actual destructive capability, enabling them to control large areas of sea.
- They are remarkably versatile, cost effective to run and relatively sparing of manpower resources.
- They have very limited peacetime environmental impact.

On the other hand, among their *weaknesses* are:

- They are liable to be on the periphery of most land/air battles, and cannot readily defend, hold or gain territory.
- They are prone to difficulties with communications.
- They are expensive to procure.
- Nuclear-powered submarines eventually produce nuclear waste, whose disposal remains an unsolved problem.

ASW

13. Over the past half century, the principal role of RN submarines has shifted from anti-surface ship warfare (ASUW) to anti-submarine warfare (ASW): that is, using submarines to hunt and destroy hostile submarines rather than hostile

[1] HC 69 of Session 1990-91, Evidence, p 27; Evidence, p 61.
[2] HC 69 of Session 1990-91, p 27.

ships. There is still some scepticism as to their efficiency in this role, and several competing and apparently contradictory concepts as to how it should be carried out. As submarines become more silent, one expert submariner told us that "the outcome of a submarine versus submarine campaign would be indecisive".[1] Another told us that there were questions to be asked about the productivity of future submarine-versus-submarine operations in the open ocean.[2] Rear Admiral Richard Hill observed that —

> "it is notable that in no higher level operation since the Second World War have submarines been seriously deployed in the ASW role"

and warned that it could be an unrewarding task[3]. High attrition rates are a distinct possibility. But, while there is a slight shift proposed in the balance of ASW assets, the same broad concept of operations is envisaged as hitherto.[4] **Submarines remain one of the most potent ASW weapon platforms against other submarines, and roaming commissions in allotted areas are likely to continue to be the principal ASW tactical concept in submarine warfare.**

14. Submarines can also be deployed to protect specific important surface forces, such as carrier battle groups or convoys. While some consider that the practicalities of "substituting SSNs for surface escorts in ASW support of a surface force or convoy" are dubious,[5] the trend towards giving surface ships an anti-air configuration implies growing reliance for ASW close support on escorting submarines.[6]

15. In addition to ASW support for surface ships, submarines patrolling an identifiable area can be used to create an ASW barrier, to prevent movement of hostile submarines to or from a particular stretch of sea.[7] The principal example for RN submarines is the so-called Greenland-Iceland-UK Gap. In simple terms the concept involves "bottling up" hostile submarines north of a defensive line, so denying them access to the Atlantic. Its weaknesses are obvious: submarines may already have passed the barrier before its activation, or may be able to get past it by long detours. Despite doubts about the efficacy of the barrier concept, based on historical precedent, it does appear to offer a measure of security and deterrence for sea lines of communication.

ASUW

16. The submarine's traditional strength has been in the threat it presents to surface shipping, which can be out of all proportion to its actual performance. This was aptly demonstrated during the Falklands War. The sinking of the General Belgrano by HMS CONQUEROR not only denied the Argentine Navy an enormous area of sea but also probably deterred further major surface ship operations. Similarly, the suspected presence of one relatively unsophisticated Argentine submarine caused considerable anxiety to the RN Task Force. More recently, Vice-Admiral James Williams, the US Deputy Chief of Naval Operations for Naval Warfare, is reported as having observed that —

> "if he [Saddam Hussein] had had the vision to buy six SSKs and positioned three of them on either side of the Strait of Hormuz, that would have complicated matters. One diesel sub can make a great difference to how you drive your ships...".[8]

The efforts devoted to ASW by NATO navies are clear evidence of the effects on potential enemies of a submarine presence.[9]

17. Expert witnesses agreed that a priority task for RN submarines was the protection of the nuclear deterrent force,[10] the four SSBNs based at Faslane. It is

[1]Evidence, p 70, para 7.
[2]Evidence, p74, para 30.
[3]Evidence, pp 66-67, paras 9, 14.
[4]Q529.
[5]Evidence, p 75, para 33.
[6]Evidence, p 70, paras 8, 12: p 67, para 15.
[7]Evidence, p 67, para 16.
[8]Jane's Defence Weekly, 13 April 1991, p 586.
[9]Q532.
[10]Evidence, p 70, para 11.

worth noting that protection of its SSBN force is also envisaged as a primary task in Soviet naval doctrine.[1] The detailed requirement for SSN and SSK support for the United Kingdom's SSBN force is naturally highly classified. As Commander Compton-Hall put it —

> "A degree of ASW support for SSBNs, involving extensive and lengthy operations, is required to make sure the road is clear for them".[2]

MoD witnesses told us —

> "One of the absolutely key tasks we identified from the outset was the need to guarantee the deployment of our Trident force...".[3]

18. Offensive mining at, for instance, maritime choke points and in entrances to enemy bases, can be covertly executed by both SSNs and SSKs. Whilst the number of mines carried is very limited, the undefined element of threat posed by submarine mining is of considerable military and even political value. Clandestine operations are a significant part of submarine tasking, particularly for smaller submarines. A number of possible tasks can be envisaged. Covert surveillance operations can establish whether potentially hostile surface or submarine forces are in fact being deployed with hostile intent. It is, for example, likely that some sort of covert watch was kept by Allied submarine forces in the Mediterranean on the naval forces of countries known to be sympathetic to Saddam Hussein, so as to protect the seatrain to the Gulf. Surveillance can also be carried out from submarines of various coastal activities. An unsuspected submarine offshore can be used to gather electronic intelligence in areas where other means would be very difficult, or provocative. Submarines are ideally suited for coastal reconnaissance, and for the insertion of special forces of various kinds, either swimmers or parties with their own subsidiary transport.[4]

19. In order to have an effective submarine fleet, it is necessary to train crews in circumstances which are realistic, without putting scarce and high-value assets at risk. There are limits to the extent to which simulation, however sophisticated, can replace real life experience. Training to a high level of realism and readiness is particularly important in the submarine service because of the exceptionally detached way in which submarines are operated, divorced from higher command for days or weeks. Submarines simulating hostile forces are the easiest means of providing realistic training and exercising for anti-submarine forces. Submarines are also required to test and trial new equipments.

Division of roles

20. We have explored with MoD in public and in private, and in discussions with submariners, the way in which particular tasks can or should be carried out by different classes of submarine: that is, by nuclear-powered submarines (SSNs) or diesel-electric submarines (SSKs). The Director of Navy Plans and Programmes put it succinctly: "They have different characteristics which make them more or less suitable in particular roles".[5] **MoD apparently remains confident that a reduced force of SSNs and in particular of SSKs can carry out the same range of wartime and peacetime tasks as their predecessors. No individual role has been abandoned.[6] There have been no changes in Government-directed peacetime tasks.**[7] Witnesses told us that they had sought to establish a total number of submarines required, and had then decided on the eventual 3:1 SSN:SSK balance proposed in July 1990.[8] While we continue to harbour doubts as to how far

[1] Evidence, p 65, 2.a.i: Q545; see Third Report from the Defence Committee, Options for Change: Royal Navy, HC 266 of Session 1990-91, para.
[2] Evidence, p 75, para 39.
[3] Q545.
[4] Vice Admiral Roger Bacon of the USN has reported that 13 USN submarines were in support of US operations in the Gulf. HMS OTUS was widely reported as having returned in late April to Gosport in unusual camouflage, and flying the Jolly Roger, with the Minister for the Armed Forces on the tower (eg Navy News, May 1991). Ministers have confirmed the participation of two RN submarines in support of Operation Granby.
[5] Q586.
[6] Qq 414-6, 539ff, 574.
[7] Qq 588-9.
[8] eg Qq 409, 417, 437, HC 266 of Session 1990-91.

this fully portrays the process, we have thought it important to establish in outline the sort of tasks for which each class of submarine is best suited, so as to be able to satisfy ourselves that both the totals and the balance are indeed about right.

21. There are some tasks which can best be carried out by SSNs because of their speed, range and endurance. These are in particular the sort of roving commission ASW operations referred to in paragraph 13 above, which require an absence of many weeks from shore support, the ability to cover great distances submerged, and to operate undetected in a heavily defended ASW environment. In the extreme case, it is self-evident that only an SSN can operate with freedom under the icecap.[1] SSNs are also best suited to the task of ASW and ASUW support for high-value surface assets (see paragraph 10 above), over a long distance and at a speed which enables them to keep pace with the surface ships under their protection. Protection of SSBNs where required in the open sea, and distant deployments in times of war or crisis are also primarily, although not exclusively SSN tasks;[2] it should be noted that at least one SSK participated in naval operations in the South Atlantic in 1982, and that Oberon class boats are still regularly deployed there.

22. Conversely, there are several tasks for which an SSK may be better suited than an SSN.[3] Although the difference in draught between a Trafalgar class SSN and an Upholder class SSK is as little as 10 to 12 feet,[4] an SSK is generally more suited to shallow water operations, being smaller and more manoeuvrable.[5] SSKs are quieter when on electric propulsion than an SSN running on turbines. They also have a capability, which SSNs do not, to lie on the seabed in complete silence, and are thus virtually undetectable, subject to the requirement to return to periscope depths or to surface to take in air; no captain would be happy to risk an SSN in this way. This renders SSKs particularly suitable for reconnaissance and surveillance. Upholder class SSKs also have a five-man chamber designed for the reception, launching and recovery of shore parties, if necessary submerged. Its relative ease of handling, and lower risk factor, makes an SSK better suited for the crucial task of training submarine crew in operational scenarios.[6] An SSK is also self-evidently better equipped to simulate a hostile SSK in ASW exercises — the so-called "clockwork mouse" or "loyal opposition" role. Training and exercising is indeed seen by MoD as the principal peacetime task for SSKs.[7] Although Commodore Blackham asserted that "for most exercises either vehicle would provide a satisfactory facility and amenity",[8] what we have been told by experienced submariners confirms that SSKs are indeed particularly suited to some specific kinds of training. Finally, primarily inshore tasks such as covert minelaying are effectively the preserve of SSKs.

23. There are in addition several tasks for which there is no obvious inherent advantage for one type of submarine over another, but where the use of an SSN, which is larger, more powerful, more expensive and more heavily manned, would be a waste, and an undue risk: equivalent to using a 60 ton tank to carry out a task which could with equal effectiveness be carried out by a scout car. If, for example, it were desired to activate an ASW barrier, an SSK, with a similar weapons system to an SSN, and in a purely defensive situation where speed is less important and deployment is pre-determined, could well be equally effective. What is more, several could be provided for the cost of one SSN.[9] Although some MoD witnesses expressed doubts about its efficacy in modern submarine battle scenarios,[10] others still see an SSK as having a powerful capability against ships and other submarines.[11] Admiral Woodward suggested that, in wartime, an SSK was particularly useful in high risk inshore or static operations, and in "non-

[1]RN News Release 71/91 on recent surfacing of HMS TIRELESS at North Pole.
[2]Evidence, p 65, 2.b.ii.
[3]Q409 HC 266 of Session 1990-91.
[4]Qq 542, 587.
[5]Evidence, pp 70-1, paras 13, 19.
[6]Q415 HC 266 of Session 1990-91.
[7]*ibid.*
[8]Q585.
[9]Evidence, p 67, para 16.
[10]Q538.
[11]Evidence, p 66, para 16.

combatant" operations;[1] the use of an SSN in trials, for example, would in many circumstances be a wasteful use of resources.

24. It is plain enough that there are indeed roles which require SSKs, and others where they are the most sensible asset to deploy. In peacetime, their training and exercise role is of particular importance: in operations, their role in covert operations, surveillance and intelligence gathering. Recent experience shows that training is the first victim of reduced submarine availability in peacetime; we do not know what role would have to be abandoned in wartime. **A severe reduction in the number of available SSKs, and a change in the balance of numbers between SSNs and SSKs, will inevitably mean that some SSK tasks are either abandoned, performed less effectively or have to be undertaken by SSNs.**

Operations

25. Some idea of what is at stake can be gained from an overview of the submarine fleet's peacetime operational pattern, bearing in mind that, more perhaps than in any other branch of the Services, there are practically no peacetime tasks which are not intimately connected with, and do not spring directly from, anticipated wartime tasks. In peacetime, submarines operate to a standard 17-week cycle, into which are fitted periods of planned maintenance and refit, and crew leave. Longer sorties, which can last as long as several months, or as little as a week, are interspersed with days spent on trials or training. FOSM, who is responsible for all submarine operations except the SSBN deterrent patrol, tasks submarines on planned operational sorties to all international waters, from deep under the polar icecap to the far South Atlantic, and from the Pacific to the Eastern Mediterranean. There are also reactive sorties, mainly in response to the passage of Soviet or other submarines; and operations in response to Government directions, including intelligence gathering, and deterrent patrols in the South Atlantic. **By its nature, the submarine service is secretive; while we have been very fully briefed on its operations, there are strict limits on what can be published. The geographical range and tactical scope of peacetime operations, including some in support of the civil power, is remarkable, and provides the clearest indication of the potential of such a submarine fleet in time of conflict.**

Numbers

26. There is no simple formula which will produce the correct number of submarines for the Royal Navy—for example, by purely mathematical reference to the strength of the Soviet Navy.[2] The potential Soviet threat must however for the present remain the yardstick against which to assess the adequacy of the capability of the RN submarine fleet. MoD told us that the latest proposed figure of "about 16" took account of the expectations of future Soviet capabilities and possible scenarios, together with the warning times associated with them, so as to find a submarine fleet of appropriate size to perform the wartime tasks for which it is designed.[3] There are a number of strands here which have to be separately identified.

Warning time

27. The recent major changes in the international political climate lead the MoD to consider that they would be likely to have a longer warning time than hitherto of the outbreak of the "sort of conflict which might require our submarines to be engaged in major operations against the Soviet Union".[4] The change is adjudged to have been dramatic — from a matter of days to 18 months or more.[5] The particular significance of warning time in relation to submarine operations is that submarines undergoing maintenance or refit can be brought back into a state of operational readiness over a shorter period than normal, and other submarines can be held ready rather than being put into refit.[6] There would also be some

[1]Evidence, p 65, para 2.b.iii.
[2]See Evidence, p 71 para 20, for argument in support of figures.
[3]Q611.
[4]Q594.
[5]Q600.
[6]Q618.

impact on personnel and stores; leave would be cancelled, spares ordered and so on. Given the period of 18 months or so which it is judged would be necessary for the Soviet Union to recover itself so that it could mount a major attack on NATO,[1] MoD officials told us that at least 10 SSNs out of a fleet of 12 could be ready,[2] compared to a peacetime figure of availability at very short notice of 7 or 8.[3] In other words, an additional 2 or 3 SSNs could be readied over a period of some months if there was perceived to be the possibility of a serious conflict. Only those SSNs which were in deep refit, which involves being taken apart, would be unavailable. In the proposed fleet of 4 SSKs, we were told that peacetime availability at short notice, with newer boats, and the possibility of restricting refit to a single "mid-life" refit (see paragraph 85), should be 3, assuming one boat in refit.[4] There will indeed be occasions when all four boats could be made available at reasonably short notice. **A fleet of around 16 submarines as proposed therefore translates, presumably with a well provisioned support system in place, as a fleet of around 10 or 11 operationally available at short notice, and around 13 or 14 given longer warning time of a year or more.**

28. It is of course also accepted that the Soviet Union has capabilities which could be deployed over very much shorter timescales against a limited objective;[5] a Soviet submarine could attack a surface, submarine or land target tomorrow, and within a relatively short space of time Soviet submarines could be on a war footing, as could RN and other Allied forces. The judgement being made of the Soviet threat is therefore a question not of altered technical capacity, but intention, and the speed with which intentions can change. There has been no dramatic degradation in Soviet naval capabilities. **The appropriate RN submarine force level now seems to be assessed in relation to a mix of hostile capability and hostile intent.**

Reconstitution

29. It is evidently not to be imagined that additional submarines could be constructed over a period of months.[6] Nor are there any plans to hold submarines in reserve, to be reactivated in a period of crisis. The very particular skills in handling submarines, and the complexity of their electronic systems, make them relatively poor candidates for storage in reserve; even if the boats could be effectively mothballed, it is questionable if crews could be found able to operate them, in the absence of any specific Royal Navy Submarine Reserve for personnel.

Allies

30. While the UK naturally must retain some unilateral capability, RN submarines are not expected to combat Soviet aggression single-handed: a naval threat to the United Kingdom from the Soviet Union is not envisaged outside a NATO context.[7] It has always been a central point in planning that the United Kingdom's role in a crisis would be to provide first line defence until the full force of Allies, and particularly the US, could be brought to bear.[8] The shorter the warning time, the greater the forces required to be operationally ready to meet the threat. For that reason, the suggestion of increased warning time impinges on how long the Royal Navy would be required to do certain things, before it is significantly reinforced by the United States Navy.[9] While the readily available assets in the case of a "surprise attack" have been reduced, the supposition

[1] Qq 606-7.
[2] Q616.
[3] Qq 617-8.
[4] Qq 620-1.
[5] Q602.
[6] Q612.
[7] Qq 438 HC 266 of Session 1990-91, Q606.
[8] eg Q490.
[9] Qq 611-2; also Q572.

presumably is that longer warning time allows time both to raise the operational availability of the RN submarine force, and to deploy substantial numbers of USN submarines to wartime positions. That of course depends on the ability and will of political and military leaders to react to warning signs.

31. MoD therefore judged that the figure of about 12 SSNs was appropriate for the contribution which the United Kingdom would make to NATO's naval operations.[1] As we observed in our earlier Report, NATO was not consulted before the July 1990 statement. Mr Mottram had told us in December 1990 that MoD had "a reasonable idea about the attitudes of others and what might be appropriate in the new strategic environment";[2] Mr Jackling confirmed that MoD had been aware of the drift in the thinking of our Allies.[3] Since then, there has been a great deal of consultation, the results of which we have yet to see.

32. In June 1981, the Government's White Paper, The Way Forward, Cmnd 8288, stated that —

> "Our most powerful vessels for maritime war are our nuclear-propelled attack submarines (SSNs)... There are 12 at present in service, and the fleet will build up further to 17... We intend also to proceed with the new class of diesel-powered submarines (SSKs)... and will if possible introduce these at the rate of one per year...".[4]

10 years later, a very different view has been taken, in what is of course a changed political situation, but not a greatly altered military one. It is therefore particularly important to ensure that proposed new force levels are not merely the result of changing fashions, or of fiscal bargains between MoD and the Treasury.

SSN numbers

33. We have received submissions from several distinguished naval experts, some of them former submariners. Working in many cases from different assumptions about wartime roles allocated to SSNs in a conflict with the Soviet Union, they came up with broadly similar figures for SSNs. In order to meet wartime operational tasks, to keep up the necessary peacetime tasks for a wartime role, and to keep the minimum UK SSN industrial base, figures between 9 and 15 were mentioned. Admiral Sir John Woodward referred to "a demand-led" SSN force of between 12 and 16 hulls; Rear Admiral Hill referred to 9 SSNs with an option of 3 SSNs in reserve; Commander Compton-Hall came up with a figure of 13 to 15 SSNs, dependent on refit plans. While there is a certain inevitable unreality in such force planning, it is in our view significant that —

(a) none suggested that it was essential to preserve the 1990 force level of 17 SSNs;

(b) there was little suggestion that there should be fewer than 12 SSNs.

The fleet of 12 or 13 SSNs proposed is the barest minimum SSN force, subject to anticipated improvements in availability rates, support and reductions in time spent in refit over a submarine's life.

SSK numbers

34. **We are however very far from satisfied with the proposal to retain only 4 diesel-electric submarines.** It has become apparent to us that one powerful factor behind this proposal has been the relative expense of an Upholder class submarine. MoD has told us that —

> "There is at present no standardised accounting system within MoD for collecting historic life-cycle costs or predicting the life-cycle costs of individual ships or submarines".

Work is in hand to develop such a standard system.[5] We have been provided with figures which show approximate life cycle costs for

[1] Q609.
[2] Q312 HC 266 of Session 1990-91.
[3] Q624.
[4] Cmnd 8288, para 26.
[5] Evidence, p 56, Answer 1.

— a new Trafalgar class SSN of £765 million; and

— a new Upholder class SSK of £315 million.

For purposes of comparison, a Type 23 frigate would cost around £350 million. These figures show that, while an SSK costs as much as a half or two-thirds of an SSN to buy,[1] its life cycle costs are around 40 per cent.

35. We can understand that these figures mean that an SSK may still seem unduly expensive in comparison to an SSN, given its different and in some respects inferior capabilities. But it would be wrong to base future force planning around such figures. A future buy of SSKs could be very considerably cheaper. Through-life costing must be taken into account in assessing the optimum proportion of SSKs to SSNs in the RN submarine fleet. In any event, we have identified above a number of roles, notably reconnaissance, surveillance and intelligence gathering, which either can or should be carried out by patrol SSKs, and which are certainly not of reduced significance in the emerging scenario. There is certainly no unanimity among those we have spoken to. Admiral Sir John Woodward felt that 4 was enough: Rear Admiral Hill suggested 9; and Commander Compton-Hall 8. **From our review of the evidence, and of the wartime and peacetime tasks of SSKs, we consider that there should be a minimum of 6 SSKs, and we recommend that HMG urgently reconsider its proposal to retain only 4. In the interim, we recommend that the SSK fleet is maintained at a minimum level of 6 boats by retention for the next few years of sufficient Oberon class boats, and that plans be made for the retention in service of the 2 most effective Oberon class boats after the entry into service of the 3 remaining Upholder boats.**

III. SUBMARINES

SSKs

Oberon class

36. At the time of the July 1990 statement, there were 10 Oberon class submarines in service.[2] ONYX and OTUS have since paid off in accordance with earlier plans, although the paying-off of OTUS was delayed for operational reasons. The paying-off of ODIN and ONSLAUGHT, both about to be refitted, was announced in July 1990.[3] There are therefore now 6 Oberon Class SSKs in operation, all with the improved sonar fit and command system ordered in 1985;[4] the most recently refitted is OPPORTUNE, which completed her refit at Devonport in August 1990 at a cost of around £33 million.[5] There will be no further Oberon refits.[6] Although decisions have not been taken on the appropriate rate of rundown of the Oberon Class as Upholders come into service,[7] it would seem that once all four Upholders are in service only a short period of overlap is planned before the retirement of the last Oberon Class; and that, if the proposals in Options for Change are implemented, by some time in 1994 there will be none in the fleet.

37. The present plan is to offer these ten submarines for sale as and when they are retired. In 1989, OLYMPUS was sold to the Royal Canadian Navy: that remains to date the only sale of an ex-RN Oberon class submarine. Despite the recent modernisation at considerable expense of six of the class, prospects for a sale are not hugely promising; receipts would be substantially greater if any sale included a major refitting contract.[8] **MoD is confident that other navies might**

[1] Qq 629ff.
[2] OTTER, ORACLE, OSIRIS, OPOSSUM, OPPORTUNE, ONYX, OTUS, ODIN, OCELOT and ONSLAUGHT.
[3] See First Report from the Defence Committee, *Royal Navy Short-term Savings: HMS CHALLENGER and Decommissioning of Nuclear Fleet Submarines*, HC 69 of Session 1990-91.
[4] Evidence, p 39, G.b.
[5] Qq 367-8 HC 266 of Session 1990-91; Evidence, p 39, Answer G.b.
[6] Q370 HC 266 of Session 1990-91.
[7] Q369 HC 266 of Session 1990-91.
[8] Evidence, p 56, Answer I.

contemplate continued operation of Oberon class submarines for a nu years. That may be taken as a good indication of at least the feasibility of of some Oberon class boats in the Royal Navy.

Upholder class

38. We will be reporting separately in detail on the procurement of U DER class submarines, on which we heard evidence on 15 May 1991. In t design contract for the first of class was placed in May 1980 and the build in November 1983. Three further submarines were ordered in 1986 from Cammell Laird yard at Birkenhead. Those bidding for this contract we to believe that other orders would follow. It is unclear exactly how ma intended; an eventual class of between 10 and 12 was probably en meaning a full replacement of the Oberon class fleet. Invitations to ten further batch had been expected at some point in 1992. VSEL have tol the price agreed was based on that assumption, and that they had mad ments in specialised plant which would not have been considered cost-ef they had known there would be no further orders. While VSEL cann been certain of winning any later contract, MoD accepts that there hac been a firm intention to order further Upholders, and that the decision r so arose out of "the perception of the changing strategic environmen **announcement in July 1990 that there would be no more than four SSKs have taken the submarine community by surprise.**

39. UPHOLDER was finally accepted into the fleet on 6 Decembe having been beset by delays, as might be expected of a first of class wh some of the functions of a technology demonstrator as well as havin operationally viable.[2] UNSEEN was launched on 14 November 1989, UI on 28 February 1991, and UNICORN follows next year. After pe docking to put right problems with the weapon handling and discharge the four Upholder class SSKs should all be operational in the course of 1

40. While they may no longer be organised as a separate squadron if t Submarine Squadron (SM1) is disbanded or amalgamated,[3] and where are based,[4] they will probably be operated, and inevitably supporte separate force. Although Commodore Blackham told us that other Eu countries operated a class of this size, and that he foresaw no particula lems,[5] it needs no special expertise to see that unit operating costs will ri the loss of economies of scale in areas such as "training personnel, main of shore support and stockholdings".[6] While MoD plans to fit to other s ines much of the long-lead equipment purchased against an expected fut of Upholders,[7] the capital investment in training and wharfside faci DOLPHIN amortised over 4 rather than 10 boats has an inevitable im their perceived cost-effectiveness. Engineering and spares support b more difficult. **It is essential that, however small the class, stores supp Upholder class submarines proves adequate to ensure that the strict op cycle which will be demanded of them is not frustrated by equipment sho**

41. Various means of coping with a force of 4 SSKs are being cons including reducing the number of refits in a 25 year life from two Double-crewing, as is the practice in the SSBN force at present, is als consideration. The proportion of time a submarine can spend at sea is dep not only on the physical and technical characteristics of the boat, but endurance of her crew. After arduous operating periods often involvin weeks at sea, submarine crew naturally have considerable leave entitler submarine may well be ready to return to sea after a few days; her crew unless urgently recalled. The concept of double-crewing simply mea another crew is ready to take on a boat as soon as necessary maintena

[1]Qq 390ff HC 266 of Session 1990-91.
[2]Eighth Report from the Defence Committee, *Statement on the Defence Estimates 1990*, HC 388 of Session para 5.9.
[3]Evidence, p 40, Answer J.
[4]See paras 82-86 below.
[5]Q407 HC 266 of Session 1990-91.
[6]Evidence, p 40, Answer J.
[7]Evidence, p 39, Answer G.c.

been carried out, much as in commercial airline operations. It is of course expensive, and would make heavy demands on the service's most precious resource — trained manpower.

SSNs

42. The oldest remaining SSNs, as a result of recent decisions,[1] are VALIANT, commissioned in 1966 and last refitted in 1986-88, and COURAGEOUS, commissioned in 1971 and last refitted in 1984-86. Although when we began this inquiry there was some suggestion that they might shortly be decommissioned, MoD has told us that they still have useful life left in them, and that the timing of their eventual paying-off would be—

> "...related both to the force structure that we are seeking to achieve and the timing in which we are seeking to do that, and what useful contribution they can make in the medium term".[2]

It has been made clear to us that there is a continuing requirement for them, not least to make some inroads into the backlog of personnel awaiting qualifying training, over the next few years.[3] **Subject to overriding circumstances, we would expect MoD to keep VALIANT and COURAGEOUS in commission for at least the next few years.**

43. The 6 Swiftsure (S) class submarines[4] were commissioned between 1973 and 1981, and, as successive SDEs have shown, have all undergone their first refit. The 6 Trafalgar (T) class submarines[5] were commissioned between 1983 and 1990, and the seventh boat, TRIUMPH, was named in 1991 and will join the fleet in the near future. No T class boat has yet been refitted. When we took evidence from MoD in December 1990, the future of the oldest S class boats — SWIFTSURE and SOVEREIGN — seemed in doubt.[6] Although no decision had been taken when we took evidence in April 1991,[7] it seems likely that they will be retained, and that SWIFTSURE will enter its second refit. **There will then be a core of 13 modern S and T class SSNs, as well as VALIANT and COURAGEOUS.** S and T class boats are in essence very similar; T class boats are marginally longer, quieter and have an enhanced sensor fit, which can be expected to be fitted to S class boats on their second refits over the coming decade.

SSN-20

44. TRIUMPH will be the RN's nineteenth SSN: the next projected nuclear fleet submarine is therefore known as SSN-20.[8] When it was assumed that SSN numbers would be held steady at around 16, SSN-20 and its successors in the new class would have been required to enter service from around 1998, to replace the two Valiant and three Churchill class boats which would then have been due for replacement. MoD told us that concept studies had begun in 1982; VSEL told us that the then Operational Requirements Committee had endorsed some related Naval Staff Targets for a follow-on SSN as early as May 1979.[9] After a lengthy period of abeyance, as a result of work on the Vanguard class Trident SSBNs, a Staff Target (Sea) (ST(S) 7027) was issued in March 1986. Full Feasibility Studies were carried out by VSEL between 1986 and 1989.[10] The Staff Target was not translated into a Staff Requirement until August 1989, and the Programmed Acceptance Date had by then slipped 18 months to the year 2000. **Over £40 million has been spent on feasibility studies and trials.[11] The result of the fall in the proposed size of the SSN fleet to 12 or 13 is that the required in-service date for**

[1] See First Report from the Defence Committee, *Royal Navy Short-term Savings: HMS CHALLENGER and Decommissioning of Nuclear Fleet Submarines*, HC 69 of Session 1990-91.
[2] Q568.
[3] Qq 568-9, 576; see para 71 below.
[4] SWIFTSURE, SOVEREIGN, SUPERB, SCEPTRE, SPARTAN, SPLENDID.
[5] TRAFALGAR, TURBULENT, TIRELESS, TORBAY, TRENCHANT, TALENT.
[6] eg Qq 420ff HC 266 of Session 1990-91.
[7] Qq 556-7.
[8] Sometimes referred to as SSN0Z, Swiftsure class having been termed SSN0X and Trafalgar SSN0Y.
[9] Evidence, pp 84 and 51, Answer L.
[10] *ibid.*
[11] *ibid.*

SSN-20 slips by several years. MoD still intends to bring a new SSN into service, but —

> "no decisions have yet been taken on the nature or timing of orders necessary to maintain that force level".[1]

SWIFTSURE will have completed 30 years in service in 2003. Taking that as a rough measure, and assuming a period of five or six years to construct a submarine, there is no operational requirement for work to have to begin before around 1996-97. By that date, designs would have to have been finalised and contractual arrangements underway. There is in that sense no great urgency in pressing ahead with SSN-20. The proposed reduction in SSN numbers has not surprisingly led to a five year slippage in the SSN-20 programme. We refer below, however, to our concern over the effects of this delay on UK submarine builders and contractors.

45. As envisaged in design and feasibility studies to date, SSN-20 would probably have been considerably heavier and larger than its predecessors, in part because of the way in which it was envisaged that the new PWR-2 reactor designed for the 15,000 ton Vanguard class Trident submarines would be fitted. The improvements in "propulsion, noise signature and the main sensor and command systems" which MoD is seeking[2] do not however necessarily require a huge submarine. MoD has told us that the work completed so far in the course of feasibility studies is applicable to possible capability enhancements in current and future SSN classes. **This suggests that a completely new design of submarine, though desirable on some grounds, may not be necessary.** MoD have told us that a "new class" is indeed envisaged, but that the extent to which it would be an improved or"stretched" Trafalgar class rather than a genuinely new design had yet to be decided, and that there were several possibilities under discussion.[3] It would clearly be foolish not to include the major improvements in weapons, sensor and command systems developed at great cost for Vanguard class submarines. The same would apply to noise signature reductions. We have been briefed on the priority requirements for SSN-20, which are classified. It is difficult to imagine which of these could have ceased to be priorities; a smaller and better submarine fleet would seem to demand greater rather than lesser capabilities. It may well be that some of the improvements in the hull propulsion system can be achieved by developments from either the Trafalgar or Vanguard class boats, or both, at less cost than a new development and without significant operational penalty. Put very simply, a few knots less, and even a few bunks less, may not be crucial. **It is, however, crucial that the priority requirements for the next class of SSNs are met as fully as possible.**

46. Very considerable sums of public money have been invested in the development of PWR-2, the steam-raising plant primarily intended for Vanguard class Trident submarines, which contains a number of significant improvements over PWR-1 installed in all UK nuclear-powered submarines to date. MoD has estimated development expenditure at around £500 million.[4] There has been substantial expenditure on development and production of the full test rig now at NRTE VULCAN at Dounreay, as well as improvements to the reactor cores. We have been briefed by Rolls-Royce and Associates, MoD's designated design authority, on the improvements in performance over PWR 1. There are also improvements in terms of radiological protection. MoD told us in 1990 that designs for future classes of submarines included targets for further significant reductions in levels of radiation exposures, as a result of the incorporation of alternative materials.[5] It is now a safety proven system. Although designed with

[1] Evidence, p 51, Answer L; Qq 420ff.
[2] Evidence, p 51, Answer L.
[3] Qq 434 HC 266 of Session 1990-91; 652ff.
[4] Q660; Evidence, p 56, Answer 2.
[5] Twelfth Report from the Defence Committee, *Radiological Protection of Service and Civilian Personnel*, HC 479 of Session 1989-90.

a large hull in mind, we understand that it could be converted to a smaller hull equivalent to Trafalgar size. **It is in our view inconceivable that SSN-20 should not be powered by some version of PWR-2.**

47. It is quite proper that MoD, prompted no doubt by the Treasury, should be cautious in moving ahead towards procurement of the next generation of nuclear-powered submarines. A class of six may cost around £2 billion at today's prices. It is however important that the process is not endlessly delayed. We have been made well aware of the sense of frustration in the submarine world at apparent vacillation and uncertainty. In December 1989, VSEL, GEC, BAe and RRA, not without difficulty and in direct response to the Ministry's initiative,[1] were able to establish a joint venture company, Underwater Management Associates Limited, to manage the project definition phase and to enable a competition for prime contractorship for full development and build phases. The placing of a contract for PD was envisaged in March 1990. Since then, the Government seem to have lost interest, and the company has had to be put in abeyance. All this has cost industry some money and a lot of goodwill. Staff Requirement 7027 may be in need of revision. Funds are short. We have been made aware that feasibility studies showed that none of the possible SSN-20 solutions proposed would have been ideal. **We do however consider that MoD should now make a firm statement of intent to procure SSN-20 with a clear guidance on timescales involved, in order to retain the vital sectors of UK industry necessary for production.**

Decommissioning and disposal

48. We have reported on a number of occasions on the issue of disposal of decommissioned nuclear-powered submarines, most recently in our First Report of this Session in 1991.[2] There is no progress to report. Submarines are likely to be stored afloat much as DREADNOUGHT has been, until a disposal route for the reactor compartments has been identified.

49. One option which may not have been fully considered is the possibility of putting an SSN on public display as a museum item. There are now a number of former Warships open to the public as museums; most recently, the former HMS PLYMOUTH. There are reports that the French Government are proposing to put either an SSN or an SSBN — or both — on public display. The United States has for several years displayed USS NAUTILUS at New London, Connecticut. The United Kingdom currently has HMS ALLIANCE on display at the Royal Navy Submarine Museum at Gosport. There are of course a number of problems, including selection of an appropriate and available site and solution of any radiological protection and related public relations issues. These and others are primarily a matter of money, and a commitment to regular inspections. Given that the costs of preparing a nuclear submarine for storage afloat are in any event substantial, at around £10-£12 million, with further ten-yearly dockings costing in excess of £2 million each,[3] we consider that an outlay by way of grant or an interest-free loan of around £1 or 2 million would not be unreasonable. A submarine returned to its shipyard of origin might act as a focus for regeneration of an area in economic difficulties. **We look to the Ministry of Defence to consider this matter further in consultation with appropriate experts and other authorities concerned.**

IV. WEAPONS AND SENSORS

Introduction

50. Submarines carry a mixture of weapons, depending on the tasking on any particular occasion.[4] Some will be carried in the five or six bow tubes, ready to fire: the rest in the racks in the weapon stowage space behind the tubes, into which they will be loaded. Because of the inflexibility imposed by the shortage of space and the length of a patrol, the composition of the weapon outload is of crucial importance to a submarine's military effectiveness. The reload capacity

[1]Evidence, p 84, 8.b.
[2]HC 69 of 1990-91, paras 48-52.
[3]Evidence, p 64.
[4]Evidence, p 38, Answer G.a.

of an SSN or SSK is around 20 torpedoes, mines or Sub- Harpoon missiles, meaning a total capacity of around 24 weapons.

Torpedo

51. The principal submarine weapon against both surface and submerged targets is the torpedo. Originally an unguided self-propelled projectile which was discharged in a salvo of up to six from as close to a target as possible, the modern torpedo is usually released singly at some distance, is guided towards a target from an attacking submarine by a wire-guidance system to within a few thousand metres of a target, and then released to complete its attack at great speed and using its own homing devices. The standard RN torpedo is the Mark 24 Tigerfish, which entered service after a development beset by problems. It has now fully replaced its predecessor, the Mark 8 torpedo, and all have been modified to standard Mod 2.[1] Tigerfish enjoys an excellent reputation among submariners.

52. Tigerfish is to be gradually replaced in the course of the next few years by Spearfish, although it is not deemed cost-effective to carry out the necessary extensive modifications on all Resolution class SSBNs or on Oberon class SSKs.[2] The required modifications to the command, fire control and weapons handling and discharge systems of existing submarines will be made during refit or maintenance periods; Vanguard class SSBNs and Upholder class SSKs have been designed from the outset to handle Spearfish.[3] Dependent on the range, a modern submarine may detect the noise from the firing of a torpedo, which is propelled from the tube by a water ram discharge system in SSNs, or by an air turbine pump in the Upholder class, and will take avoiding action by changing course, speed and depth.[4] The quieter the means of discharge, and the quieter the torpedo's own motor is, the less likely it is that the target will be alerted. A torpedo also needs speed over the final distance to match the speed of a modern submarine capable of 40 knots or more. Spearfish will be faster than Tigerfish, with a reported speed of 60 knots, have considerably greater range, and is fitted with a directed energy warhead, compared to Tigerfish's relatively weak 134 kg explosive warhead. It is also heavier than Tigerfish, and there are "more stringent magazine safety requirements".[5] **Spearfish is designed to be faster, have a greater range and hitting power, improved stealth, manoeuvrability and guidance:[6] it represents a necessary and welcome upgrading of submarine capabilities.**

53. Development of Spearfish is nearing completion, with over 60 in-water trials conducted to date and 100 weapons manufactured under a combined development and initial production prime contract. A further 40 test firings are required under a Reliability Assurance Programme, agreed with Marconi Underwater Systems Ltd, which it is hoped will demonstrate the required level of reliability.[7] A main production order would follow if the programme is successful. MoD confirmed that —

> "The weapon has a good overall performance and meets the Agreed Characteristics called for in the contract".[8]

54. Torpedoes are very expensive, costing several hundred thousand pounds each. It is therefore possible comparatively infrequently to conduct exercise firings in conditions of open ocean where the torpedo is unlikely to be recovered. The RN makes extensive use of UK torpedo ranges off Scotland, and of a highly sophisticated instrumented three-dimensional commercial range also used by the US and other NATO navies in the Bahamas, the Atlantic Underwater Test and Evaluation Centre (AUTEC). It is however important that submariners should be able to engage in exercises using complete weapons systems in realistic environments, including in Northern waters. MoD have told us that —

[1]Evidence, p 49, Answer G.d.
[2]Evidence, p 49, Answer G.d and e.
[3]Q703.
[4]RN submarines do not at present have silent discharge, whereby a torpedo leaves the tube under its own power — so-called "swim-out".
[5]Evidence, p 49, Answer G.e.
[6]Q701.
[7]Evidence, p 49, Answer G.e.
[8]*ibid.*

"When Tigerfish stocks become surplus to requirements, the weapons may be offered for sale through the Defence Export Services Organisation or scrapped".[1]

We recommend that consideration be given to the use of a small number of surplus Tigerfish torpedoes in realistic battle scenarios.

Sub-Harpoon

55. Sub-Harpoon was purchased to give submarines a long-range anti-surface ship missile capability. The RN's Sub-Harpoons are manufactured in the United Kingdom under licence from McDonnell-Douglas of the USA. Fired from the tubes of a submerged submarine, the missile rises to around 100 feet, then swoops down to a wave-skimming glide-path. Although it has the disadvantage of revealing a submarine's location, it is both faster and effective over a considerably greater range than a torpedo, and therefore extends the potential of a submarine as a weapons platform.

Mine-laying

56. Clandestine mine-laying from torpedo tubes rather than from external fittings is accepted as one possible task for submarines, although a dangerous and not always a cost-effective one, given the limitations on space. With high-value sophisticated mines, however, and against targets closely defended on the surface, such as harbours or coastal narrows, a submarine may well be the best means available. Mines can now be laid in deep as well as shallow water. The RN only holds the relatively old-fashioned and easily detectable Mk 5 ground mine, although it would be possible if the need arose to purchase sophisticated mines manufactured in the UK. A modernisation programme is currently underway, awaiting authorisation for further development.[2] There are no arrangements for the use or procurement of US Captor anti-submarine mines, nor plans for developing an equivalent.[3] Although MoD assured us that minelaying is regularly exercised by RN submarines, we have the impression that submarine minelaying has not always been afforded the priority it deserves. Experience in the Gulf War has demonstrated once more the disproportionate effect and diversion of effort which can be achieved by sea-mines. **We recommend that MoD press on with the mine modernisation programme, and that steps are taken to ensure that RN submarine crews are trained and exercised in the deployment of the more advanced mines which are commercially available.**

SLCMs

57. Both US and Soviet submarines have a capability to launch sea launched cruise missiles (SLCMs), with nuclear or conventional warheads, to attack high-value land targets, or surface naval targets such as aircraft-carriers. The recent firing of Tomahawks from US submarines in the Red Sea and the Mediterranean gave an idea of their range; with a conventional warhead, of about 900 kms, and with a nuclear warhead of 2,500 kms. The Soviet Navy has specific land attack, ASW, and ASUW SLCMs.[4] SLCM capability gives an additional deterrent factor to a submarine; hostile territory can be held under threat without the provocation represented by an aircraft or surface force deployment. The possibility of a "warning shot" against a land target considerably extends the options available to a commander. Concealment can be maintained even after firing of an SLCM, unlike Sub-Harpoon; the former can be programmed to ensure that "back-tracking" its line of approach will not reveal the submarine's location. There are some limiting factors. The requirement to preset guidance systems requires a target to be previously identified and mapped; given the vagaries over submarine communications with base, this imparts an element of inflexibility, as does the need to decide in advance the mix of weapons a submarine will carry. We understand however that it would be technically feasible to add the necessary launch hardware.

58. **We were surprised to learn that no consideration has been or is being given to the possible introduction of such a capability, apparently because it would have**

[1]Evidence, p 49, Answer G.d.
[2]Qq 707-8.
[3]Evidence, p 50, Answer G.g.
[4]See Evidence, p 81, Annex C.

to be at the expense of other capabilities, and because the role envisaged is one "where the RAF is in the lead".[1] Given the acknowledged need for consideration of future stand-off capability, it is particularly bizarre that Service distinctions should be thought to justify a failure to investigate the feasibility of a stand-off weapons capability using currently available technology. In 1981 our predecessors concluded that cruise missiles did not offer a credible alternative as a strategic deterrent to an SSBN force;[2] the fact that they were even considered demonstrates that they are not beyond the capabilities of UK technology. We have recently visited a USN submarine which carries a mix of conventionally armed Tomahawk cruise missiles, Sub-Harpoon and heavyweight torpedoes, without technical problems. We recommend a full feasibility study of the deployment of sea-launched cruise missiles in RN submarines in the context of national conventional force capabilities.

Self-defence

59. Submarines are relatively unprotected in terms of short-range, quick reaction self-defence. In evidence to us, MoD accepted the need for submarine self-protection and made it clear that they would be pressing ahead with capability enhancements.[3] Submarines have counter-measure capabilities to "confuse and distract enemy sonars and weapons";[4] in effect, electronic decoys which are an equivalent to the chaff dispensed by aircraft to confuse radar. There are other measures which are intended to mislead enemy sonars. Against what some experts regard as the principal equipment threat to a submarine, however, a cleverly managed ASW helicopter with a dipping sonar, RN submarines have no direct defence. Soviet and US submarines are reported to have some air defence missile capability. While it may be that escape by manoeuvre represents the best defence, particularly for SSNs, there remains the possibility that an SSK can be so harried by successful ASW techniques as to be obliged to surface: a tactic recognised as "hunting to exhaustion". **Some sort of anti-air weapon could be of value; we recommend that MoD actively pursue this and other additional self-defence capabilities for submarines.**

Sonar

60. A submarine is still largely dependent on its sonar to detect other submarines and surface ships, although the advance in non-sonar detection methods may in time produce alternative methods. There are two sorts of sonar, active and passive. *Active sonar* consists of the deliberate transmission of high energy sonar pulses, and the interpretation of their reflection or refraction to discover, locate and identify other submarine objects. It is akin to the system used by bats in place of vision. The use of active sonar sacrifices stealth, since other sonars will be able to detect its use and its source. Research into concealment of active sonar emissions is being carried out in the United States. *Passive sonar* is akin to listening in complete silence, and relies on ultra-sensitive pick-up of sound patterns at all frequencies. There is a lot of ambient noise underwater, which can mask the noise made by submarines. The use of passive sonar is optimised by anticipating from experience the frequency on which various sounds produced by submarines are likely to be detectable, and by differentiating these from the myriad other sonar patterns of the undersea environment.

61. Submarines carry sonar in several positions, to provide maximum coverage of the areas ahead, to the sides and astern of a submarine, and above and below, so that a complete sonar picture can be obtained. Information from all the sonars in operation is displayed on a number of consoles in the command centre of a submarine. A medium-range passive sonar and an active sonar array are normally mounted in the bows of a submarine. On the flanks are carried a medium-range passive array and passive ranging sonar to establish the distance of any object identified. On the hull and fin casing is an active sonar intercept to detect hostile active sonar transmissions. Towed on a cable as much as 1,000 or 2,000 metres astern of a submarine is its principal long-range listening device.

[1] Q705.
[2] HC 36 of Session 1980-81, para 11.
[3] Q700.
[4] Evidence, p 39, Answer G.c.

The towed array sonar has to be far enough away from the submarine's own noise to be able to listen to more distant noise.

62. Submarine sonar systems are exceedingly complex, software intensive and at the frontiers of technology. As technology produces ever quieter submarines, with astonishing degrees of stealth, signal processing technology, acoustic detection and classification becomes ever more challenging. It is therefore essential that submarine sonars are regularly updated, which is an expensive process. The Sonar 2051 fit, for example, which, together with the new Outfit DCH Command System, was part of the Oberon update programme agreed in 1985, cost around £4 million per set.[1] Similar sums were spent on sonar suites for an expected future buy of Upholder submarines.[2] The development costs of the sonar suite and associated command system for the Vanguard class Trident SSBNs are of the order of several hundred million pounds.

63. We have therefore been concerned to ensure that existing SSN and SSK submarines were being fitted as planned with advanced sonars, and that financial pressures were not interfering with the planned updates.[3] **From the information given to us by MoD and from the classified briefings we have received, we are satisfied that the opportunity has been and will continue to be taken to fit SSNs at refit with the latest sonar fits.**[4] The latest Sonar 2076 suite is about to enter Project Definition Phase.[5] We are pleased to note that it draws heavily on the technology and system architecture developed for the Sonar 2054 suite designed at great expense for Vanguard class SSBNs, on which we have reported in the context of our annual reviews of the Trident Programme.[6]

Communications

64. Submarines need to be able to receive communications from shore-based authority while on the surface or while submerged, as well as on occasions from aircraft, surface ships and other submarines. Although a submarine can operate autonomously for long periods and seldom transmit signals, in circumstances short of total war it is likely that rules of engagement will require regular communication with superior authority, along the lines of the permission sought by the Captain of HMS CONQUEROR in 1982 to attack the General Belgrano. A submarine must be able to do this without betraying its position, and the means of communication must be secure against interception and decryption.

65. In order to receive or transmit radio signals, a dived submarine has to be connected to an aerial above or on the surface. Signals are transmitted to submarines on a variety of frequencies and by a variety of means. The principal means of transmitting signals to submarines over a long distance is by Very Low Frequency or Low Frequency groundwave signals, known as the Submarine Broadcast. To receive signals a submarine may have to alter its course at a particular time and to listen on a pre-arranged frequency slot. Signals can also be transmitted over shorter ranges by High, Very High or Ultra High Frequency (HF/VHF/UHF) transmissions, either direct or relayed via a surface ship, aircraft or surface installation. Submarines use a periscopic mast to receive or transmit such signals, which has the disadvantage of increasing the risk of detection. Signals can in some circumstances also be transmitted and received by satellite. Submarines can communicate with each other over short ranges by satellite or by underwater telephone, and with shore either by satellite or HF/VHF/UHF transmissions. In general communications from submarines are both more laborious and less practical than communication to submarines. It can in some circumstances be of crucial importance that a submarine conveys information gathered to others, and also that shore- or surface- based commanders communicate with a submarine. **From the classified information provided,**[7] **we**

[1]Evidence, p 39, Answer G.b.
[2]Evidence, p 39, Answer G.c.
[3]Evidence, p 50, Answer G.h.
[4]*ibid.*
[5]*ibid.*
[6]eg HC 374 of Session 1988-89, paras 45-53; HC 237 of Session 1989-90, paras 30-33.
[7]Evidence, p 50, Answer G.j.

are confident that MoD are seized of the need to respond to a number of problems in the field of submarine communications, and are actively seeking improvements. We are not, however, persuaded that the techniques employed have kept pace with the impressive rate of technological change in submarines generally, and consider that this area of technology may be a suitable candidate for multilateral collaborative research.

V. PERSONNEL

Requirement

66. The current manpower requirement for the Submarine Service stands at 1,040 officers and 6,883 ratings, a total of 7,923.[1] Around 40 per cent of these posts are sea-going; the remainder are either administrative or provide engineering and similar support. In sharp contrast to the situation throughout most of the Armed Services, there are no planned manpower gaps in operational submarines, and the actual strength is the same as the requirement. A shortfall in volunteers is made good by drafting men to submarines — so-called "pressed men". MoD has told us that almost all officers, and around 75 per cent of ratings, are volunteers; it has been evident to us that the vast majority of those drafted into submarines without having expressed a firm preference subsequently elect to remain in submarines.

67. The gradual paying-off of the remaining Oberon class submarines, and the recent decommissioning of three SSNs, leads to a small fall in the overall manpower requirement over the next few years.[2] Several factors however combine to produce a marginally increased overall requirement over the next five years or so —

- the possible introduction of "double-crewing" of the four Upholder class submarines;
- the entry into service of SSN-19, HMS TRIUMPH;
- the overlap for several years of Polaris and Trident SSBNs.

This results in a relatively short-term strain on the training programme, until the requirement falls to a steady post-Options level of around 6,500. The slight shift in the balance of SSK/SSN/SSBN service should not cause any manning problems; while ratings in particular have in the past tended to remain in one particular class of submarine, many of their specialities are such as to be readily transferable.[3] Commodore Blackham, Director of Navy Plans and Programmes, told us that he expected such rotation to continue, and even increase, in a smaller fleet.[4] There would not seem to be any insuperable manpower planning difficulties in the reductions proposed.

Training

68. In evidence printed with this Report, submarine specific training is set out in detail. It will be seen that a considerable proportion of both the initial and later training arises from the requirement that all officers and many ratings should have a considerable knowledge of nuclear propulsion and nuclear safety, either at RNC Greenwich or at HMS SULTAN at Gosport. In the case of Engineering Officers, this involves a two year post-graduate course. The other significant feature is the period of qualification at sea: twelve months for Seaman Officers, six months for Weapons Engineering Officers, three months for Engineering Officers (of the Watch), twelve weeks for junior ratings, and possibly more for MEAs to qualify as a Category C nuclear plant operator. It should also be noted that there are a number of stages of post-qualification training, most notably the Perisher course to qualify officers to command a submarine, but also embracing a range of specialist courses for officers and ratings.

69. Submarine-specific training is provided at a number of sites throughout Britain: Sultan, Collingwood, Dolphin, Faslane, Greenwich and Dounreay, in

[1] Evidence, p 31, A.a.
[2] eg Q392 HC 266 of Session 1990-91.
[3] See eg Qq 393-5 HC 266 of Session 1990-91; and Q., 691ff.
[4] Q694.

addition to RN-wide training at Dartmouth, Manadon and Raleigh. Over 200 courses are offered, many of them specific to class and type. For a service of 7,500, that seems a lot. Much travelling is involved, particularly where a course is offered other than at a submarine home base. This is particularly striking in the case of continuation training, which should ideally be collocated with the submarines to which it relates. If it is not, it is likely that its quality will suffer. **We note that thought is being given to rationalising Service training and the Service training estate;[1] a similar rationalisation in submarine training courses and sites would be of advantage.**

PVR

70. MoD is reported as having told the Armed Forces Pay Review Body (AFPRB) in its most recent report of "a serious deterioration in the manning position at all levels, ranks and rates, within the submarine service".[2] The principal symptoms of this perceived malaise were the rates at which qualified officers and ratings were applying for premature voluntary release (PVR), leading to shortages of qualified personnel, and the need to fill a number of posts at all levels with personnel not formally qualified for the job. For example, there were as at 1 December 1990 only 373 qualified Seaman Officers on the strength, against a requirement for 457; the resultant shortfall of 84 is made good by the employment in other specialisations of Engineer Officers. The shortage of submarine command qualified officers has necessitated the employment in shore posts of unqualified officers, agreed to be undesirable.[3] Similar shortages of qualified personnel existed in certain rates, notably the Weapons Engineering Artificer (WEA) specialities.[4] MoD provided us with PVR figures for officers, but told us that separate figures for PVR rates for ratings were not maintained.[5] Witnesses subsequently clarified this by explaining that they were not maintained on computer.[6] We have in any event seen figures which seem to show an alarming rise in PVR applications among submarine rates from the middle of 1989, over 15 per cent in some areas of specialisation, meaning in practical terms that 1 in 5 are seeking to leave the service. This bears out the anxieties expressed in 1990. **We urge MoD to take rapid steps to improve its record-keeping system on submarine personnel, so that it can keep a close watch on trends and analyse the causes of any problems.**

Training places

71. One reason for the current shortfall in qualified personnel lies in the bottleneck in the system of qualification caused by the fall in the number of submarines, and in the hiccup in operating patterns as a result of the recent defect inspection programme of nuclear-powered submarines. Officers and ratings rely on berths on operational submarines to gain a sea qualification following completion of shore-based training. An SSN with a complement of 114 may carry up to 15 or 20 trainees as supernumeraries. Those personnel awaiting Part III berths (see below) are left "on the jetty" until berths can be found. Some personnel wait for as long as 12 months. There are at present around 230 submariners on the jetty, a number agreed to be undesirably high.[7] Steps are being taken to solve this problem; **we welcome the proposal that one or two SSNs should carry a higher than usual complement of trainees as a way of hastening qualification.**

72. To the extent that the principal cause of the shortage of qualified personnel was the increased rate of PVR, however, and assuming that dissatisfaction with pay and conditions was a major, if not the only cause of that, we are satisfied that the 1991 AFPRB settlement, and the fact that it was met in full by the Government, will have removed a potent cause of discontent.[8] With that familiar talent for production of happy statistics when less happy ones are harder to come

[1]Evidence, p 56, Answer 4.
[2]Evidence, p 43, para 58; Qq 712ff.
[3]Qq 737ff.
[4]Evidence, p 31, Answer A.a.
[5]Evidence, p 32, Answer A.d.
[6]Q718.
[7]Qq 732-3.
[8]Qq 716-7, 729-730, 745.

by, MoD assures us that PVR rates are now falling.[1] In particular, the introduction of a fifth tier of submarine pay of £11.85 a day for the more experienced Lieutenants and above, an increase of £3.04 a day over the previous top rate, should, as MoD told the AFPRB —

> "demonstrate to the personnel concerned the value of their services and lead to a reduction in current premature voluntary retirement levels".[2]

Taken together with the general pay settlement, this represents a considerable financial commitment to the retention of experienced and expensively trained submarine officers. **The Ministry must monitor with particular care the effects of the recent pay settlement on Seaman Officer retention in the Submarine Service.**

Specific shortages

73. MoD drew our attention to the shortage of Chief Petty Officers qualified as Nuclear Chiefs of the Watch, who are among the most highly qualified of Marine Engineering Artificers. The task is essentially that of a nuclear plant operator, and includes responsibility for continuous monitoring of the reactor systems when the submarine is alongside, and most other personnel are free to leave. In recognition of these onerous duties, and the amount of on-shore training required, a Nuclear Propulsion Senior Rates supplement is paid to Category B and A2 nuclear Watchkeepers of £4.90 and £7.20 a day respectively.[3] **While this may in itself suffice to solve the shortage problem, we consider that other means of ensuring the qualification and retention of an adequate number of qualified Nuclear Chiefs of the Watch could usefully be examined in conjunction with the nuclear safety authorities.**

74. A shortfall in the number of Medical Assistants (MA(SM)) was also drawn to our attention. There are 94 available for drafting, of whom 78 are qualified as submariners, against a requirement of 114.[4] 68 of the 94 are at sea in submarines, including 38 of the 43 junior ratings. MAs(SM) have a particular significance in radiological monitoring of submarine personnel in SSBNs and SSNs; while radiation monitoring posts ashore have been temporarily filled by men from other branches who have received appropriate training from the Institute of Naval Medicine,[5] posts on submarines have to be filled by properly qualified Medical Assistants.[6] The fact that almost all qualified MAs(SM) are at sea puts a particular strain on them, since it is that much more difficult to provide individuals with a balance of sea and shore service.[7]

Pay

75. Submarine service personnel receive a special supplement to pay, known as Special Service Pay (Submarines) (SSSM). This supplement, which is now paid at five rates from £7.35 to £11.85, recognises the special demands of submarine service; MoD told us that it reflected evaluation of the job, and the perceived need for an incentive to recruit and retain submariners.[8] SSSM is also paid to those in shore postings for as long as they have liability for submarine service. The 1991 AFPRB report recommended a somewhat reduced rate of £7.05 a day for ratings and £9.35 for officers who had been on shore for over three years. MoD told us that this rate would apply from 1 April 1991 to 944 Submarine Service personnel, and will save around £500,000 a year from 1992-93 onwards.[9]

[1] Qq 746-8.
[2] Evidence, p 44, Annex, para 60.
[3] Evidence, p 33, Answer B.
[4] Evidence, p 45, Answer A.e.
[5] *ibid*, Answer A.g.
[6] *ibid*, Answer A.e.
[7] *ibid*.
[8] Q720.
[9] Evidence, p 46, Answer B.b.

It seems to us to err on the generous side to pay over £2,000 a year extra to Service personnel for submarine service when they have not served in submarines for three years or more. We recommend that MoD consider a revision of the scheme for submission to the AFPRB after a few years experience of the new reduced rates.

Radiation

76. In our Report on Radiological Protection published in November 1990, we reported that —

> "Although some submariners are subject to radiation exposure, it is generally at a lower level than for land based personnel because the reactor is heavily shielded when operating",

and that there had been a "steady decline in the annual average dose of monitored submariners in the past decade".[1] Maintenance and refit workers are those most liable to exposure to radiation. Although we concentrated in that Report on exposures of civilian personnel at Devonport and Rosyth, we also noted that there had been no major reduction in HMS DEFIANCE at Devonport or HMS NEPTUNE at Faslane.[2] Provisional figures provided to us in April 1991 suggest that, while a general decline in radiation doses continues, there were considerable increases in the collective dose, in average doses and in individual instances of exposures of over 15 mSv at both bases in the course of 1990.[3] MoD witnesses told us that this had arisen as a result of work under the current submarine defect inspection programme.[4] **MoD has a good recent record of exposure reduction. The recent increases in exposure levels at Devonport and Faslane are exceptions to a generally favourable and downward trend. To maintain that they must make renewed efforts to ensure that, once the submarine defect inspection programme has been completed, annual and lifetime exposure levels at the Devonport and Faslane bases reflect the fall in exposure levels at the Royal Dockyards.**

Health

77. The general health of submariners is inevitably affected by long periods in a very confined space, with limited possibilities for exercise. Submariners are subject to "rigorous and wide-ranging" medical examinations at various stages, including before qualifying or requalifying for Submarine Escape Tank Training, and their physical condition is "regularly monitored".[5] MoD told us that "shore facilities are well used between deployments and regarded as satisfactory".[6] There are however no plans to develop facilities aboard submarines specific to maintaining physical fitness. We fully realise that space is at a premium; accommodation and facilities for the crew seem to be the last thing in the mind of submarine designers. While the provision of improved washing and toilet facilities on submarines is very welcome, the physical welfare of submariners is too easily neglected. Many boats have nothing more than a static exercise machine. **We recommend that further consideration be given, in co-operation with Service physical education authorities, and Allied navies operating submarines, to developing physical fitness programmes for submariners, specifically designed for life in a submarine, and to considering the ergonomic aspects of submarine operations, particularly in watchkeeping positions.**

78. We have been briefed on the diet of submariners, which has to be particularly carefully pre-planned in view of space limitations and the impossibility of re-supply. That alcohol is by binding convention only sparingly taken in submarines at sea no doubt has the same good effect on general health that enforced abstinence was observed to have had during Operation Granby.

79. **We consider that some further thought, and the commitment of resources, should be devoted to improving the shore conditions for submariners, so that they**

[1]Twelfth Report from the Defence Committee, *Radiological Protection of Service and Civilian Personnel*, HC 479 of Session 1989-90, para 27.
[2]*ibid*, para 34.
[3]Evidence, p 46, Answer A.h, and p 53, Tables 16 and 18.
[4]Qq 750-2.
[5]Evidence, p 45, Answer A.g.
[6]*ibid*.

are at least as good as their colleagues in surface ships. Submariners cannot live in their boats when in harbour, and are therefore more liable to the vagaries of local taxation, accommodation problems and costs, and more dependent on shore facilities for recreation. It seems likely from our discussions that discontent with conditions on shore is a significant additional factor in PVR rates, and so that some investment would be well worthwhile.

Command

80. The Submarine Service at its present strength has been for many years administered and controlled directly by Flag Officer Submarines (FOSM), a 2-star Rear Admiral, occasionally promoted in post to Vice-Admiral. This officer's responsibilities include that of submarine adviser to the Admiralty Board as well as the whole range of personnel, technical, operational and logistic functions. The scale of his responsibilities can usefully be compared with the duties of other 2-star operational posts. MoD will quite rightly be seeking reductions in the number of Flag Officers commensurate with the fall in the Navy's strength. But it is essential that the peculiar needs of the Submarine Service, and the particular responsibilities of FOSM, are recognised. Even with a reduced submarine force, a 2-star Flag Officer Submarines will continue to be a highly cost-effective commander.

Morale

81. **From our visits to submarine bases, it was apparent that the reductions in the submarine fleet had come as an unwelcome surprise to the Submarine Service.** Some officers and ratings clearly felt that their service had been sacrificed on the altar of political and financial expediency. Career expectations are inevitably affected. In general, however, we found morale to be high, no doubt strengthened by the Government's acceptance in full of the 1991 AFPRB report.[1] The 1990/91 entry target of 67 officers and 672 ratings has been meet in full, with the usual minority of pressed men.[2] MoD told us in December 1990 that there was no evidence that the July 1990 proposals were having an effect on PVR rates, and that the uncertainty which was affecting morale had been a significant factor in making the announcement about proposed future force levels as early as possible.[3] **Some loss of motivation may be inevitable as the Cold War ends, and submarine force levels fall: but we are confident that the Submarine Service will continue to attract high quality officers and ratings.**

VI. SUPPORT

Squadrons and bases

82. Submarines are organised into four Squadrons, at three bases. The First Submarine Squadron (SM1) consists of six SSKs, including UPHOLDER, and is based in HMS DOLPHIN at Gosport. SM2 has three S and six T class SSNs, based in HMS DEFIANCE at Devonport.[4] SM3 has four SSNs[5] and two SSKs, and is based in HMS NEPTUNE at Faslane together with the four SSBNs organised as SM10. There is also a Submarine Sea Training Squadron at Faslane, where submarines are based for operational training or for courses such as the Commanding Officer's Qualifying Course. Submarines in refit are, ideally, based at the relevant dockyard, and may be allocated to a different squadron on returning to operational duties.

83. These arrangements are flexible, and open to change. There are, for example, some obvious advantages in concentrating all submarines of one class at one base, where all support and shore training for that class can also be concentrated.[6] While any such concentration must of course depend on operational and training needs,[7] there would not seem to be any reason why these should require a S class rather than a T class submarine. Evidence provided by

[1] Q749.
[2] Evidence, p 32, Answer A.c; Qq 721-3.
[3] Q461 HC 266 of Session 1990-91.
[4] WARSPITE and CONQUEROR were also part of SM2.
[5] Two S class and VALIANT and COURAGEOUS.
[6] Qq 689-690.
[7] Q696.

MoD gives some idea of the range of complex facilities required for SSN support, primarily available at Devonport.[1] **There is evidently room for some rationalisation of SSN basing in the years ahead.**

84. There has been widespread speculation over the possible transfer of Upholder class boats from their intended base at DOLPHIN, probably to Devonport, as part of a complicated series of moves designed to rationalise the RN estate at Portsmouth. There has been considerable capital investment in waterfront facilities at Dolphin specifically for Upholder class boats, to a value of around £12.8 million. These include specialised facilities for the provision of chilled water and electricity for charging submarine batteries.[2] The main jetty provides for the possibility of berthing nine submarines in all, three at each of the three mooring points with a tracked crane and deep draught pontoons. Almost £6 million has been spent on improved crew accommodation, not intended exclusively for Upholder class crews. Training facilities specific to Upholder class boats costing around £30 million have also been installed, notably highly sophisticated simulators which we saw in the course of our visit. These include a £5 million Weapon Handling/Discharge Trainer, a £2.5 million Ship Control Trainer and a £4.6 million Sonar Maintainer Trainer.[3] The various Trainers are in modern purpose-built buildings; almost £3 million was incurred on works costs connected with this training equipment.[4] Although MoD told us that the alongside facilities, the storage warehouses and the spares depots could be used for ships or submarines of any type,[5] a number of the specialised facilities would in fact be ill-adapted to other uses and would, in any event, have to be reproduced elsewhere, at yet further cost. The training facilities are highly specific to Upholder Class submarines.

85. As MoD told us —

> "The unit operating costs of an SSK will rise in comparison with previous assumptions if only four UPHOLDER class submarines are procured".[6]

One step which is proposed in order to mitigate the effects of the loss of economy of scale is the amalgamation of SM1 with another squadron, thus reducing the number of squadron staff.[7] As Commodore Blackham told us —

> "If you have less submarines you ought to be looking to see whether you need the same administration support and structure".[8]

The issue of squadron organisation must not be confused with basing; submarines from one squadron can operate from more than one base, much as at present two squadrons operate from one base.

86. MoD told us in April that decisions on these matters were part of the wide-ranging overall review of naval support, on which it was hoped to offer advice to Ministers "within the next two or three months", although decisions could be taken even after the autumn public spending round without affecting the savings to be made.[9] We urge Ministers to be wary of pursuing short-term savings at the expense of operational good sense. We cannot think it a prudent use of public funds to abandon expensive and specialised support facilities and reprovide them elsewhere. **We consider that there are very good grounds for the basing of Upholder class submarines at HMS DOLPHIN.**

Refits

87. While submarines normally undergo routine maintenance, and regular Docking and Essential Defects (DEDs) at their home base, full refits for SSNs, which cost around £100 million, can at present only be carried out at Rosyth or Devonport, and for SSBNs, costing marginally more, only at Rosyth. SSBNs do not have DEDs, but undergo annual dockings at Faslane. Most Oberon refits

[1]Evidence, pp 46-48 , Answer D.e.
[2]*ibid.*
[3]Evidence, p 46, Answer D.e.
[4]*ibid.*
[5]Q389 HC 266 of 1990-91.
[6]Evidence, p 40, Answer J.
[7]*ibid.*
[8]Q697.
[9]Qq 558 to 573.

have in the past been carried out at either Rosyth or Devonport. At least one refit has been satisfactorily carried out in a private yard; the refit of OTTER in 1985 by Humber Shiprepairers Ltd for around £16 million.[1] Tenders were invited from six companies for the refit of ONSLAUGHT, including Humber Shiprepairers, Swan Hunter, VSEL and Yarrow; the refit did not go ahead, the boat being prematurely decommissioned.[2] MoD's written evidence suggested that "suitably qualified private yards" might carry out an Upholder refit[3] and that —

> "some commercial ship builders and ship repairers may have the capability to refit submarines and could in principle be invited to tender for refits and docking in the future".[4]

MoD would carry out an assessment of companies to satisfy themselves that they had the necessary facilities and resources to carry out the work; companies considering themselves qualified would be alerted by a notice in the Contracts Bulletin.[5] We note that the first docking of UPHOLDER was subject to competition.

88. For a variety of reasons, some beyond MoD's control, nuclear submarine refitting is in a state of ill-concealed confusion. There is evidently considerable over-capacity at present in nuclear submarine refitting. Once decommissioning work on CONQUEROR, CHURCHILL and WARSPITE is complete,[6] and dockyard work arising as a result of the defect inspection programme is completed, dockyards will face all the more clearly the implications of a reduced fleet of SSNs. The possibility of faster refits, and longer periods between refit, are other factors in the equation. MoD has told us that "future requirements for refit capacity are under review following Options for Change",[7] and that no decisions were expected for as much as 12 months.[8] MoD has not as yet established the technical feasibility of one dockyard handling all refits, let alone the operational implications. We are aware that VSEL at Barrow, the manufacturers of both SSNs and SSKs, the latter at their Cammell Laird yard, have in the past expressed interest in qualifying for nuclear refit work, without much encouragement from MoD. MoD confirmed that "VSEL are showing some interest in undertaking SSN or SSBN refit or DED work".[9] The yard would be required to make a very substantial capital investment in order to gain a licence to undertake nuclear refitting. MoD told us that its estimate was that this could be in excess of £100 million; while VSEL's estimate was lower, it is still a substantial figure. It is implausible to expect investment of this sort without public funding. **There are obvious risks in relying on only one nuclear refitting facility. Conversely, very pressing reasons indeed would have to be adduced to justify investment of public funds in creating a third such facility where two already exist.**

89. The customary pattern of submarine refit is for a submarine with an assumed life of 30 years to undergo two refits, one after eight or nine years, and another about ten years later, so that it has three operational cycles of around eight years each. There are prospects of altering this pattern. Upholder class submarines for example may have only one major refit. In any event, the refitting of a submarine can put considerable strains on the crew, many of whom are retained to assist dockyard staff in the refit task. They may well be away from their home base, and in some areas of specialisation, most obviously in the engineering trades, the crew are an integral part of the refitting. **In the course of general review of the submarine cycle of maintenance and refit, it is to be hoped that more account than hitherto will be paid to the effects of such decisions on the lives of submarine personnel and their families, and more attention paid to ensuring that amenities at base ports are such as to encourage retention of personnel.**

[1] Q687; Evidence, p 56, Answer 3.
[2] First Report from the Defence Committee, *Royal Navy Short-term Savings: HMS CHALLENGER and Decommissioning of Nuclear Fleet Submarines*, HC 69 of Session 1990-91, para 5; Evidence, p 48, Answer D.f.
[3] Evidence, pp 37 and 48, Answer D.b and f.
[4] *ibid*, p 39, Answer H.
[5] Evidence, p 48, Answer D.f.
[6] *ibid*, Answer D.h.
[7] *ibid*, Answer D.g.
[8] Qq 665ff.
[9] Evidence, p 48, Answer D.g; Q680.

Deployments

90. RN Submarines are not tied to their home base. They regularly operate from US and other Allied ports.[1] For example, the Oberon class submarine OPOSSUM recently completed a remarkable tour of the world, including a South Atlantic deterrent patrol and a visit to Pitcairn Island. It was able to carry out a 4-week Assisted Maintenance Period (AMP) in Australia, and a Self Maintenance Period (SMP) in Singapore. Support for such deployments is normally provided by transporting equipment &c in containers; for a more prolonged deployment, an RFA or other vessel can readily be converted to act as a support ship. The RFA has only one specialised repair facility, RFA DILIGENCE. **We suggest that consideration should be given to exercising an RFA in the role of submarine support ship at short notice.**

91. There is a particular problem with nuclear powered submarines arising from the safety aspects, and from political and popular resistance to nuclear power. MoD told us that nuclear powered submarine maintenance could only be conducted away from the UK in the Falkland Islands, in the USA or at USN facilities. **We urge Her Majesty's Government to use its best endeavours to persuade other Allied nations to consider hosting visiting RN nuclear powered, but conventionally armed, submarines.**

Industrial base

92. It is essential that the United Kingdom retains the capacity to design, produce and supply nuclear and conventional powered submarines.[2] That requires a minimum level of skilled and experienced design and manufacturing know-how of submarines, of their nuclear steam raising plant, and of the unique items of weapons and sensor systems technology. Much of the technology is peculiar to submarines, with little or no evident other military or civil application. There are a handful of principal companies involved, together with a number of other companies who supply specialist equipment such as torpedoes, sonars and periscopes, and an even greater number of sub-contractors. They require a minimum level of orders to stay in business. Some specialised components for nuclear submarines are already sourced from abroad, but on grounds of price rather than non-availability of technology; it would give us, and no doubt MoD, great cause for concern if the United Kingdom were to lose certain key technologies.

93. MoD told us that, in developing forward plans for the submarine fleet, it—

> "take account of the implications for the likely incidence of orders for the shipbuilding industry".

and that the maintenance of a viable national capability for nuclear submarines was "an important policy objective".[3] They also accept the importance of the maintenance of the industrial capability necessary to support the existing submarine programme, and that there are therefore companies and technologies whose maintenance is of strategic importance.[4] In proposing submarine force levels, however, although MoD had had an eye to the impact of the incidence of ordering on VSEL,[5] such considerations had not been a major consideration in formulating advice to Ministers, since officials were confident that the force levels proposed and the rate of ordering required to sustain it did not put that minimum capability at risk.

94. In the light of full and thorough briefings by VSEL and RRA, of written information from both companies and from GEC-Marconi, and of other related evidence,[6] **we consider that the proposed submarine fleet and in particular the hiatus over SSN-20 leaves the UK industrial base for the design and manufacture of submarines perilously close to the edge. It is increasingly difficult for a number**

[1]Evidence, p 37, D.c.
[2]eg Qq 456 HC 266 of 1990-91; and Q643.
[3]Q643.
[4]Qq 644-5.
[5]Q653.
[6]Evidence pp 84 *et seq*.

of companies to keep their teams of designers and engineers together when there is not enough real work for them to do. RRA, for example, employ 1,850 people, 60 per cent professionally qualified and many with enormous experience;[1] a further gap in the SSN ordering programme will inevitably threaten this core of nuclear engineering expertise. We have been briefed on the effects on a number of smaller companies making specialised components. As GEC-Marconi pointed out, "stop-go" patterns of home demand put at risk future collaboration in this or in other areas of defence technology.[2] **It is essential that MoD keep a very close eye on industrial developments so as to ensure that key UK submarine system manufacturing capabilities are not irreversibly lost.**

Exports

95. Export possibilities for UK nuclear submarines are severely constrained by the 1958 Agreement with the United States. The prospects for exports of SSKs have long been considered as good: VSEL have in the past sold new and reconditioned diesel-electric submarines to a number of countries, and there are some current sales prospects. The market is a vigorously competitive one. We will be reporting at greater length in our forthcoming Report on the procurement of Upholder class submarines. But it is clear enough that any help which HMG can give, subject to the appropriate restrictions, is repaid in the employment generated, and in the assistance it gives to the maintenance of the submarine industrial base.

VII. RESEARCH

General

96. **Continuing investment in research into submarine and anti-submarine warfare is essential if the United Kingdom is to retain a technological lead, and all the more if there is a smaller fleet charged with the same tasks.** The Admiralty Research Establishment (ARE) currently spends around £30 million a year on research into submarine platform characteristics, sensor, weapons and self-defence systems; £10 million of that is spent with industry.[3] MoD's Sea Systems Controllerate at Bath is responsible for studies of various kinds. MoD told us that they see "a continuing requirement for a major British contribution to submarine warfare in the future".[4] With the downturn in the United Kingdom market for submarine warfare technology, it would be idle to expect the leading firms involved to be able or willing to invest substantial sums of their own in research and development. **It is essential that MoD identifies those areas of submarine technology where they genuinely desire British excellence to be maintained, and fund them accordingly.**

Nuclear propulsion

97. MoD has a substantial investment in nuclear propulsion research, in particular at NRTE Vulcan at Dounreay, which has been managed and operated by Rolls-Royce and Associates Limited since 1962. This establishment includes not only the PWR-2 Shore Test Facility but also the Loss of Coolant Accident Investigation (LAIRD), a complete Valiant class submarine stern section designed to simulate catastrophe loss of coolant. RRA, funded by MoD, also maintains a major Engineering Laboratory and other facilities. Together with its sub-contractors' base, these are the sort of facilities which take decades to build up, but only a few years to destroy.

98. We were very helpfully briefed by Rolls-Royce and Associates on the operation of the 1958 US/UK Agreement on the transfer of certain nuclear technology to the UK, and specifically that required for submarine nuclear steam-raising plant. While the details are highly classified, the essence is simple: many things have changed in 30 years which lead us to question whether the terms agreed then were not unduly restrictive. It does not seem wholly equitable that the undreamed of improvements of the last 30 years which RRA have

[1]Evidence, p 88.
[2]Evidence, p 91, para 5.
[3]Evidence, p 40, Answer K.a.
[4]Q454 HC 266 of 1990-91.

brought to the original Westinghouse system should be covered by the terms of a 30 year old agreement. **We recommend that consideration be given to the implications of seeking a review of the Agreement.**

Non-nuclear propulsion

99. There has been some direct MoD input into current research into Air Independent Propulsion (AIP), which covers a variety of technologies designed to make future conventional submarines as free of the need to surface to take in air as is a nuclear-powered submarine.[1] The principal thrust of MoD-sponsored AIP research has been carried out at ARE Holton Heath, in the development of Lithium Aluminium/Iron Sulphide (LAIS) battery technology, which would significantly increase the endurance of SSKs, although without rendering them truly Air Independent. MoD judges that there is sufficient commercial interest and investment in fuel cell technology to render MoD sponsorship superfluous, although the possible future need to investigate"areas specific to a submarine application" is being kept under consideration, and a MoD/VSEL joint study has recently been completed. VSEL were reported as recently exhibiting a methanol-fuelled solid-state fuel cell developed as a private venture with a Canadian firm. The future of ARE's fuel cell test facility is "under review as part of the Defence Research Agency (DRA) restructuring".[2]

100. Commander Compton-Hall's paper briefly reviews the types of non-nuclear AIP available, and draws particular attention to Gaseous Storage of energy in a Toroidal hull (GST) developed in Italy. The German Navy has been developing fuel cell submarine technology, albeit with limited success, and both Swedish and Dutch manufacturers are marketing submarines based on the Stirling engine. MoD told us in relation to the prospects for IEPG input that "future collaboration may be possible".[3] It is essential that the UK does not fall behind in the development of AIP technology, which seems an area of military technology self-evidently tailored for co-operation between Allies. **We recommend that MoD actively seek opportunities to develop international collaboration, and continue funding of AIP research and development sufficient at least to ensure that the UK is abreast of European developments.**

101. We also noted in the course of our inquiry reports of the cancellation of a research programme begun in 1985 for the development of a closed-cycle steam turbine (CCST) system, primarily designed for lightweight torpedoes delivered by helicopters or aircraft, but with potential application to submarine-delivered torpedoes. Such a propulsion unit would be quieter and less detectable than existing torpedo propulsion. MoD told us that, while substantial progress had been made in some areas, development of the boiler by ARE and of the pyrotechnic device intended to initiate the chemical reaction cycle remained high risk areas.[4] One boiler test had resulted in a contained explosion at the contractor's test site. The programme has been cancelled, after an outlay of around £16 million, excluding ARE's costs. **Although CCST technology may prove to be a blind alley in the future of torpedo development, we look to ARE to maintain its involvement in research into new means of torpedo propulsion, and to the Defence Research Agency under whose aegis it now comes to ensure that the setback to the CCST programme does not lead to the abandonment of MoD involvement in such research.**

Small submarines

102. The Royal Navy has shown little interest over the years in the possibility of procuring smaller submarines. While this is a field in which the fanciful is not always readily separated from the potentially effective, there are a number of designs already on the market for small or very small submarines, which might well be able to carry out some of the tasks assigned to SSKs, so as to free those for other tasks. While smaller submarines would probably be slow and have low weapon loads, they would be considerably cheaper to procure and run. **The**

[1]Evidence, p 50, Answer K.b.
[2]Evidence, p 50, Answer K.b.
[3]*ibid.*
[4]Evidence, p 49, Answer G.f.

opportunity presented by force restructuring should be taken to embark on some imaginative consideration of the potential of small or midget submarines.

Future

103. From classified evidence given to us by MoD, we are aware that a range of research is being undertaken into submarine warfare. It is of course difficult to quantify the benefits which accrue from such research, and proportionately difficult to scrutinise research programmes of this sort. ARE is now the maritime division of the DRA, and will be subjected to ever more searching efficiency and commercial-style scrutiny. It is important in that process not to lose sight of the fundamental necessity for research if the United Kingdom is to retain anything like its current status in submarine warfare technology.

VIII. SUBMARINES AND FISHING BOATS

Antares

104. At approximately 0218 on 22 November 1990, HM Submarine TRENCHANT, operating submerged in the Clyde area, snagged the fishing gear of MV ANTARES, a 16m trawler from Carradale. The trawler was sunk, and the crew of 4 were lost. The vessel was subsequently recovered by MoD. In the course of responding to a Private Notice Question on 23 November 1990, the day after the incident, the Minister of State for the Armed Forces announced that, in addition to a Department of Transport inquiry, there would be a Royal Navy Board of Inquiry, and told the House —

> "We shall make every attempt to produce an early report on the incident. Delay is in nobody's interest, and we will ensure that that report is produced as soon as possible".[1]

The report was completed in December 1990. A summary was not placed in the Library until 6 June 1991.[2] **While fully appreciating the necessity for thorough examination of the implications of the findings of the Board, we are also mindful of the desire of all those involved to see the issues dealt with speedily as well as properly. Given the Minister's earlier assurances, the delay in publishing the summary has been unacceptable.**

Safe areas

105. The loss of the ANTARES is not the first such incident involving submerged submarines and fishing vessels. The Minister of State's description of it to the House on 23 November 1990 as a "freak accident"[3] does not fully reflect the number of other incidents which might well have involved loss of life. MoD has provided us with a list of 16 incidents since 1980 in which submerged RN or Allied submarines have fouled fishing gear,[4] four of which involved US submarines. In April 1982 FV SHERALGA was lost in the Irish Sea; the crew were recovered. MoD pointed out that only 2 of the nearly 350 UK fishing vessels lost at sea since 1980 foundered as a result of a submarine fouling fishing gear, while accepting that —

> "two fishing vessel losses from submarine action are two too many".[5]

MoD also made it clear that it does not seek to deny submarine involvement in an accident or loss "if it is clear that this has happened",[6] and pointed out that many incidents alleged to be attributable to submarine activity were in shallow waters where neither the RN nor the USN operate, on grounds of safety.[7] There will always be allegations that otherwise inexplicable losses may be attributable to submarine activity, particularly in the wake of a tragedy such as the loss of ANTARES. They are at present hard to substantiate and difficult to rebut. **We consider that the publication in some form by the RN of those areas of open sea**

[1] HC Deb, 23 November 1990, col 548.
[2] HC Deb, 6 June 1991, col 348*w*; Qq 223-5; also HC Deb, 22 April 1991, col 303*w*. For summary, see Evidence pp 62-63.
[3] HC Deb, 23 November 1990, col 548.
[4] Evidence, p 58, para 10 and Annex.
[5] *ibid*, para 9.
[6] *ibid*, para 11.
[7] *ibid*, para 12.

where it is not their normal practice on safety grounds to transit submerged in peacetime could go some way towards alleviating anxieties and refuting many allegations without sacrificing operational security.

Issues

106. There are general issues arising from the incident which we have pursued with MoD.[1] While submarine sonars can detect a surface vessel operating its engines, and would normally detect trawls dragged along the seabed, submarine sonars cannot always pick up towed or "pelagic" trawls. The effectiveness of passive sonar in inshore water is in any event hindered by general underwater noise; the action of a net being towed often quite slowly through the waters is unlikely to be audible. It may be worth noting in this context that in earlier days static harbour defence nets were indeed deployed against submarines. MoD accepts that it is reasonable to ask why submarines seem to be incapable sometimes of detecting the presence of fishing gear.[2] **We accept that there are good reasons why this should be so, and that the solution must lie in deconfliction of submarines and fishing boats, and in the use of specific devices to alert submerged submarines to the presence of fishing gear, rather than in changes to a submarine's sonar or navigational systems. We are confident that submarine commanding officers go to great lengths to avoid confrontation with fishing boats and welcome the instruction given to avoid vessels engaged in fishing by as much distance as is navigationally prudent and the commissioning of studies on ways of providing submarines with better equipment for establishing the range of fishing vessels.**[3]

107. **We also accept that there is a valid operational requirement for submarines to transit submerged.**[4] Denying a potential enemy knowledge of the operating patterns and deployment routes of submarines greatly increases the security with which they can operate in periods of tension or war. While an enemy may fairly readily discover the approximate time of departure or arrival of submarines from, say, Faslane or Devonport, precise deployment routes and times are a closely guarded secret, and can only remain so if submarines transit submerged. In peacetime, submerged operations in these waters are essential for training purposes for commanders and crews; as MoD points out,

> "The turnover of personnel through the Naval Service, the need to qualify sailors for in-service advancement, the introduction of new equipment, the evolution of new tactics — all these contribute to a continuous training task".[5]

There may be room for adjustment, to the extent that in some sea areas such as the Straits of Dover and sections of the north eastern sector of the Irish Sea, UK and Allied submarines already transit on the surface on safety grounds. We note that the policy of operating dived submarines close inshore has been reviewed by the RN and the need for such operations confirmed —

> "as a necessary means of preparing the submarine flotilla to operate in the shallow waters of the Continental Shelf and the Northern Seas".[6]

We welcome the announcement that —

> "greater emphasis will be given to training for increased safety in inshore waters".[7]

It is unrealistic to expect submarines to give up submerged operations in coastal and inshore waters.

Bleepers

108. The principal solution proposed to the problem is the attachment to fishing gear of electronic bleepers or pingers, which would emit a signal capable of reception and identification by submerged submarines. The Minister of State

[1]Evidence, pp 57-59.
[2]Evidence, p 57, para 5.
[3]Evidence, p 63, para 10.
[4]Evidence, p 57, paras 2-4.
[5]*ibid*, para 4.
[6]Evidence, p 63, para 10.
[7]*ibid*.

told the House in November 1990 of his "high hopes for the bleepers that can be fitted to nets".[1] The current programme of research into bleepers began in 1989, when the Department of Transport (DTpt) commissioned ARE —

> "to conduct a feasibility appraisal of technical proposals put forward by the Humberside International Fisheries Research Institute and Seametrix Ltd of Aberdeen".[2]

Seametrix was invited to modify its system to meet an ARE specification, and the resultant device was successfully trialled underwater in July 1990. It was suggested by the Navy that the trials should be repeated in a different area. Following the loss of the ANTARES, these were dispensed with and the first of a series of underwater sea trials were held in December 1990. A second round of trials, intended to provide other manufacturers with an opportunity to display the effectiveness of their equipment, was anticipated in March or April of this year.[3]

109. These trials have not taken place. MoD told us that in their enthusiasm to make rapid progress in the aftermath of the ANTARES incident, they had perhaps underestimated the amount of work that needed to be done.[4] While the trials had gone satisfactorily, subsequent scientific work was necessary "to look at conditions which could not be tested in the trials themselves".[5] The report from ARE on this work, received by MoD on 17 April 1991, is intended to shape the specifications against which the various pinger devices on offer from manufacturers will eventually be tested;[6] as MoD witnesses told us —

> "The performance of those devices is going to vary according to the depth of the water, the quality of the bottom of the sea, the sea state and sea temperature",[7]

and

> "The water conditions for the various areas that we are considering are very diverse and very difficult to analyse".[8]

It is evident that MoD is very properly taking considerable trouble to ensure that any devices procured prove effective in the very varied conditions in which they will be called upon. **We are not, however, convinced that the matter is being pursued with the urgency that it should be. Two years have now elapsed since the original contract to look at such devices. We look forward to further trials in the very near future, and recommend that devices should be made available for fitting to fishing gear before this winter.**

110. Decisions have yet to be taken on the financing of the bleepers; and in particular as to whether they will be provided by MoD or DTpt free of charge to all or selected fishermen.[9] A number of fishermen affected are from the Republic of Ireland; MoD's witnesses were guarded in their response to any suggestion that the acquisition by other than United Kingdom fishermen would be funded by MoD, although seeing no objection in principle if satisfactory financial arrangements could be made.[10] There may also be implications for insurance of fishing vessels and their gear.

Notification

111. On 5 December 1990 it was announced that, following a meeting with representatives of Scottish fishermen, the RN would introduce a scheme giving advance notice to fishermen in the Clyde area of the times and general areas of planned submarine activity; on 7 December, details of the Clyde notification scheme were agreed at a meeting at Clyde Submarine Base.[11] Information is

[1] HC Deb, 23 November 1990, col 549.
[2] Evidence, p 59, para 14.
[3] HC Deb, 22 February 1991, col 318*w*.
[4] Q754.
[5] Q769.
[6] Q762.
[7] Q755.
[8] Q764.
[9] Qq 770ff.
[10] Q780.
[11] RN News Releases 40 and 41/90.

broadcast by the Clyde Coastguard every four hours on VHF, and is also available by telephone from the operations room at Faslane. The information is in the form of an announcement that "submerged submarine activity is planned for a particular day in a designated general area".[1] This acts as a warning to fishermen rather than as notice of exclusion; it also indicates where they can fish in confidence that there will not be submerged submarines.

112. The scheme became operational on 17 December 1990. MoD told us that they were "very satisfied" with the way the scheme was working, and that they were looking at the feasibility of extending it to other areas, hoping to be in a position to take a decision on that by about the end of June.[2] The Minister of State told the House in March that —

> "There are no technical reasons that I know of why the reporting system covering the Clyde should not be extended".[3]

An announcement is expected shortly.[4] Of the 16 incidents recorded since 1980, two were in South Western approaches (FVs UNISON and ALGERIE) and two in the North Channel (FVs HEROINE and PREVAIL). Only four were in the Clyde area. **We recommend a prompt extension of the Clyde Notification Scheme to these other principal fishing grounds where submarines transit submerged.**

[1]Evidence, p 59, paras 17-18.
[2]Q777.
[3]HC Deb, 19 March 1991, col 145.
[4]Evidence, p 63.

LIST OF ABBREVIATIONS

AAW	Anti air warfare
AFPRB	Armed Forces Pay Review Body
AIP	Air Independent Propulsion
ARE	Admiralty Research Establishment
ASUW	Anti surface warfare
ASW	Anti submarine warfare
BAe	British Aerospace
CCST	Closed-cycle steam turbine
COMSUBACLANT	Commander, Submarines Allied Command, Atlantic
DED	Docking and essential defect
DRA	Defence Research Agency
DTpt	Department of Transport
FOSM	Flag Officer Submarines
FV	Fishing Vessel
IEPG	Independent European Programme Group
MA(SM)	Medical Assistant (Submarines)
MEA	Marine Engineering Artificer
MoD	Ministry of Defence
MV	Motor Vessel
NATO	North Atlantic Treaty Organisation
NRTE	Naval Reactor Test Establishment
PD	Project Definition
PVR	Premature Voluntary Release
RN	Royal Navy
RNC	Royal Naval College
RRA	Rolls-Royce and Associates Limited
S class	Swiftsure class
SACLANT	Supreme Allied Commander Atlantic
SDE	Statement on the Defence Estimates
SLCM	Sea-launched cruise missile
SM1 &c	Submarine Squadron 1 &c
SSBN	Nuclear-powered ballistic missile submarine
SSGN	Nuclear-powered guided missile submarine
SSK	Diesel-electric submarine
SSN	Nuclear-powered fleet submarine
SSSM	Special Service Pay (Submarines)
T class	Trafalgar class
UK	United Kingdom
US	United States of America
USN	United States Navy
WEA	Weapons Engineering Artificer