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UNDERWATER WEAPONS AND THE ROYAL NAVY: 1869-1918

PhD War Studies.

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UNDERWATER WEAPONS AND THE ROYAL NAVY 1869-1918

The development of underwater weapons in the mid-nineteenth century gave to small navies with small vessels the power to destroy the larger vessels on which depended the supremacy of the larger navies; and this development was particularly ominous for the world's largest navy, that of Britain. The Royal Navy's dilemma was whether it should exploit the new weaponry for its own use or whether it should concentrate on countering the dangers posed.

The Admiralty reluctantly developed the Whitehead torpedo because it could not afford to slip behind other nations technically. At the same time however it sought to minimise expenditure by seeking a cheap national manufacture, and failed to adopt the radical alteration of priorities which was involved in providing battleships with adequate protection against a steadily increasing threat. Meanwhile there was little inclination either to use or develop the submarine mine, which was regarded as a static defensive weapon; and no attempt was made to come to terms with the threat it posed in the hands of an enemy.

The torpedo was delivered by two weapons. In the nineteenth century the torpedo boat was the main threat against which the Admiralty developed counter-measures, though not without difficulty and confusion aggravated by some muddled thinking about the value of 'offensive' tactics. The same thinking was applied with some individual exceptions to the similar problems posed by the submarine in the twentieth century with the result that no solution was available by 1914. By contrast the Navy's own submarine service was developed quite separately with considerable energy and effectiveness.

The Royal Navy failed to organise itself to cope with changing technology and its tactical and strategic implications; and failed to clarify its thinking sufficiently to identify and differentiate between the potential value and threat of the new weapons.

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PREFACE

'Pitt was the greatest fool that ever existed, to encourage a mode of warfare which those who commanded the seas did not want, and which, if successful, would deprive them of it.' This was the comment alleged to have been made by the Earl of St. Vincent in 1805 on the subject of underwater 'torpedo' explosions. It is equally a remark which neatly summarises the problems of deciding Admiralty policy in relation to the development of underwater weapons in the period 1869-1914.

British command of the seas was rooted firmly in the power of its large number of capital ships. These vessels were the ultimate arbiters of 'the effective control of all such maritime communications as are or can be affected by the operations of either belligerent'.[1] Not that their activity was necessary to exploit sea power. The exercise of that nebulous concept lay with the auxiliary and cruising vessels which carried the war to the enemy, drove him from the seas and maintained freedom of transit for the shipping which sustained an immense empire. When faced with a strong challenge, however, these weaker vessels inevitably fell back upon their more powerful allies, who waited dutifully in the wings to bring their power to bear when the issue of 'command of the seas' was in doubt. Julian Corbett neatly expressed the position with the sentence: 'On cruisers depends our exercise of control; on the battleship depends the security of control.'[2]

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1. J.R. Thursfield Naval Warfare (Cambridge: University Press, 1913) p.15.
2. Julian S. Corbett Some Principles of Maritime Strategy (London: Longmans, Green and Co., 1911) p. 113.

The 'wooden walls' which had won Trafalgar were therefore the historical trustees of British sea power. Steam and steel replaced canvas and wood, as the enormous changes of the industrial revolution of the nineteenth century altered the shape and construction of major warships, and the wooden walls of Nelson evolved into the ironclads of the late Victorian Navy. Whatever its form, however, the capital ship remained the key to British sea power.

The development of underwater weapons threatened to undermine this pattern. The blow delivered below the ~~Plimsoll~~ water line was capable of inflicting damage out of all proportion to the size of the explosive charge, by virtue of the effect of water pressure on the extent and direction of the explosion. When the expatriate English engineer Robert Whitehead developed a means of delivering such an explosion from a distance by use of the locomotive torpedo, even the most powerful ironclad was in danger. The peril was compounded by the ease with which the torpedo could be applied from even a small launch. When another Englishman, John Thorneycroft, developed a fast torpedo-boat suitable for this purpose, the delivery system was not only cheap and easy, but, by virtue of its speed, potentially deadly. The submarine was a still deadlier menace, because of the invisibility which enabled it to approach to a range suitable for launching the torpedo. The submarine mine threatened to be even more dangerous. Small and deadly, it required no fallible human hand to guide it, while its presence was revealed only when it struck. To an extent unrivalled by all the other advances in naval technology of the nineteenth century this mode of warfare therefore indeed threatened to deprive the Royal Navy of her 'Command of the Seas'.

It is a commonplace to refer to the Royal Navy as 'unprepared' for war in 1914, and in the field of underwater weapons no less than in other respects there were indeed many inadequacies of preparation. The Navy failed to resolve St. Vincent's dilemma satisfactorily. Underwater weapons were particularly advantageous to other nations, and, by the same token, disadvantageous to England. Should efforts therefore be made to develop them, should they be ignored as unsuitable, or should concentration be centred on counter-measures? Priorities were never decided, so that in 1914 the Navy was able effectively neither to use nor counter underwater attack.

This work attempts to discover the causes of this failure by a detailed investigation of the administrative, technical, strategic, tactical and personality factors involved. Such an analysis serves to reject the concept of the Navy as a monolithic organisation, and reveals the variety of conflicting theories, departmental interests and personalities which played their part in the formulation of official policy. These factors emphasise and illuminate St. Vincent's dilemma, and explain why it provides the underlying theme of the following pages.

The subject itself virtually dictates the arrangement of the material. The first three chapters deal with the administrative and technical problems arising from the introduction and development of the Whitehead torpedo, and the evolution of suitable counter-measures. Tactical and strategic matters are then raised by the emergence of the torpedo-boat. This problem is discussed by an outline of the experience of foreign countries, a critical analysis of the Royal Navy manoeuvres of the 1880s and 1890s in which the

torpedo boat played a prominent role and an investigation of the reaction of official and unofficial service opinion. These are treated at length because the issues and problems involved remain substantially the same during later developments which in their turn are dealt with along similar lines.

The chapter on the role of the torpedo-boat destroyer is a natural corollary of that which precedes it, while the submarine issue, discussed in the next chapter reveals a further development of much the same principles. Because of this, the technical, administrative, tactical and strategic issues involved with the submarine are all discussed in one chapter, which relates to and complements the preceding chapters. The selection of material and content in this chapter is designed to investigate the submarine not in isolation but in the context of the general problem of underwater weaponry, as it had developed in the preceding thirty years. Similar treatment is given to the submarine mine, the emergence of which as a deadly weapon of open sea naval warfare was contemporaneous with that of the submarine boat. This survey of pre-war developments is completed by a chapter on the Torpedo Service, which is designed to analyse various aspects of the men and administration responsible for underwater weaponry, to draw together themes and problems raised in earlier chapters and to summarise the state of play on the eve of war. Lastly, the final chapter investigates aspects of the 1914-18 war, relates inadequacies revealed here to problems, dilemmas and conflicts dealt with earlier and attempts to indicate some general conclusions.

It is believed that much of the content of this work has never before been the subject of serious study. In particular, the

investigation of the research and development processes of the Victorian naval bureaucracy, the manoeuvres of the 1880s and 1890s and the development (or otherwise) of the torpedo service breaks new ground. Much of the material used has never been fully exploited, and has certainly never been used to elucidate the significant aspect of British war preparations which is the subject of this study. It has therefore been possible to break new ground and at the same time to concentrate on the more significant issues in those topics, such as the submarine, which have already received generous treatment from others. The intention is that this detailed investigation of one aspect of the Royal Navy will succeed not only in answering the questions posed, but will also contribute to a wider understanding of the Senior Service at this time.

CHAPTER ONE - CHOOSING THE WEAPON

(a) The Adoption of the Whitehead Torpedo

The locomotive torpedo was first brought to the attention of the Admiralty by a report in January 1867 from the British vice-consul in Fiume. 'A newly invented marine torpedo' was undergoing trials at a factory managed by Mr. Robert Whitehead, an expatriate English engineer. This weapon was claimed to be capable of

> completely destroy/ing/ any vessel of war passing, or at anchor, by its contact when so directed, and launched off from shore or from a vessel afloat, the Machine is self-propelled with necessary force, and has speed under the water's surface, at six feet depth, less or more, so to be perfectly invisible to the enemy advancing when on its contact with the object it explodes and destruction is complete all round.[1]

Whitehall made no response.

Not until the following year, however, in the summer of 1868, was Whitehead ready to offer his torpedo for sale. It was then that he wrote to the C-in-C of the Mediterranean Fleet, Lord Clarence Paget, extolling the virtues of the device. He claimed that the torpedo could hit a target with fair certainty at a cable's length, and often at three cables' length. Paget was clearly unimpressed. 'I have informed him in reply, that as it is a projectile, his proper course will be to apply to the War Office'.[2] Strictly speaking, this response was correct, for decisions on all ordnance matters were the province of the Army Ordnance Board, rather than of the respective services. Nevertheless, Paget's coolness reflected the scepticism

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1. Vice-consul report, 4 Jan. 1867; ADM 116/135.
2. Paget to Admiralty, 25 Aug. 1868; ibid.

with which Whitehead's bold claims were greeted in London. Rear-Admiral Astley Cooper Key,[1] the first holder of the newly created post of Director-General of Naval Ordnance, remarked: 'This is not a new idea - I very much doubt the probability of the machine making a straight course for over a cable's length. But it is easily tested and I recommend a trial of it when Mr. Whitehead makes his proposition'.[2] Within a month of being so informed Whitehead announced his presence in London and requested an interview.[3] This being granted, his talents of persuasion soon won over Cooper Key. The latter reported: 'This mode of warfare has long appeared to me that which would prove most formidable to armoured ships.' If Whitehead's claims were justified, the invention was 'one of the highest importance'.[4]

The administrative problems following this decision were, however, considerable. Key himself could take no executive decisions. His task was to advise and co-ordinate the activities of the Director of Ordnance at the War Office, with those of the Controller and the Board at the Admiralty. The Controller decided on questions of naval matériel, and the W.O. decided on ordnance matters. Action therefore depended on the agreement and co-operation of these bodies.[5] Key had

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1. Admiral Sir Astley Cooper Key (1821-88). Served on Royal Commission on the Defence of the United Kingdom, 1859-60. Captain HMS Excellent, 1863-66. First Director-General of Naval Ordnance, 1866-69, First President of the Royal Naval College Greenwich, 1872-75, First Naval Lord, 1879-85.
2. Key minute, 17 Sept. 1868; ADM 116/135.
3. Whitehead to Admiralty, 28 Oct. 1868; ibid.
4. Key minute, 5 Nov. 1868; ibid.
5. P.H. Colomb, Memoirs of Sir Astley Cooper Key (London: Methuen & Co., 1898), p. 378.

neither supporting staff nor departmental influence,[1] and his personal relations with the Controller, Admiral Sir Spencer Robinson, were strained.[2] The situation could hardly have been less hopeful for Whitehead.

Key himself showed considerable judgement. He proposed a trial of two torpedoes in England and a careful consideration of how much should be paid in the event of a 'success', a term which itself needed clarification. Nor was he fooled by Whitehead's offer of the 'exclusive' rights to the secret, since he noted that the secret had already been bought by Austria.[3] The W.O. however rejected Key's proposal for a trial, and while awaiting this decision Whitehead lost patience. He announced his intention of returning to Fiume via France, where he claimed to have eager potential customers.[4] This crude blackmail could not possibly speed up the administrative process, but it did succeed in angering Key, with unfortunate consequences.[5]

The torpedo issue was forgotten in the confusion attending the changing of the Admiralty Board after the General Election of 1868[6] and the uncertainty of Key's position until it was confirmed under the new regime in early 1869.[7] Whitehead again had to take the initiative, which he did by writing in April 1869.[8] His tactlessness, however, still rankled with Key. Furthermore, a report from the

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1. See Navy Lists, 1868-69.
2. Colomb, op cit, p. 379.
3. Key minute, 12 Nov. 1868; ADM 116/135.
4. Whitehead to Key, 12 Nov. 1868; ibid.
5. Key minute, n.d.; ibid.
6. Admiralty to Whitehead, 23 Nov. 1868; ibid.
7. Colomb, op cit, p. 382-83.
8. Whitehead to Admiralty, 12 April 1869; ADM 116/135.

Foreign Office pointed out that Whitehead's partner, Luppis, had acquired a reputation among French officials as a 'slippery customer'.[1] Suspicion therefore explains the failure to answer this letter.

Whitehead was, however, persistent, and in June the Admiralty received another letter, enclosing a memorandum containing 'a concise general description of the nature and capabilities of the new armament'. This claimed that the torpedo was easily ejected, unaffected by waves, thoroughly reliable and without deviation as it travelled underwater. It was able to attack armoured vessels in their unprotected underwater sections and could be launched from a long distance, from another vessel or from the shore, with a fair degree of certainty of hitting and destroying. It was destined to play 'an important part in naval warfare', possibly by replacing 'the dangerous system of ramming'.[2]

This appeared to overcome Key's suspicions, for he took immediate action. He proposed to circumvent the problem of W.O. and Treasury opposition by sending a committee of naval officers to investigate.[3] The new D.N.O., Captain A.W.A. Hood,[4] who succeeded Key in July 1869, took up the idea, and H.M.S. Mitre was ordered to Fiume to watch a demonstration.[5] The report was enthusiastic. The

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1. Key minute, 21 April 1869; ibid.
2. Whitehead to Admiralty, 1 June 1869; ibid.
3. Key minute, 28 June 1869; ibid.
4. Admiral Lord Hood of Avalon (1824-1912). Captain HMS Excellent, 1866-69. DNO, 1869-74. Second Naval Lord, 1877-79, First Naval Lord 1885-9.
5. Admiralty to H.M.S. Mitre, 12 July 1869; ADM 116/135.

torpedo, fired from underwater frames by a compressed air piston, reached a speed of 8½ knots, with a maximum deviation of 25 feet at 200 yards, increasing to 40 feet at 400 yards. In a series of shots fired from frames which were elevated and depressed to represent a heeling and pitching ship, there was at 400 yards a horizontal deflection of only 11½ feet and a vertical deflection of 2½ feet. Its accuracy was estimated to be sufficient to hit a ship end-on at 200 yards and broadside-on at 400 yards.[1]

This somewhat euphoric and exaggerated opinion of the torpedo was assessed coolly by Hood. He noted that more realistic trials were necessary to give some idea of actual capability, particularly when the tube from which the torpedo was ejected was actually moving, as would be the case in battle. The progress made by Whitehead had however been considerable and justified the trial of two torpedoes in England, to test the probable accuracy of the weapon when fired from a moving vessel against a moving target, its loss of accuracy when the rudders were damaged on discharge from the moving ship and the actual destructive effect of a 50-60 lb explosive charge when delivered from a torpedo.[2] 'My opinion is, that if this invention is proved to fulfil all the conditions stated by Messrs. Luppis and Whitehead, it is a most formidable means of attack, and one which this country should have the advantage of possessing.'[3] His proposals were intended to ensure a thorough test of the weapon, and unlike Key, he received the full backing of the First Lord, now Hugh Childers.[4]

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1. H.M.S. Mitre report, 2 Sept. 1869; ibid.
2. Hood minute, 1 Oct. 1869; ibid.
3. Hood minute, 18 Nov. 1869; ibid.
4. Childers minute, n.d.; ibid.

The Treasury sanctioned the experiments in January 1870,[1] and in September and October of that year, Captain Morgan Singer, Captain William Arthur and Lieutenant A.K. Wilson[2] carried out no less than 101 runs with the two trial specimens. These trials constituted a thorough test of all the conditions under which torpedoes were likely to be fired, and culminated in a spectacular explosion which completely destroyed the target ship. The report of these three officers concluded that 'any maritime nation failing to provide itself with submarine locomotive torpedoes would be neglecting a great source of power both for offence and defence'.[3] In June 1871, the secret of the Whitehead torpedo was purchased at a cost of £15,000.[4]

Manufacture became the responsibility of the Royal Laboratory at Woolwich. This arrangement ensured that the secret did not leave authorised government circles[5] and that the W.O. paid for the torpedoes. The former was essential to maintain the agreement with Whitehead; the latter naturally found favour in the Admiralty.[6] But one result was the curious anomaly that the Secretary of State for War was obliged to defend estimates about which he had little

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1. Treasury to Admiralty, 29 Jan. 1870; ibid.
2. Admiral Sir Arthur Knyvet Wilson, V.C., (1842-1921). Torpedo Committee 1870. In charge of instruction, H.M.S. Vernon, 1876-9. Captain H.M.S. Vernon, 1889-92, Controller and Third Naval Lord, 1897-1903, First Sea Lord, 1910-12, Special Adviser to the Admiralty 1914-18.
3. 'Report of Committee on Whitehead Torpedoes', 28 Oct. 1870. Printed pamphlet, Naval Library.
4. 'Agreement of the British Government with Messrs. Luppis and Whitehead', 11 June 1871; ADM 116/146.
5. Admiralty to W.O., 24 June 1871; ibid.
6. Hood minute, 23 June 1871; ibid.

knowledge and even less control![1] The Admiralty maintained a firm interest in events. 'It is not desired by Their Lordships simply to reproduce the torpedo as now envisaged by its inventors, but that its efficiency in every way as a weapon of offence may be improved upon in this country'. Accordingly, Captain Singer and a naval engineer accompanied Woolwich representatives when they were sent to Fiume to receive a technical briefing on the weapon from Whitehead.[2] This instruction constituted the only technical information received by the Royal Navy on their new acquisition.

Considerable salesmanship by Whitehead had been necessary before the obstacles posed by a confused administrative situation and a welter of personal tensions had been overcome and the torpedo finally purchased. Despite 'official' difficulties, however, naval assessments of the weapon tended, if anything, to be exaggerated rather than pessimistic. All who saw it were impressed by its potential and believed that its employment would benefit the navy. At this stage there was no indication that anybody realised that the nature of its power endowed it with a capacity to endanger rather than strengthen the supremacy of the Royal Navy.

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1. Edward Cardwell, Secretary of State for War, to Admiralty, 6 Jan. 1874. 'Torpedo Reports'. Printed pamphlet, Naval Library.
2. Admiralty to Singer, 11 Aug. 1871; ADM 116/146.

(b) The Torpedo Committee

There remained the problem of deciding on the place of the new weapon both in the general field of naval warfare and in the particular field of 'torpedo' or underwater warfare. Hood had envisaged purpose-built sea-going vessels with low freeboard and thick armour-plating, which could use their speed and low silhouette to attack ironclads.[1] Both he and the officers of the Mitre anticipated its potential use from launches,[2] while the committee of 1870 noted the increased offensive powers which the Whitehead would give an ironclad.[3] However, the emphasis so far had been on investigating Whitehead's claims, rather than on assessing the effect of the weapon on naval warfare. Much the same ignorance surrounded the whole field of underwater weapons, a subject then very much in its infancy, and struggling to establish itself under the auspices of Commander J.A. Fisher,[4] an instructor in Vernon, a tender attached to the gunnery school HMS Excellent. Fisher was eager to promote and publicise his cause and was exasperated by the absence of any thorough appraisal or widespread knowledge of the subject.

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1. Hood minute, 1 Oct 1869; ADM 116/135.
2. H.M.S. Mitre report, 2 Sept 1869; ibid.
3. 'Report of Committee on Whitehead Torpedoes'. 28 Oct 1870. Printed Pamphlet. Naval Library.
4. Lord Fisher of Kilverstone (1841-1920). Served on the staff of H.M.S. Excellent, 1864-69. Commanded Vernon 1872-76. Captain, H.M.S. Excellent 1883-86. DNO 1886-92. Controller and Third Naval Lord 1892-96. First Sea Lord, 1904-10, Chairman of the Royal Commission on Oil Fuel, 1912. First Sea Lord 1914-15. Chairman Board of Inventions and Research 1915-16.

As early as August 1869 he had proposed that a Committee should be established to investigate the subject of underwater warfare.[1] Though the Admiralty was receptive to his idea, however, no positive action was taken, and Fisher adopted a rather irregular method of achieving his aim. In November 1872 he printed a lengthy memorandum on the subject and circulated it through the fleet as if it were an official statement of Excellent opinion. In this, he outlined the main questions of the day concerning torpedo warfare. These were: the methods of clearing a way rapidly through hostile torpedoes or mines; the protection of ships against torpedoes when blockading; the desirability of a permanent naval torpedo service; the adoption of submarine torpedo vessels; and the place of the Whitehead torpedo in future wars.

> It requires no elaborate argument to point out the necessity that exists for speedily determining upon some course of action in regard to the above questions, as the enforced inactivity of the French squadrons in the Franco-German war, and their daily evening departure from the vicinity of the harbours they were blockading for fear of torpedo attacks, have sufficiently illustrated the folly of deferring consideration of these subjects until the time of actual war.

He proposed the formation of a committee to consider these questions and carry out practical tests on the various weapons available. He compared the paucity of training staff at Vernon with the enormous establishment in Russia, and noted the necessity of the fleet including some men with the ability to carry out countermining and to rig obstructions. Although the Whitehead

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1. Report of Commander J.A. Fisher, 21 Aug 1869; ADM 1/6088. See also discussion in R.F. Mackay, Fisher of Kilverstone (OUP, 1973) p. 64.

torpedo needed a fast and manoeuvrable special vessel of at least 1000 tons for ocean service, 'it appears to be specially adapted for use from boats, particularly against a blockading squadron'. All these questions, he concluded, should be investigated.[1]

The appearance of this apparently 'official' circular embarrassed the Board considerably and Fisher noted gleefully: 'The Admiralty do not approve of my having printed it.'[2] It seems however to have achieved its object, for May 1873 saw the formation of the 'Torpedo Committee'. This consisted of a panel of naval officers (including Fisher), the W.O. chemist F.A. Abel, and a Royal Engineer Lieutenant-Colonel Stotherd. Its terms of reference were to investigate:

1. The most efficient manner of protecting vessels, both at sea and at anchor, from the attacks of offensive torpedoes of the various natures known.
2. The best means to be adopted for operating against an enemy's vessels, under various conditions, with the various offensive torpedoes known.
3. The best mechanical or practical system of arranging impromptu means for naval attack or defence.
4. The most efficient manner of clearing a passage through the torpedo defences of an enemy, and of destroying booms and other submarine and floating obstructions.[3]

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1. 'Naval Torpedo Warfare', 14 Nov 1872. Fisher memorandum; Phipps Hornby Mss Phi 121a.
2. Fisher to Phipps Hornby, Dec 1872; ibid.
3. Terms of reference of the Torpedo Committee, 23 Aug 1873; ADM 116/158.

The main area of torpedo warfare lay in coastal defences, at a time when the Royal Navy expected to play a blockading role very similar to that of the Federal Navy in the American Civil War. It was the task of the committee to resolve priorities and analyse the various weapons systems available. There was little knowledge and even less experience of the problem. The committee started from nothing.

Preliminary work began in June 1873, when reports were collected and officers questioned. In July and August a series of experiments was conducted to test the dangers of attack by torpedo launches on an anchored ship. Results, from the point of view of a navy which could expect to receive many such attacks, were disappointing. Guard boats were found to be useless, heavy guns too inflexible, musketry ineffective and the necessary vigilance by the crews exhausting. Even Gatling machine guns were of doubtful value against special high speed torpedo boats.[1]

The great bulk of the committee's work was done between December 1873 and June 1876, when extensive experiments were conducted. Defensive netting systems, mines and electric lights were all tested, and the outrigger torpedo, an explosive charge attached to the end of a spar and projected over the bows of the torpedo vessel, was given extensive trials.[2] This had been the main 'offensive' torpedo weapon of the American war. More complicated devices, guided from the shore by electric cables, such as the foreign Lay and von Scheliha

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1. 'Preliminary report of Torpedo Committee', 15 Oct 1873; ibid.
2. Report on experiments F, G, H, J, K, M, O, In 'Final Report of the Torpedo Committee', 28 July 1876; ADM 116/163.

designs, were rejected because 'the essentials of simplicity and certainty of action are missing'.[1]

Most attention was, however, paid to the Harvey and Whitehead torpedoes. The former, a towed explosive charge, was fitted to the gunboats H.M.S. Glatton and H.M.S. Grinder, which were then manoeuvred against each other. These exercises indicated conclusively that the successful employment of the Harvey against even a crippled and stationary vessel required considerable skill and expertise. Obstructions, consisting of spars fitted as swinging booms, with a martingale from the keel to the outer end of the spar to catch the Harvey's towing line, could easily stave off the attack. While the Harvey could be very useful as a defensive auxiliary particularly as a deterrent to the ram, its capabilities, on the whole, were insufficient to justify the construction of special vessels. 'Great skill is required to enable either [means of using it] to be performed successfully, and that this skill can only be acquired by constant practice under circumstances assimilated as far as possible to those that would occur on actual service.'[2]

The Whitehead offered greater prospects. Noting that extemporised net defences were not possible at sea, 'the Committee believed that if the Whitehead torpedo could be efficiently projected from the broadside of a ship proceeding at considerable speed, it could prove a most formidable weapon for action at close quarters'. Experiments showed that 'by employment of a light strong shield, the torpedo can be projected from the broadside of a ship at all speeds up to eight knots,

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1. 'Report on the Lay Torpedo', 24 June 1874; ADM 116/158.
2. 'Report on Experiments with the Harvey Torpedo', 15 April 1874; ibid.

and that an object the length of a small corvette can be struck almost with certainty, whether stationary, or moving in a direction parallel to and opposite to the ship's course, at ranges up to 200 yards'. The evidence adduced for this claim was the result of 33 test firings, when the torpedo deflected from its straight aimed run by between 25° and 38°. This, in fact, is an extraordinary degree of inaccuracy from which to make such a claim. Even when allowance was made for deflection when taking aim, there was still a likely variation in accuracy of 13°.[1]

The committee undoubtedly underestimated the difficulties of aiming, and ascribed to the Whitehead powers which at this stage it was far from possessing. Nevertheless, the general conclusion was sound enough. 'The Whitehead torpedo, on account of its certainty of action and of the comparatively small amount of skill required for its effective use, is far superior to any other offensive torpedo known to them as a weapon for general service at sea, [compared with the Harvey].' Broadside fire was particularly suitable for ships at sea, and it was in this sphere that developments would be of greatest use. Ejection for this purpose should therefore be developed.[2]

An offensive weapon requires a defensive response, and this the committee recognised. Rather than wait for the results of the Oberon trials,[3] it carried out its own experiments to ascertain the powers of resistance of ships to torpedo explosions. An experimental

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1. 'Report on Experiments on the Projection of the Whitehead Torpedo from the Broadside', 8 Oct 1875; ibid.
2. ibid.
3. See pp. 91-92.

section was constructed to resemble part of H.M.S. Devastation, Sir Edward Reed's[1] novel ironclad which was recognised as the quintessence of battleship strength. A 100 lb explosive charge was then exploded against it with devastating effect; it appeared that only bulkheads of increased number and strength could preserve the ironclad. These precautions, however, would increase weight, so that sacrifices in protection would have to be made elsewhere.[2] This was an order of priorities which successive administrations were to prove unwilling to adopt.

The committee's final report was produced in July 1876 under the guidance of Captain Singer, whose experience[3] made him the best qualified officer in the navy to chair a body, the composition of which had altered radically in the three years since its formation. By now, too, the Whitehead itself had developed so that it was capable of 12½ knots for 300 yards, 10½ knots for 750 yards and 9 knots for 1200 yards. This improved capability supported the general conclusion that it was 'incomparably superior for general purposes to either the towing or outrigger torpedo and would in future be used by large and small ships, as an extension of the ram or deadlier still from the broadside, and as the principal armament of a special unarmoured torpedo vessel'. While sound enough, the committee's conclusions were based on some rather confused thinking. For instance, it was claimed that a broadside target could be hit at 400 yards, though such an estimate made no allowance for evasive

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1. Sir Edward James Reed (1830-1906). Naval architect and consultant. Chief Constructor of the Navy, 1863-70.
2. Report on Experiment C. 'Final Report of Torpedo Committee'. 28 July 1876; ADM 116/163.
3. See pp. 16-17.

action by the proposed target. No clear distinction was drawn between the capabilities of the torpedo in trial conditions and the probability of effectively practising those capabilities in action.

The power of the Whitehead at sea emphasised the importance of defensive measures, for 'the most powerful ship is liable to be destroyed by a torpedo projected from a vessel of the utmost comparative insignificance'. This was to be the kernel of the entire debate around underwater weapons, and at this stage, 'no satisfactory description of defence against attacks made by Whitehead or other locomotive torpedoes has yet been devised'.

Even if effective external defences were devised, they were still liable to damage by fire or collision. Safety lay in improved ship construction, with watertight compartments, bulkheads, an increased distance between double bulkheads, strengthened armour, secure boilers and engines, and some means of stopping the influx of water through torpedo holes. Great faith was placed in the detection of the approaching attack by the use of electric lights, which were 'without doubt the most efficient agent that can be employed for the purpose under consideration'.

These were wide-ranging recommendations based on a series of extensive trials on a wide variety of weapons. From a position of total ignorance, the committee had assessed the implications and capabilities of the weapons with conclusions which in essentials were to stand the test of time well. The concluding remarks are instructive.

> The tendency of stationary torpedoes is to increase the difficulties hitherto experienced in invading the seaboard of an enemy, whereas offensive torpedoes will also play a most important part in future ocean warfare. The committee recognises the introduction of the latter as specially inimical to the manoeuvring of large squadrons, and as <u>having a tendency to reduce to one common level the Naval Power of the greatest and most insignificant nations.</u>[1]
>
> The protection from offensive torpedoes of our ships at sea is by far the most important branch of inquiry submitted to the committee, and one requiring immediate attention; <u>it is moreover the only one on which they are unable to make a confident recommendation.</u>[1] At present they have no hesitation in expressing their opinion that none of our large vessels could remain for any length of time during war off an enemy's port without imminent risk of destruction by offensive torpedoes; experiments in this and other countries have furnished data which leave no room for doubt upon this head ... The greatest caution will in future be necessary in war-time in preventing a strange vessel, however small, from approaching the fleet.
>
> [The Whitehead Torpedo] ... is a most formidable weapon, and will become more so when its powers are fully developed ... The committee have such confidence in the future development of the powers of this weapon that they do not hesitate to recommend that it be supplied, with the necessary fittings for projection above water, to all of H.M. Ships ... with as little delay as possible ... If it strikes the ship's bottom and explodes, the wound caused thereby would be sufficient to inflict fatal injury on the strongest ships of modern warfare.[2]

These conclusions were intelligent and varied, pointing to the potential and threat of the torpedo and including the realisation of the torpedo's levelling power and its threat to the blockade. There was however, also a determination to use the weapon for the benefit of the Royal Navy. This explains the constant pre-occupation with its application at sea, for it was here that the Navy would be most employed. It was envisaged as a sea-going weapon. While

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1. Author's italics.
2. 'Final Report of Torpedo Committee', 28 July 1876; ADM 116/163.

above-water fittings were quick and easy to apply, underwater projection was still doubtful at speeds of more than eight knots, so that the former method was recommended.

There was, therefore, no attempt to denigrate the torpedo and if anything, its capabilities were exaggerated. Its destructive powers were fairly assessed, but the unspoken assumption that these would necessarily be applied led to too great an emphasis on it. 'If it strikes', is a pregnant clause. Around the 'if' hung an era of debate on underwater weaponry. Nevertheless, the committee had done a thorough job, and the distribution of 600 copies of its report,[1] together with Fisher's torpedo manual,[2] demonstrated the importance attached to the subject. Whether these reports were read, and what would be done to develop the weapon and meet the problems posed by the committee, were other matters.

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1. DNO, Rear-Admiral Boys, minute, 15 Feb 1876; ibid.
2. Fisher 'A Treatise on Electricity and the Construction and Management of Electrical and Mechanical Torpedoes'. 1872. Naval Library.

(c) The Alternative Weapons

Despite the administrative difficulties, the Whitehead had been adopted with a considerable degree of enthusiasm. Indeed British naval officers consistently over-rated its capabilities. Whatever the complaints of the torpedoists,[1] the Royal Navy led the world in Whitehead torpedo development in the 1870s. Foreign countries however mainly preferred the simpler outrigger torpedo, and other devices were in close competition. Through the 1870s the Admiralty showed a keen awareness of the need to maintain its tactical lead over other countries and just as the Whitehead had been scrutinised and adopted, so other weapons were considered, although none managed to displace the Whitehead.

Only the outrigger and Harvey torpedoes were adopted by the British Navy, but these were discarded by the 1880s. The former was potentially useful for improvised attacks by ships' boats, and its employment in the equivalent of 'cutting-out' expeditions was anticipated with some enthusiasm.[2] Neither the Board, nor the Service at large, however, had any faith in its use from major ships.[3] The outrigger was doomed by the development of machine-gun fire, although its advocates maintained until the mid-1880s that its delivery by hand gave it a certainty all other weapons lacked.[4]

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1. See pp. 18-19. 276-8.

2. Captain Hon. F.R. Fremantle 'Naval Tactics on the Open Sea', RUSI, XXIV, No. 104 (1881), 2.

3. Hood minute, 2 Mar 1872; ADM1/6238. RUSI discussions in the 1870s and 1880s emphasise the role of the Harvey and Whitehead torpedoes, rather than the outrigger.

4. Captain Sleeman, Torpedoes and Torpedo Warfare (Portsmouth; Griffen and Co., 1880), p. 156. Also, Sleeman's comments in RUSI discussion, 6 Mar 1885, RUSI, XXIX, No. 124 (1885), 489-90.

Indeed, not until 1904 was the outrigger finally abolished. When this was suggested,[1] the Captain of H.M.S. Vernon defended its retention not because of its efficiency as a torpedo weapon, but because it might be useful for other tasks, such as shoring up bulkheads in storms.[2] His real motive was to prevent any diminution of the sphere of torpedo officers, which he feared might follow from the removal of some of their equipment. In fact this sort of rigid departmental narrow-mindedness which had become entrenched at Vernon, appalled more acute observers.[3] Vernon would undoubtedly have perpetuated this demonstrably useless equipment, if not for outside intervention.

Greater hopes were held out for the Harvey torpedo, since it was apparently possible to use this at sea, even if only in the auxiliary role proposed by the Torpedo Committee. Its life was, however, much shorter. The difficulty of using it was exemplified by the problem of prescribing rules for practice. It was too dangerous for ships to manoeuvre while practising with it so they were limited to steaming at 8 - 10 knots past a stationary target.[4] The Second Naval Lord, Sir Geoffrey Phipps Hornby,[5] considered the speed to be both too dangerous and yet not fast enough for realism.[6]

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1. By Captain Bethel, the ADNO, in a minute to H.M.S. Vernon, 11 May 1904; ADM1/7833.
2. Egerton to Bethel, 23 May 1904; ibid.
3. Such as Herbert Richmond. Richmond to Fisher, March 1905; Richmond Mss, RIC 12/4.
4. 'Regulations for Exercise with the Harvey Torpedo', 10 May 1875; ADM1/6347.
5. Admiral Sir Geoffrey Thomas Phipps Hornby (1825-95) C-in-C, Channel, 1871-4. Second Naval Lord 1874-77. C-in-C Mediterranean, 1877-80 (including the expedition to Constantinople, 1878). President, R.N. College, Greenwich 1881-82. C-in-C, Evolutionary Squadron 1885.
6. Phipps Hornby minute, n.d., ADM1/6347.

In fact, realism and safety were requirements which were too contradictory to be effectively reconciled.

The Harvey was disliked from the beginning by those who were expected to use it. In June 1876, for instance, the C-in-C of the Channel Fleet claimed that it was 'more likely to injure friends than foes in battle'.[1] The First Lord, W.H. Smith, shared this opinion and urged that the matter should be considered. 'I do not, I may say frankly, like the idea of a Harvey towing astern coming down upon a ship when it becomes necessary to stop her, and I cannot help thinking that the lines necessary to the Harvey are very likely to get foul of the screws.'[2]

The DNO, Rear-Admiral Hamilton[3] and the three senior serving Admirals, Phipps Hornby, Key and Lord John Hay, all condemned the Harvey. Efficiency could be achieved only by practice, which could be done realistically only at great risk, while the Whitehead had gone far to supersede the role of the Harvey in deterring the ram.[4] One of Key's captains commented: 'In single-ship action nothing could induce me to attempt the towing of it, and I consider it would be suicidal to attach a most dangerous mine within a few yards of one's own ship, for at any moment you may find you have destroyed yourself.'[5] The Whitehead, with its possibilities of improvement,

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1. Cited by Rear-Admiral R.V. Hamilton in minute 19 Aug 1878, ADM 116/182.
2. Smith minute, 14 Aug 1878; ibid.
3. Admiral Sir Richard Vezey Hamilton (1829-1912). DNO. 1878, Member of 'Committee of the Three Admirals' investigating the 1888 manoeuvres. Second Naval Lord, 1889. First Naval Lord 1889-91.
4. Hamilton minute, 19 Aug 1878, Key report, 23 Sept 1878, Hornby report, 19 Oct 1878, Hay report, 19 Dec 1878; ADM 116/182.
5. Captain Cator to Hay, 28 Nov 1878; ibid.

was the weapon of the future, while the Harvey remained condemned. 'There probably never was a subject in which there is greater unanimity than on the necessity of not using Harvey torpedoes in large ironclads.'[1] In May 1879, the decision was taken.[2]

There was also a variety of weapons which were never even adopted, but which were carefully considered. The von Scheliha torpedo, for instance, was under consideration by Russia and Germany,[3] and despite its obvious limitation to use from the shore,[4] Hood, as DNO, went to great lengths to collect all relevant information. He arranged an exchange of officers with Germany, to observe trials in June 1874,[5] and studied plans of the device which had been 'acquired' by the military attache in St. Petersburg.[6] Hood's eventual decision, that it was unsuitable for use at sea,[7] anticipated the decision of the Torpedo Committee, and its soundness reflected the care he had taken. The similar Lay torpedo was also rejected after consideration by the Torpedo Committee and Hood's successor, Boys.[8]

Perhaps the most ambitious, and certainly the most expensive invention, came from the American inventor Ericcson, the originator of screw propulsion. He claimed to have created 'a sub-aqueous projectile torpedo about 25 feet long, 1500 lb weight, with a charge

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1. Hamilton minute, 5 Feb 1879; ibid.
2. Fleet circular, May 1879; ibid.
3. Naval attache, report, 13 Oct 1871; ADM/6198.
4. Barnaby, DNC, minute, 12 Mar 1873; ADM/6281.
5. Hood minute, 9 April 1874; ADM/6314.
6. F.O. report on activities of military attache, 15 April 1874; ibid.
7. Hood minute, 30 April 1874; ibid.
8. Boys minute, 4 July 1874; ADM/6315. See pp. 21-2.

of 300 lb.' which would penetrate nets and supersede the ram.[1] His representative obtained an interview with Key, now First Naval Lord, who remained sceptical.[2] The enthusiasm of the Civil Lord, George Rendel, was, however, decisive in the decision to send Lieutenant Gladstone, of Vernon, to investigate.[3] Gladstone's mission was to distinguish between the claims and capabilities of the device. This, however, was precisely what he failed to do.

He reported: 'This is no vague idea existing only in the brain of a fanatic inventor, but is an actual reality completely worked out on sound scientific principles by perhaps the most eminent naval architect and naval engineer now living.' Absolute vertical and horizontal accuracy had been achieved, and the weapon could be employed from ships at sea.[4] On the basis of this report, the Board was unanimous that there was sufficient potential to justify a trial.[5]

At considerable expense, the gun and several projectiles were brought over for a trial. However, Gladstone had never actually seen the gun in action, a fact stated in the first paragraph of his report but not noticed by any member of the Board. Ericcson had convinced him by sheer salesmanship. Hood noted this as soon as he became First Naval Lord in 1885.[6] By an elementary but quite

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1. Naval attache report, 11 June 1884; ADM 116/252.
2. Key minute, 12 Dec 1884; ibid .
3. Rendel minute, 5 Dec 1884; ibid .
4. Gladstone report, 30 Mar 1885; ibid .
5. Captain Markham of Vernon, minute 24 April 1886, Concurred in by Barnaby, Brandreth, Rendel and Key; ibid .
6. Hood minute, 21 July 1885; ibid .

colossal oversight, the Board had sanctioned trials from which they had originally had little hope of success, and had, moreover, agreed to pay for them.

Key's first impression was justified by events. After a departmental wrangle in which Vernon asserted its jurisdiction in this 'torpedo' matter over the gunnery establishment Excellent[1] trials began in August 1886. An explosion in the bore of the gun brought 'a happy (but premature!) end to the experiments'.[2] It was a convenient end to an embarrassing situation, where Gladstone's poor judgement and the uncritical acceptance of his report by the Board of Northbrook[3] and Key had caused the Admiralty to spend £4000[4] on a weapon from which nobody had originally expected much.

This was undoubtedly a blunder, but generally the work of the Admiralty in the 1870s was sound enough. From a variety of weapons systems, thorough and systematic work had evaluated the most practical devices. Much of the burden of decision making lay with the DNO, in which position Hood distinguished himself by his sound and careful judgements. The work of the Torpedo Committee was invaluable, and Vernon was available for technical advice, while torpedo questions had often involved the whole Board. Underwater weapons at this stage were one aspect of a period which saw immense technical changes, from which the Admiralty intended to benefit fully. Hence the interest in these questions, and the importance of the quality of the DNO, for decisions were virtually personal affairs, with very little

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1. Correspondence between Admiralty, Vernon and Excellent, 9 Oct 1885 to 14 Nov 1885; ADM 116/261.
2. Captain J.O. Hopkins minute, 30 Sept 1885; ADM 116/272.
3. Thomas Baring, First Earl of Northbrook (1826-1904). First Lord of the Admiralty, 1880-85.
4. Hood minute, 30 Sept 1886; ADM 116/272.

'departmental' advice. Hood was an excellent appointee and his soundness served as a foil for a policy of bold acquisition followed by successive Boards after the adoption of the Whitehead torpedo.

CHAPTER TWO - DEVELOPING THE WEAPON

(a) Improving the Whitehead

The Board had intended that the Whitehead should be developed and improved by the resources of the Navy and the War Office. Although British torpedo work initially led the world, the prospects for the future were not good. The Torpedo School, Vernon, was starved of staff and equipment for instruction, and was neither intended nor suitable for use as a development and research centre.[1] Manufacture was the task of the Royal Laboratory (later named the Royal Gun Factory) at Woolwich, a fact to which Fisher somewhat unfairly ascribed many of the ills of the Torpedo service.[2] Although he was correct that such a system divided WO work from Admiralty responsibility, the fact was that no sort of organisation could compete with the genius of Whitehead. Unaided, he pioneered three major improvements in his invention and maintained his position as the leading torpedo manufacturer and designer until his death in 1904. The history of the development of the torpedo in the 1880s and 1890s is the story of Whitehead's remarkable achievements and the Admiralty's often reluctant adoption of his improvements.

The early Whiteheads were primitive machines, and the Navy's stock of 100 in January 1876 were capable of only 9½ knots. Whitehead was reported to be selling 20 knot torpedoes to Germany, and Fisher, Captain of Vernon, heard of this. He urged his professional confidant

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1. See Chapter 10, p. 275, 276, 289-92.
2. Fisher to Phipps Hornby, 9 Dec 1875; Phipps Hornby Mss, Phi 121b.

and patron[1], the Second Naval Lord Phipps Hornby, to ensure the purchase of at least 50 of the new weapons, which could be fired from above water over the bows of an ironclad, in the role of an extended ram. If realised, this concept would replace the ram by the torpedo as the primary weapon of warships.[2]

Hornby, however, was not only sceptical of the possibilities of above-water discharge but favoured the cheaper products of the Woolwich Laboratory. This attitude infuriated Fisher, who believed that Woolwich was incapable of producing a 20 knot torpedo, and expected the Navy to be left with a stock of obsolete torpedoes.[3] His enthusiasm was unavailing, and not until Whitehead made a personal appearance at Whitehall was the matter considered. In an interview in August 1876, the inventor outlined the choice of weapons now available from his workshops. There was a long 21" torpedo with an 80lb charge, or a short 14" 24lb torpedo capable of 15 knots for 2500 feet or 20 knots for 600 feet, the latter being suitable for above-water discharge. Both could be discharged by a new system in which hydraulic power activated by compressed air replaced the old method of straightforward piston operated by compressed air.[4]

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1. In his authorised biography of Fisher, First Sea Lord (London: George Allen and Unwin Ltd, 1969) pp 58-60, Richard Hough dates this relationship during the second half of the 1870s. The Phipps Hornby Mss, however suggest strongly that Fisher was already well known to the Admiral in the early 1870s. See the familiarity of Fisher's letter of December 1872, above p. 20 Ruddock Mackay in op cit p 93 addresses this question in a more satisfying manner.
2. Fisher to Phipps Hornby, 11 Jan 1876; Phipps Hornby Mss, Phi 121b.
3. Fisher to Phipps Hornby, 10 Feb 1876 and 14 Feb 1876; ibid.
4. Hall report on interview, 19 Aug 1876; ADM 116/164.

Lieutenant W.H. Hall, serving at the Admiralty in a secretarial role, favoured Whitehead's small (25lb charge) fast torpedo, which would be manageable enough for broadside use and powerful enough to inflict sufficient damage. It would in fact be ideal for the above water discharge recommended by the Torpedo Committee and endorsed with such enthusiasm by Fisher.[1] Only the Controller, Rear Admiral Stewart, however supported Hall[2]. The rest, led by Hornby[3], favoured under-water discharge and moreover believed the War Office's categorical assurance that the Laboratory could meet an order for 300 torpedoes of suitable quality. In fact, however, the torpedoes ordered from the War Office turned out to be larger but slower than Whitehead's, containing a charge of 50lb and capable of a speed of only 16 knots.[4]

There emerges a clear divergence of opinion between Whitehall and those serving officers most acquainted with Whitehead's work. The order for the Woolwich torpedoes was placed before their trials were complete, on the assurance of the Laboratory that the job could be done.[5] There was, however, no comparable faith in Whitehead, whose torpedoes were equally not yet tried, but whose proven achievements were much better. On the other hand, the new Captain of Vernon, William Arthur, urged vigorously that every effort should be made to keep in close touch with Whitehead, to take advantage of any possible improvement. 'When we consider the growing importance of the weapon,

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1. Hall Minute, 28 Aug 1876; ibid .
2. Stewart minute, 29 Aug 1876; ibid .
3. Hornby minute, 22 Aug 1976; ibid.
4. WO/Admiralty conference decision, 30 Aug 1876; ibid.
5. Boys, DNO, minute, 7 Oct 1876; ibid.

and that it is the only Naval sea-going offensive torpedo that can be used for attack beyond a distance of 20 yards, the question of expense should become a secondary consideration.'[1] His faith was fully justified by the results of the trials of Whitehead's new torpedoes, which in the opinion of the British observers Captains Singer and Fisher, fully justified all the inventor's claims.[2] Within five days of receiving this report, an order was placed for 200 of these 20 knot torpedoes, but too late to cancel the order for 300 obsolete weapons already given to Woolwich.[3] Whitehead had therefore made the first major improvement in torpedo design and had sold it to an unwilling Admiralty by the sheer merit of the design. Clearly those officers with the closest experience of his work had the greatest trust in him; equally clearly there was a tendency in Whitehall to favour Woolwich because of cheapness, an argument in fact of doubtful validity. This was to be the cause of much trouble later. In the meantime, Whitehead, by this first improvement, had established himself as the leading manufacturing supplier of his own brand goods, to the greatest potential market for naval materiel in the world.

The remainder of the 1870s and 1880s was a period of gradual but undramatic improvement. By incorporating the new Brotherhood engine, a product of the Peterborough engineering firm, Whitehead improved the speed of the new torpedoes to 23.4 knots for 600 feet

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1. Arthur to Admiralty, 15 Sept 1876: ibid.
2. Singer and Fisher report, 20 Nov 1876; ibid.
3. Admiralty telegram to Whitehead, 25 Nov 1876; ibid.

and 19.2 knots for 1800 feet. Contemporaneously, Woolwich introduced a propulsion system of twin screws working in opposite directions, giving greater accuracy. By 1880, therefore, the torpedo was a weapon of considerable powers,[1] though not nearly as formidable as some of its advocates claimed.

Fiume models maintained their superiority in every respect except sturdiness of construction.[2] Whitehead's Mark III torpedo, for instance, so impressed Commanders A.K. Wilson and W.H. May[3] that four were ordered for experimental purposes in 1881. Comparative trials on the Woolwich canal, however, appeared not to substantiate the claimed 17% superiority in speed over other torpedoes[4] and Captain Gordon of Vernon was, in view of the conflicting evidence, unable to recommend adoption of the new weapon. Tests at Port Said by Wilson resolved the issue by showing that the Woolwich results were 'entirely delusive'. Whereas the Woolwich claim for the RL MK II was a speed of 22.49 knots, Wilson registered less than 20 knots.[5] The fault lay in the Woolwich canal. Not only was it less than the 600 yards over which the tests should have been made, but it was also too shallow at one end to employ the whole of its inadequate length, and contained

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1. Peter Bethel 'Development of the Torpedo'. Printed pamphlet 1946, Naval Library.
2. Annual report of H.M.S. Vernon (hereinafter cited as Vernon) 1881; ADM 189/1.
3. May and Wilson report, 12 Aug 1881; ibid.
   Admiral Sir William Henry May (1849-1930) On staff of Vernon 1877-80. Captain H.M.S. Polyphemus 1881-84. Naval attache service 1890-92. ADT 1894-95. Captain H.M.S. Excellent 1897-1901, Controller and Third Naval Lord, 1901-05. C-in-C Atlantic Fleet, 1905-07. C-in-C Home Fleet 1909-11.
4. Vernon 1881; ADM 189/1.
5. Wilson report, 16 Nov 1882. Vernon 1882; ADM 189/2.

fresh rather than salt water.[1]

With such a handicap at their factory of origin, it was small wonder that Woolwich designs remained consistently inferior. Only in an improved depth-control system were they better. This, however, reflected on no organisational or institutional superiority, but on the personal inspiration of Lieutenant E.P. Gallwey, a member of the Vernon staff.[2] Wilson and Fisher, the two most experienced torpedoists in the Navy, preferred Whitehead's work. 'Mr Whitehead has always been ahead of us, is now ahead of us, and always will be ahead of us,; his torpedoes go faster than ours and are more accurate ... every advance has come from him.'[3]

Despite this, the Admiralty assumed that Woolwich would soon hold a monopoly of torpedo propulsion. In view of Whitehead's record and the opinion of the experts, this was an astonishing attitude. Nevertheless, this policy, conceived in the 1870s[4] had become an article of faith by the 1880s and was to have serious consequences in the 1890s.

By late 1884, however, circumstances were forcing a re-consideration. Woolwich's earlier claims for an annual production rate of 300 torpedoes had evidently been over-optimistic, for there was then an estimated shortfall in Naval stocks of some 600.[5] In the atmosphere of crisis which followed the revelations of the Pall Mall

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1. Vernon 1885; ADM 189/5.
2. Vernon 1882; ADM 189/2.
3. Fisher memorandum to Admiralty, 22 Mar 1882; ADM 116/224.
4. See p. 16 . Also Hood minute 24 Feb 1879; ADM 1/6498.
5. Captain J.O. Hopkins, DNO, minute 29 Oct 1884: ADM 116/244.

Gazette series of articles on 'The Truth about the Navy' in September 1884 such an inadequacy was a serious matter.[1] When Thorneycroft's and Armstrong's applied to manufacture torpedoes, therefore, their reception was not unfavourable. Whitehead, too, suggested setting up a second factory in England.[2] The new additional Civil Lord, George Rendel, led the change of opinion by urging the necessity of increasing the extent and variety of the sources of supply, rather than concentrating on actual stocks of torpedoes or relying too heavily on foreign sources of supply.[3] Being closely involved with Armstrong's, he had a certain interest in this policy, but its wisdom was nevertheless patent. Reliance on Woolwich had not, after all been a success. Eventually, Key, now First Naval Lord, made the momentous decision. 'The time has arrived when the provision of torpedoes should be entrusted to the Admiralty'.[4]

Complications followed in December 1884, however, when Thorneycroft's asked for the release of technical data concerning the torpedo[5]; Whitehead and Woolwich were the sole repositories of the 'secret' of the torpedo, for the inventor had sold his secret to the government. Was the government legally entitled to release it to a private firm? Astonishingly, not until March 1885 was it suggested that legal advice be sought.[6] In fact the answer was simple.

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1. For the Pall Mall Gazette episode see A.J. Murder, Anatomy of British Sea Power, (London: Frank Cass, 1964) 120-123.
2. Thorneycroft's to Admiralty 11 Oct 1884; Armstrong's to Admiralty, 26 Nov 1884; Whitehead to Admiralty, 13 Oct 1884; ibid.
3. Rendel minute, 22 Oct 1884; also Hopkins minutes 13 Oct 1884, 15 Nov 1884 and 16 Dec 1884; ibid.
4. Key minute, 25 Oct 1884; ibid. 'The Admiralty' rather than the War Office via Woolwich.
5. Thorneycroft's to Admiralty, 13 Dec 1884; ibid.
6. Rendel minute, 17 Mar 1885; ibid.

The 1871 agreement stated clearly:

> The British government shall have full right to make or procure to be made in any place or places in the British Dominions any locomotive torpedoes on the principle of the said invention which they may require, and to their doing so the said firm of Luppis and Whitehead shall not nor shall any member of the said firm interpose any let or hindrance.[1]

By now, however, not only had six months elapsed between the Thorneycroft letter and the eventual decision to allow private manufacture, but a potential war with Russia was looming, at a time when the Admiralty was expecting a shortfall of 900 torpedoes by 1886-1887[2] and had no concrete proposals for increasing supplies. In fact, nothing had been done to follow up Key's instructions.

The First Lord, Northbrook, announced the allocation of torpedo orders in April. It was an interesting and bewildering contradiction of the arguments advanced in favour of diversifying and increasing the sources of supply. Thorneycroft's and Armstrong's received no orders, the Leeds engineering firm of Greenwood and Batley received an order for 20 per annum over five years, Woolwich an order for 200, Whitehead 220 and an undecided number from the Berlin firm of Schwartzkopf.[3] Only one British firm had benefited, and then only marginally, while the main diversification lay in the order from a foreign firm.

The latter point is only explicable in terms of panic at the

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1. Admiralty Solicitor minute, 30 Mar 1885; ibid.
2. Hopkins minute, 9 April 1885; ibid.
3. Northbrook minute, 4 April 1885; ibid.

prospect of war. Schwartzkopf had developed a torpedo with a non-corrosive phosphor-bronze air-vessel. In December 1884, an officer from Woolwich and a naval engineer were sent to watch its trials. Their report was sufficiently favourable for the Superintendent of the Royal Laboratory to indulge in a lengthy apologia for his establishment, in which he urged the superiority of his product and the continuation of his work.[1] He evidently felt that his department was, by implication, under attack. The DNO, Captain J.O. Hopkins, endorsed this defence with the popular argument that British manufacturers should make up any shortfall in supply.[2]

Schwartzkopf, however, was as persistent a salesman as Whitehead. In April 1885 he obtained an interview with the DNO, and offered 200 torpedoes for immediate delivery.[3] Hopkins demurred at this large number but suggested accepting 100.[4] The Controller, Vice-Admiral Brandreth, preferred to stick to Whitehead.[5] Key endorsed Hopkins' recommendations,[6] and this decision was confirmed in May 1885,[7] the first batch arriving at Chatham later that month.[8] This speed of despatch makes it clear that the torpedoes were in fact already made, Schwartzkopf had to sell in order to avoid a loss, and the Admiralty was a customer which needed them immediately. A quick sale was to the

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1. Superintendant, Royal Laboratory, remarks, 25 Oct 1884; ibid.
2. Hopkins minute, 16 Dec 1884; ibid.
3. Schwartzkopf to Admiralty, 14 April 1885; ADM 116/250.
4. Hopkins minute, 15 April 1885; ibid.
5. Brandreth minute, 16 April 1885; ibid.
6. Key minute, 17 April 1885; ibid.
7. Hopkins minute, 4 May 1885; ibid.
8. Hopkins minute, 22 May 1885; ibid.

mutual interest of both parties in April, when the pressures of possible war were on Britain, but not before. The well-established prejudice against foreign manufacture was thus overcome by the needs of war.

This is plausible enough, but raises other interesting points. If the needs of war were so pressing, why order only 100? One suspects that Hopkins merely halved the number first mentioned, which was itself only suggested because it accorded with the numbers Schwartzkopf happened to have ready for sale. It bore no relation to the 1300 torpedoes needed,[1] or to the anticipated shortfalls.[2] 100 was a large number for trial purposes. If the shortage was so acute and the German weapons were good enough, why not indeed order 200? Admiralty thinking was clearly unsystematic and entirely amateur. Personal guesswork replaced policy.

Nor was the sequel favourable. The torpedoes were not tested in Germany because of the pressure of work on Schwartzkopf. When the first batch of 50 arrived at Chatham, the Chief Engineer there was busy testing Woolwich torpedoes. Normally they were stringently tested before being accepted for the Service. Maximum inaccuracies allowed, for instance, were a lateral deviation of 20 feet either way, and a vertical deviation of 18 inches after a run of 2500 feet.[3] Now, however, matters were so urgent that Hopkins argued for their issue to the Service without waiting for them to be tested.[4] Brandreth disagreed,

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1. Hopkins minute, 29 Oct 1885; ibid.
2. See p. 42.
3. Admiralty specifications for torpedo acceptability tests; ADM 116/359.
4. Hopkins minute, 29 May 1885; ibid.

but Key supported the DNO.[1] Not until October 1885 was it noticed that anything was amiss. It was then that Woolwich informed Vernon and the Admiralty that the gun-cotton charge was only 37lb 4oz, compared with the 44lb specified. This deficiency had to be made up by lead ballasting in order to achieve reliable running.[2] The explanation was simple. Schwartzkopf weighed his powder wet, so that it gave a reduced weight when measured dry by Woolwich.[3] But nobody had noticed for three months. Evidently, neither Vernon nor the Fleet tested or practised with them in this time.

The episode reflects poorly on the Admiralty. Stocks had not been maintained, a deficiency had arisen, diversification intentions had come virtually to nought, another foreign supplier had been brought in, testing proccdures had been inadequate, and the Navy had been equipped with a weapon with faults which had gone unnoticed for three months. The weapons procurement system, amateurish and unsystematic as it was, resting entirely on the personal discretion of the DNO and his relations with the Board, had broken down under the strain of sudden pressure.

Although in 1880 the DNO had received an assistant to help with torpedo work, it was not until 1886 that the staff were appointed who could allow him to attempt all his work efficiently. On his appointment as DNO, Fisher established A.K. Wilson as his Assistant Director of

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1. Brandreth minute 28 May 1885, Key minute 30 May 1885; ibid.
2. Vernon to Admiralty, 1 Oct 1885; ibid.
3. Schwartzkopf to Admiralty, 17 Oct 1885; ibid.

Torpedoes (ADT), together with three assistants.[1] Wilson in effect dealt with all torpedo matters, and the appointment of an ADT was a major administrative step towards meeting the burden of the DNO's responsibilities. He was able to deal with torpedo questions more thoroughly than might otherwise have been the case, an advantage demonstrated by his examination of a claim by Greenwood and Batley to have developed an entirely aluminium-bronze torpedo. Woolwich had adopted bronze for many internal parts, but the Leeds firm claimed that in this new torpedo, with a type of bronze which was far lighter than that of Schwartzkopf, buoyancy and anti-corrosive power would be maintained at no cost to the explosive power of the weapon,[2] Fisher was enthusiastic,[3] but a practical investigation by Wilson ended the idea. Bronze was simply too soft.[4]

So far, development had been in the hands of Woolwich and the commercial companies, while Whitehead had in practice been responsible for virtually all improvements in torpedo design. Fisher set about rectifying this position by establishing a Torpedo Design Committee in July 1887. Superintended by Wilson, the Committee consisted of representatives from Vernon and Woolwich, and was to investigate and develop accordingly the most suitable torpedo for the Royal Navy.[5] For the first time, the British government was launching on a programme of 'research and development' of the torpedo.

The Committee investigated the effect on speed of different

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1. Navy List, 1886. Also F.E. Bradford, Life of Admiral of the Fleet Sir Arthur Knyvet Wilson (London: John Murray, 1923)107.
2. Greenwood and Batley to Admiralty, 25 Nov 1886; ADM 116/273.
3. Fisher minute, 17 Dec 1886; ibid.
4. Wilson to Fisher, 26 Aug 1887; ibid.
5. Admiralty to Wilson, 30 July 1887; ADM 116/303.

torpedo shapes, and the effect on accuracy of various forms and dispositions of weight. Experiments were conducted with the help of R.E. Froude, who had succeeded his father, the famous marine architect William Froude, as Director of the Admiralty experimental tank at Torquay. These indicated that a bluff-head increased a torpedo's speed by one knot, at the cost of a loss of stability, which could be rectified by properly adjusted ballast. Further experiments indicated that in a torpedo of unchanged size greater stability could be achieved by an increase in ballast; this, however, could be accomodated only if the air chamber were made smaller, and this in turn would involve a loss of speed of two knots.[1] The alternative was to increase the torpedo size.

Wilson submitted this report to Fisher, pointing out that he opposed the idea of a torpedo of larger diameter because this would raise problems of interchangeability, that the explosive charges were large enough for the moment, and that the emphasis on accuracy rather than speed was a desirable reversal of policy. Fisher concurred. It was nevertheless proposed both to increase speed and maintain stability,[2] a suggestion which raised many problems. Speed required a large air-chamber, stability required more space for ballast, and yet the possibility of increasing torpedo size to provide room for both was specifically excluded.

Two possibilities were open. Either the air pressure could be increased, or the size of the explosive charge could be decreased. The latter was excluded on the grounds that other countries were

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1. TDC report, 1 Mar 1888; ibid.
2. Wilson to Fisher, 12 Mar 1888; Fisher minute, 23 Mar 1888; ibid.

increasing the size of their charges. The former was excluded by widespread apprehension about the effect of a shell hit on a heavily charged torpedo air chamber. The justification for this fear was in fact very doubtful, being based on some experiments in which guns were fired at torpedoes from a mere 25 feet![1] Nevertheless, it was suggested that an increased torpedo length (rather than diameter) would accomodate more ballast and a bigger air chamber, and thereby avoid the necessity of increasing air pressure.[2] Accordingly, the Navy's entire torpedo stock was lengthened, at a cost of £8 each.[3]

This first systematic exercise in torpedo research reflects creditably on the Service. The officers involved, who had acquired their knowledge in Vernon both by learning and by teaching their successors, had developed a degree of expertise which enabled them to conduct sound empirical work with favourable results. When the resources were deployed and the concentrated effort made, the results were as technically sound as those of Whitehead, a favourable commentary on the standards reached by those virtually self-taught 'engineer' officers. This progress was, however, almost immediately overshadowed by Whitehead's second dramatic improvement.

In March 1889 Whitehead informed the Admiralty that he had developed an improved propulsion in the form of a lighter, handier and more effective air compressor, and quoted his prices, as usual reduced for a bulk offer.[4] Wilson, now Captain of Vernon, had been

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1. Wilson report, 28 Dec 1888; ibid.
2. Wilson report, 5 June 1888, 15 June 1888; ibid.
3. Fisher minute, 9 Nov 1888; ibid.
4. Whitehead to Admiralty, 23 Mar 1889; ADM 116/311.

badly impressed by the poor workmanship of recent torpedoes, which he ascribed to the piece-work system operated at Fiume.[1] On the basis of this opinion, the new ADT, Captain Jeffreys, declined Whitehead's offer, but took the precaution of sending Captain E.P. Gallwey to see for himself.[2] Before this officer reached Fiume, Whitehead made a new claim. His torpedo was now able to travel at 32 knots for 400 metres, and at 27 knots for 1000 metres. This invention he offered to the Admiralty at a royalty of £50 per air chamber.[3]

Jeffreys was impressed. 'This charge of 132lb with high speed and small length is a considerable advance.'[4] He ordered 150 immediately, leaving Gallwey merely to settle the details.[5] This was a bold and daring step which demonstrated great faith in Whitehead. Could it be that this faith was gained while he was with Vernon in the early 1880s, imbibing torpedoist attitudes as well as technical skills? Wilson, meanwhile was appalled at the thought of all his committee's work being cast aside, particularly when this new diameter torpedo would end the interchangeability of torpedoes throughout the Fleet, towards which he had been working. The resultant conclusion could be justified only by the 'most decided superiority in new design, such as would lead us to anticipate its substitution for the old design within a measurable time. So far from this being the case, the only advantage we know the 18in torpedo to possess is increased speed, which is only an advantage in so far that it reduces the errors due to a wrong estimate of the enemy's speed'. There was nothing to

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1. Wilson report, 5 April 1889; ibid.
2. Jeffreys minutes, 12 April 1889, 3 June 1889; ibid.
3. Whitehead to Admiralty, 19 July 1889; ibid.
4. Jeffreys minute, 25 July 1889; ibid.
5. Jeffreys minute, 23 Sept 1889: ibid.

be gained from increasing the charge, and the enlarged size of the weapons would multiply the difficulties and dangers of handling and firing them. Finally, the proposal to buy before testing the torpedoes was 'entirely indefensible and quite as absurd as it would be for the Great Northern Railway Company to supplement their rolling stock with a lot of broad gauge carriages'.[1]

Jeffreys was unrepentant, arguing that preoccupation with uniformity would obstruct progress, and that 14in torpedoes had been introduced successfully in 1876, in addition to the 16in models then in use.[2] In October 1889, Gallwey's report on the new weapons supported Jeffreys. The new 18in was 'the best torpedo I have ever seen'. At 800 metres the maximum lateral deviation was a mere 8 metres, the torpedo had reached 33 knots for 800 metres and 29 knots for 800 metres, and carried a charge of 100lb.[3] The First Naval Lord, Hood, was satisfied. The confusion resulting from the introduction of the new torpedo was as nothing compared to its speed, power and accuracy.[4]

Like the 14in, however, it rendered obsolete all other torpedoes, and raised the awkward problems of interchangeability suggested by Wilson. Although suitable for above-water use, the 18in could not be used underwater without the development of a special discharge system. Unless this was developed, however, ships would have to use two separate types of torpedo, the old 14in for underwater use, and the new 18in for above-water. Jeffreys was quite prepared to face

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1. Wilson to Jeffreys, 5 Aug 1889; ibid.
2. Jeffreys minute, 7 Sept 1889; ibid.
3. Gallwey report, 12 Oct 1889; ibid.
4. Hood minute, 23 Oct 1889; ibid.

the implications of his decision and ordered the development of a new 18in torpedo and tube for underwater use.[1]

Whitehead's new improvement consolidated his position as a leading torpedo manufacturer which had been threatened by thoughts of British manufacturing development and pre-occupation with Woolwich. His sales success owed much to the enthusiasm of Jeffreys, who had acted with a speed which bordered on the rash, while Wilson of Vernon was all scepticism. It was an interesting reversal of the roles of Whitehall and Vernon, and quite contrary to all trends revealed so far. This suggests two points of significance. Firstly the importance of personality, which Jeffreys was to demonstrate again later; and secondly, the very real difficulties of persuading an institution to accept a major change. The institution resisted not simply as a psychological reaction, but because it involved substantial material change at considerable expense for doubtful benefits. It was therefore right that Wilson and Vernon should be sceptical unless and until they were persuaded that the change was for very good reasons.

Such was Whitehead's position at the beginning of the 1890s, that he proposed to build a new factory at Portland, capable of producing 100-300 torpedoes annually by late 1892.[2] Interestingly, he picked and persuaded Gallwey to become superintendent of this factory,[3] an eloquent testimony to the abilities of this officer, a

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1. Jeffreys minutes, 13 Nov 1889; 19 Nov 1889; ibid.
2. Whitehead letter, 22 Oct 1890; ADM 116/359.
3. W.H. May memorandum, 25 June 1894; ADM 116/412.

favourable reflection on the rest of the torpedo service and a commentary on the nature of the expertise of the Navy's 'specialists'. The First Lord, Lord George Hamilton, commented: 'I shall be sorry to lose Gallwey, as he is a very reliable man, but undoubtedly it will be much to our advantage that a torpedo factory should be established at Portland, so we must let him go.'[1]

Both Hamilton and the Controller, now Rear-Admiral Fisher, welcomed Whitehead's move. Hamilton had no faith in government manufacture of arms, claiming that it was futile to turn a military officer into a factory manager for a few years.[2] He argued for competition to avoid stagnation.[3] Fisher retained his old respect for Whitehead, pointing out that the expert inventor would have better facilities in the salt water near the Portsmouth naval base, than Greenwood and Batley.[4] But neither Hamilton, nor the Civil Lord, Forward, would contemplate the unemployment which would be caused by terminating contracts for the Leeds firm, which therefore continued to receive orders.[5]

Hamilton's 'competition' philosophy, however, departed with him, while the members of the Torpedo Design Committee were less enamoured of Whitehead's work than the loyal Fisher. For instance, Whitehead's design for a short 18in torpedo was treated in a positively cavalier fashion. The specifications were for a maximum weight of 858lb, so

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1. Lord George Hamilton to Admiral Sir R. Vezey Hamilton, 16 Oct 1890; Vezey Hamilton Mss, VHM/9.
2. But this was precisely what the whole system of Vernon and Excellent specialisation tended to do, as Gallwey's career and Wilson's expertise demonstrated. See Chapter 10 pp. 283-4, 292-4.
3. Hamilton memorandum, nd; Vezey Hamilton Mss VHM/10 .
4. Fisher minute, 4 Nov 1890; ADM 116/359.
5. Hamilton and Forward minutes, Nov 1890; ibid .

that Whitehead's 888lb model was rejected as overweight. Yet another model of 795lb was also rejected as 'unnecessarily small'.[1]

Fisher was no longer concerned with minor design details, so that Whitehead was without friends. He faced two problems. Firstly, he was now competing with weapons produced by the Navy, which involved touching on some delicate sensitivities in the torpedo service. Secondly, the vogue for uniformity and regularity in torpedo supplies was again popular. During the early 1890s, Whitehead met a consistent effort to eliminate his designs. His position, (and therefore livelihood) as a manufacturer was dependent on his ability to produce new weapons, like the two types in 1876 and 1889. If he were reduced to manufacturing Woolwich models, he became a mere manufacturer who could lose his contracts at any time. Whitehead therefore fought the Admiralty at every step. It was, however, in vain.

Whitehead's Mk V 14in model was produced for trials in July 1893, and preliminary running by Vernon gave satisfactory results, with a speed of 27.47 knots for 600 yards.[2] Two of them were bought for comparative trials with the Woolwich (RGF)Mk IX 14in, a new model produced under strong pressure from the ADT, Captain W.H. May[3]. In December the TDC[4] carried out tests which led them to recommend the faster, simpler RGF model.[5] May, however, rejected these findings.

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1. Vernon 1891; ADM 189/11.
2. Vernon to Admiralty, 7 July 1893; ADM 116/403.
3. May minute, 15 Jan 1894; ibid.
4. Now consisting of Captain W.H. Hall of Vernon, the Staff Engineer of the Torpedo Store, and the Superintendent of the Royal Gun Factory, to which manufacture had been transferred from the laboratory. See Vernon 1890; ADM 189/10.
5. TDC report, 29 Dec 1893; ADM 116/403.

Using the Committee's own records, he pointed out that the torpedo was unsteady and its speed uneven. 'I cannot recommend adoption of a torpedo until it has been tried complete in all its details, and satisfactorily reported on, so as to ensure as far as possible that no alterations will be necessary when it goes afloat.' Lieutenant H.B. Jackson[1] was added to the Committee, which was told to improve the RGF Mk IX.[2] After overhauling and stripping the torpedo, then testing it under stringent weather conditions, the committee claimed it was satisfactory in May 1894. This time the report was accepted.[3]

Whitehead did not make the same apparent progress and this gave encouragement to the TDC. In February 1894, it drew up specifications for 14in torpedoes, towards which Whitehead was to work.[4] This was a major shift of policy. Instead of waiting for manufacturers to produce their weapons and improving on current models, the Navy took the initiative in torpedo design. On the other hand, it was conspicuously not the policy of cooperation which alone could have brought the best results. Indeed, Whitehead's ideas were specifically precluded by presenting him with these specifications.

In the event, he rejected the Admiralty specifications, on the

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1. Admiral Sir Henry Bradwardine Jackson (1855-1929). The navy's most outstanding technical expert. Qualified in Vernon and then member of staff 1882-5. Naval attache France, 1897-99, ADT 1902-04. Captain Vernon 1904. Controller and Third Sea Lord 1905-08. Director of RN War College, Portsmouth, 1911-13. Chief of War Staff, 1913-14. First Sea Lord, 1915-16.
2. May minute, 15 Jan 1894, May minute, 7 June 1894; ibid.
3. TDC report, 23 May 1894, May minute, 7 June 1894; ibid.
4. TDC to Whitehead, 9 Feb 1894; ADM 116/412.

grounds that they would produce unsatisfactory torpedoes.[1] The TDC refused to accept this, however,[2] and by the time Whitehead agreed to produce a suitable torpedo, May had lost patience with him. Whitehead was ordered to produce the RGF Mk IX type. By this step, the ADT hoped to simplify production by merely having one standard 14in model, which it was believed, was far in advance of other countries' designs.[3]

A similar process of uniformity was taking place with the 18in torpedo. In late 1893, Whitehead's Mk II 18in was compared with the RGF Mk II 18in, in an exhaustive series of range and practice trials. The TDC reported that there was very little to choose between the two types, although the RGF model was slightly tougher and simpler. The naval members of the committee favoured waiting for Whitehead's improvements,[4] in view of his past successes. The RGF superintendent, however, argued against delay, claiming that his factory's weapon was quite good enough.[5]

May agreed with the latter. Speed was the essence, while adoption of the RGF 14in and 18in torpedoes would guarantee uniformity.[6] Whitehead was given a contract for 60 18in RGF models, and his attempt to incorporate his own engines was rejected outright.[7] His pre-eminent position was lost and he was bargaining from a position

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1. TDC minute, 19 Sept 1894; ibid.
2. ibid.
3. May minute, 28 Sept 1894; ibid.
4. TDC report, 15 Dec 1894;ibid.
5. Superintendent RGF minute, 19 Dec 1894; ibid.
6. May minute, 8 Jan 1895; ibid.
7. Admiralty to Whitehead, 5 Feb 1895, 9 Jan 1895, ibid.

of weakness. The triumph of 1889 was short-lived.

In fact, these decisions were disastrously wrong. The first hint of trouble came in February 1895, when the Director-General of the Ordnance Factory reported that the TDC had pressed upon him certain alterations in the design of the 1894-5 batch of 18in torpedoes, to conform to the new specifications. As a result of alterations made to reach the TDC specifications, the torpedoes had now actually developed a small negative buoyancy. In order to restore buoyancy and stability, ballast adjustments were necessary, with a consequently shortened balance chamber and a reduced charge.[1] In other words, the TDC had authorised alterations to the torpedoes, which affected them so adversely that further alterations were needed. £808 had to be spent to rectify the error, and the torpedoes were not ready in time to meet the urgent demands of the Fleet.[2]

Developments with the Mk IX 14in displayed an even more glaring error. On being tanked in March 1895, the first two torpedoes were found to be faulty. The encasing head used in the experiments was not the same weight and metacentric height as the one with which the torpedo had been tanked.[3] The torpedo was consequently completely useless.[4]

The new ADT, Captain Bourke, was scathing:

> I consider with reference to the Mk IX that the TDC and Woolwich are to blame for this failure.

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1. DGOF to DNO 9 Feb, 2 Mar, 26 Mar, 1895; ibid.
2. Bourke report 15 June 1895; ibid.
3. 'Tanked' meaning tested ready for operational use.
4. Bourke report, 15 June 1885; ADM 116/412.

> The Committee, having an entirely free hand, recommended a torpedo to carry a warhead which it appears had never been fitted and tried on the experimental torpedo; and the Woolwich authorities who were represented on this committee were even more to blame for having accepted proposals, which as designers of the torpedo, they ought to have known through their calculations, were not possible to carry out.

Again the charge had to be reduced to make the torpedo serviceable.[1]

There was no choice but to spend considerable sums of money to make the weapons serviceable.[2] The First Naval Lord, Admiral Sir Frederick Richards,[3] demanded an enquiry.[4] This was made by Bourke, who illuminated the mistakes made. He recommended the end of the system of a virtually independent TDC, and suggested that all communications on torpedo matters should go through the DNO. A representative at Woolwich should be directly responsible to the DNO for ensuring that stringent specifications were observed.[5]

The Civil Lord, Kay-Shuttleworth, was sceptical of the value of these proposals, for he observed that the main fault lay in the failure of Woolwich and the TDC 'to discharge efficiently the very important duties entrusted to them'.[6] His point was sound. An additional check by a representative at the factory <u>might</u> ensure that there were no more appalling mistakes like the recommendation of a different warhead on a new torpedo, but the members of the TDC

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1. <u>ibid</u> .
2. Captain Kane, DNO, minute, 3 May 1895, Fisher minute 3 May 1895; <u>ibid</u> .
3. Admiral of the Fleet Sir Frederick Richards (1823-1912), C-in-C China 1890-2, First Naval Lord 1893-9.
4. Richards minute 6 May 1895; <u>ibid</u> .
5. Bourke report 15 June 1885; <u>ibid</u> .
6. Kay-Shuttleworth minute, 18 June 1895; <u>ibid</u>.

and those involved in manufacturing the torpedo were already the most able men in the torpedo service. The Captain of Vernon, the RGF Superintendent, the Portsmouth Torpedo Store Engineer and Jackson were the experts, and if these could botch their work, what hope was there for the suggested representative? Sending correspondence through the DNO was of value only if he were more expert than the Committee, yet the whole point of the committee system was to concentrate all available expertise.

Although much happened about which the DNO's department was ignorant, the main lesson from this exercise in delegated responsibility is the thorough lack of mastery of their subject by the technical experts, a remarkable contrast to the achievements of Fisher, Wilson and Gallwey in the 1870s. There is one word in mitigation. The TDC had suggested delaying the introduction of the RGF 18in until Whitehead's designs were complete, but had been over-ruled by May's desire for uniformity.[1] For his part, the ADT could not delay supplies of torpedoes unduly. Nevertheless, the basic cause of these disasters lay in the desire for uniformity of design, and the end of confusion and expense caused by new types. This policy, however, assumed the premise that a finite point could be reached in torpedo development, and such a premise is quite wrong in any matters of technical advance. Uniformity, tidiness, the baneful influence of Woolwich and this totally false premise, dogged torpedo development from the purchase of the first weapon to the logical conclusion of a complete disaster. Whitehead had again been vindicated, but this time his suggestions had been ignored. As in the 1870s, the Admiralty paid the price.

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1. See p. 55.

Whitehead felt justifiably aggrieved. His design had been rejected for failing to meet faulty Admiralty specifications. Equally, Naval opinion was embarrassed by its errors. Captain Sir Baldwin Walker, who had been Captain of Vernon while the TDC was making its mistakes of 1894-5, quickly rebuffed a complaint by Whitehead that stringent trial conditions were unfair.[1] Nor did Woolwich escape criticism, when the DNO, Captain H.C. Kane, testily asserted that the resident Admiralty overseer at the RGF in no way relieved that institution of responsibility for quality of material and workmanship.[2] However, despite the obvious fault of the naval officers involved, nonesuffered. May, Walker and Jackson all reached flag rank. Indeed, having participated in one failure, Walker was appointed ADT, in which capacity his handling of the next major improvement again left much to be desired.

Nevertheless, Whitehead was no longer able to produce his own torpedoes and stood in imminent danger of losing even his position as a supplier of Woolwich weapons. He had no friends in Whitehall, and the skill which had previously vindicated his work had now merely annoyed those whose cooperation he most needed there. As before, he was to re-establish his position by promoting another major improvement in the torpedo.

In July 1896 reports reached London of the trials at Fiume of the Obry-Petrovich gyroscope. This device, described as 'a clock-

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1. Whitehead to Admiralty 23 July 1895, Walker minute, 29 July 1895; ADM 116/412.
2. Kane minute, 20 Nov 1895, ADM 116/403.

work gyroscope working in connection with a servo-motor activating two vertical rudders' reduced torpedo deflection almost to nothing. For instance, torpedoes fired from a TB at 25 knots suffered no deflection over a distance of 800 yards.[1] Captain Durnford of Vernon suggested sending Captain Robinson of the torpedo depot ship, H.M.S. Vulcan, to investigate. 'Whilst on the one hand it is not desired to complicate by introducing mechanical appliances of doubtful benefit, still we cannot afford to neglect an opportunity of ascertaining the practical use of this invention, which may turn out to be extremely valuable.' This device was reportedly capable of ensuring accuracy over a distance of 2000 yards, three times the range at which torpedoes were customarily exercised.[2]

Despite this departmental enthusiasm, it was as usual Whitehead who made the first approach, with his customary eulogy of the new device:

> /The apparatus/ .... corrects the course of the torpedo just as certainly as the diving gear regulates the depth line, and ... with an apparatus properly arranged, good shooting at the greatest distances (we have fired at as much as 2300 yards) can be easily ensured. Moreover, the position of the tube in the vertical plane at the moment of firing is quite immaterial the ship may roll or pitch, or may even be turning, the impulse may be high or low, it is not necessary that the torpedo should possess great stability, and it makes no difference however much the torpedo may be heeled on striking the water. Admitted that this apparatus is of the greatest importance to the torpedo itself, it has a scarcely less value in connexion with the launching gears employed: for instance, in broadside submerged fire although it is easy to ensure the torpedo being fired without damage, this apparatus is absolutely essential in order that the torpedo so fired may keep its proper direction.

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1. Naval attache report, 22 July 1896; ADM 116/519.
2. Durnford minute, 14 Aug 1896; ibid.

Whitehead was offering the device for £50 each, or a lump sum of £20,000.[1] Walker thought the price excessive, but 'in view of the great importance of this invention' was willing for trials to be made.[2]

Robinson's report was received in November 1896. Although the new apparatus was 'no doubt still somewhat in the experimental stage', he urged that some should be bought,[3] while Captain Drury of H.M.S. Hood claimed that 'sufficient evidence has been obtained by him to warrant exhaustive and immediate trials on our part of this most important invention'.[4] Durnford recognised that the longer and more certain ranges attainable by the torpedo would help the weaker nations, while Britain's lead in torpedo development would now be annulled. Nevertheless, the gyroscope should be adopted and developed.[5] Walker, still smarting from his mistakes on the TDC, insisted on a 'thorough and practical test'.[6]

It was at this point that Whitehead attempted to recover his market in 'brand' torpedoes. He attacked the RGF specifications, to which he was obliged to work, and which resulted in weak shells, lack of buoyancy, weak joints and engines, and a dangerous reducer. 'Not one [of the 14in torpedoes] it would be prudent to fire even one shot with in war time until they have been taken to pieces and

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1. Whitehead to Admiralty, 7 Sept 1896, 24 Oct 1896; ibid.
2. Walker minute, 7 Sept 1896, 3 Nov 1896; ibid.
3. Robinson report, 23 Nov 1896; ibid.
4. Drury report, 24 Nov 1896; ibid.
5. Durnford minute, 17 Dec 1896; ibid.
6. Walker minute, 22 Dec 1896; ibid.

strengthened,'[1] an assertion with which Durnford agreed.[2] Whitehead refused to make any more RGF 14in, but suggested his own torpedoes, complete with gyroscope.[3]

This time Whitehead's criticisms could not be brushed aside, for his gyroscope was an unanswerable argument. This did not increase his popularity, however. 'No man ever did his country a worse service. The millions which his invention has taxed his country up to the present would have built a large fleet ... he has made himself an indispensable nuisance ...' raged Richards.[4] This resentment of the weaponry which he was producing, did not, however, alter the fact that the Royal Navy would have to keep pace with the latest developments. It could not do otherwise, a fact which increased the bitterness felt in Whitehall at this diversion from more important arms.

Accordingly, the new device was tested at Weymouth under conditions of strict secrecy to ensure that no foreign power acquired the information sought by the Admiralty.[5] The results were impressive. Durnford reported: 'It was very striking to see the marvellous directive force it exerted, the oscillations each side of the centre line being particularly equal'. It would evidently be extremely useful, if it could withstand the buffetings of normal service life.[6]

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1. Whitehead to Admiralty, 15 Dec 1896; ibid.
2. Durnford minute, 2 Jan 1897; ibid.
3. Whitehead to Admiralty, 30 Jan 1897; ibid.
4. Richards minute, 11 Feb 1897; ibid.
5. Richards minute 16 Mar 1897; ibid.
6. Durnford report, 26 Mar 1897; ibid.

During the summer of 1897 Robinson carried out extensive tests, from which there emerged a 'very marked improvement in the accuracy of torpedoes', with deflection being virtually eliminated.[1] Despite the enthusiasm of Durnford and Robinson, however, Walker was sceptical, arguing that the Italians were having trouble with their gyroscopes, and that there was no indication that it could stand the strain of service in a TB. He preferred to wait for the stronger Woolwich gyroscope.[2] Jeffreys, who had returned as DNO, was this time not prepared to push his ADT.[3]

Durnford pressed strongly for full-scale Fleet trials, rather than neglect 'a most valuable improvement in torpedo design', which opened up the possibility of torpedo range exceeding gun range. Although success could be anticipated from the Woolwich trials, tests of the Whitehead brands should still continue, 'firstly, because it is very desirable that the two systems should be well compared, for, in a new departure of this kind it is all-important that we should start on the right principle, and secondly, because however undesirable it may be to be too precipitate in adopting new ideas, it is decidedly unwise to allow undue delay in the adoption of a new development of this nature, which is open to any nation who chooses to pay for it, and which raises their torpedo strength to a comparative superiority instead of a decided inferiority'.[4] Walker, however, was not to be moved. In March 1898, a full 18 months after the first reports, he minuted that there was no need for the Admiralty

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1. Robinson report, 20 Nov 1897; ibid.
2. Walker minute, 23 Nov 1897; ibid.
3. Jeffreys minute, 11 Jan 1898; ibid.
4. Durnford report, 26 Dec 1897; ibid.

to commit itself.[1]

Jeffreys, however, was prepared to tolerate no more delay. While Walker preferred to wait for the Woolwich models,[2] on which he pinned great hope, Jeffreys urged comparative trial tests of the Woolwich and Whitehead types. He argued that preference for Woolwich had resulted in earlier misfortunes, and that fair competition was the best solution. When production difficulties delayed the appearance of the Woolwich gyroscopes, he ordered trials of the 18in Whitehead model to proceed alone.[3] By the summer of 1898 there could no longer be any doubt that the Woolwich model was demonstrably a failure,[4] while the Whitehead was equally demonstrably a success.[5]

The final decision was taken by another ADT, Captain George Egerton, who took office in September 1898. He noted that no less than 337 tyroscopes had already been sold, and 477 were on order to foreign governments. All the evidence favoured the device. Further improvements were likely, 'but the policy of waiting until the instrument has arrived at a perfect stage in its development, would leave us behind other nations, and it is not recommended'. At last, after two years of prevarication by Walker, the decision was made. 85 Woolwich, 100 Weymouth (i.e. Whitehead) and 50 Greenwood and Batley 18in torpedoes, together with 130 Woolwich and 100 Weymouth 14in torpedoes, were ordered. Whitehead was to supply the gyroscopes

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1. Walker minute, 3 Mar 1898; ibid.
2. Walker minute, 18 Mar 1898; ibid.
3. Jeffreys minute, 19 Mar 1898; ibid.
4. Durnford report, 18 July 1898; 27 Aug 1898; ibid.
5. Report by Captain White of H.M.S. Vulcan, 24 June 1898; ibid.

for the Woolwich torpedoes.[1] He had regained his position, and the Admiralty had acquired the device necessary to maintain the quality of their weapons. The cost, in terms of money and the complications of duplication, was considerable, but technical progress and its associated expense could not be ignored. This painful lesson was now being driven home for the third time.

The whole process of torpedo development was marked by a familiar pattern. The inventor, Whitehead, devised the weapon and sold it to an Admiralty unwilling to allow itself to slip behind in the arms race, yet seldom eager to indulge in new expenditure. The new device was given to Woolwich, where matters rested until Whitehead produced his next technical breakthrough. Not until the formation of the TDC was any attempt made to develop torpedo designs in this country. Woolwich showed little flair, while Vernon was primarily an instructional vessel where any new developments resulted from the spontaneous inspiration of off-duty staff.[2] The DNO and ADT were increasingly occupied with floods of paper-work.[3] Only the committee was intended to work out new developments, and its effectiveness was limited by the sporadic and part-time nature of its meetings,[4] while the over-riding concern for uniformity vitiated much of its efforts. Cooperation with private industry was virtually non-existent.

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1. Egerton minute, 11 Oct 1898; ibid.
2. See p. 289.
3. Richmond to Fisher, Mar 1905; Richmond Mss, RIC 12/4.
4. All members held other full time appointments. May minute, 15 Jan 1894, ADM 116/403.

The result was that weapons were produced with no coherent tactical purposes, their functions being ascribed to them after production. Technical developments completely dominated tactical needs and dictated the supply of equipment. Obviously, in any research and development programme it is a somewhat unreal exercise to differentiate between technical and tactical needs; each affects the other. Nevertheless, the result of this system was that each new development had to be treated very much on an ad hoc basis, and fitted into the tactical framework as well as possible. The preoccupation of torpedo officers was however very much that of developing each new technical advance, almost as an end in itself, for they were technical rather than tactical experts.[1] As a result, the weapons dominated tactics, the means dictated the ends, and very little sustained effort was made to coordinate the two. The TDC for instance was concerned entirely with technical details. Only once before the war, in 1904-5, was an attempt made to coordinate technical development with tactical thought, and consideration given, when developing the weapon, to the uses to which it might be put.

This happened when the TDC was recreated in the form of Captains Bethel,[2] Egerton and Bacon,[3] the RGF Superintendent and a naval engineer, this time with a twofold task. Its main task was to increase the speed of the 18in torpedo, but it also faced a tactical problem. Before the gyroscope, torpedoes were fired at maximum speed and at the maximum range which they were capable of

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1. Also pp. 292-4.
2. Later Admiral the Hon Sir Alexander E. Bethel.
3. Vice Admiral Sir Reginald H Bacon (1863-1947). Joined Service 1877, Inspecting Captain Submarines 1900-04, Naval Assistant to Fisher as First Sea Lord 1904-5, CO. H.M.S. Dreadnought 1905-06, DNO and Torps, 1907-09, Managing Director of Coventry Ordnance Works 1909-15, having left the Service, recalled 1915 and served as Senior Naval Officer Dover until 1917.

covering accurately. Now, accuracy could be guaranteed over 2-3000 yards. Given the limitations of the engines, a choice was necessary. Torpedoes could be propelled either at low speed over long distances, or at high speed over short distances. A choice in torpedo range had to be made.[1]

Opinions were canvassed in the Fleet, but most Flag Officers had no opinions,[2] a reflection on their professional concern. The Committee therefore had to resolve the question itself, and neither the engineer nor the army officer were suited to this purpose. The naval officers were however in no better a position, for Vernon was not a tactical school, nor were its officers tactical experts, although they were certainly expected to pronounce on such matters. While the Fleet remained silent technical experts therefore resolved tactical problems, although their eventual conclusions were in fact sound enough. Destroyers and submarines were to have fast short-range weapons for close attack, while battle-ships were to have slow long-range torpedoes for 'browning'[3] the enemy.[4]

The committee then worked on its primary purpose. Minor alterations increased speed by only one knot, but it was a chance observation which presaged a major breakthrough. It was noted that the torpedo's speed increased in warm water, particularly when a greater proportion of the air-pipe was exposed to the water. From

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1. Minutes of TDC meeting, 15 Feb 1904; ADM 1/7759.
2. Richmond to Fisher, Mar 1905; Richmond Mss, RIC 12/4.
3. i.e. firing a spread of torpedo in the general direction of an enemy force occupying a fairly large area, in the hope that at least one hit might be made.
4. TDC report, 29 Aug 1904; ADM 1/7759.

this sprang the concept of increasing the speed of the torpedo by artificially heating the air which propelled it. This was the fourth major advance in torpedo design, and the first which owed nothing to Whitehead. Trials began of 'Thermit' heating material, a mixture of finely divided aluminium and oxide of iron which decomposed into iron oxide and heat, producing neither gas nor smoke, but a temperature of 5000°F. In the meantime, the only course was to increase air pressure,[1] since air vessel capacity could not be increased because of problems of cost, weight and handling difficulties.[2] Even this however did not bring Woolwich designs up to the standard of Whitehead's torpedoes.

Thermit was replaced by the petrol air heater in 1905, and preliminary experiments increased speed by six knots. Air thus heated expanded, so that the pressure generated was increased, without either the size of the air chamber or the level of air pressure in the chamber being increased.[3] Various other devices were tried in 1905, all encouraging,[4] and by 1908 the common fitting for all R.N. torpedoes was the RGF heater, which gave speeds of 35.25 knots over 4000 yards.

Just as Whitehead played no part in the origins of 'heating' so he played no part in its development. He had died in 1904, and the survivors of the firm's leadership had now sold out to Vickers and Armstrong. who had been persuaded by the Admiralty to buy the Weymouth Company in order to keep the works and firm in British hands.[5]

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1. ibid.
2. Vernon 1905; ADM 189/25.
3. ibid.
4. Vernon 1906; ADM 189/26.
5. J.D. Scott, Vickers - A History (London: Weidenfeld and Nicolson, 1962) pp 83-84.

The torpedo had been a potentially deadly weapon for Fleet action in the 1870s and 1880s, because its limited range was suitable for the melee of ramming and broadside-to-broadside actions which were expected at that time. In the 1890s, the increasing range at which battles were expected to be conducted rendered the torpedo an occasional weapon, with only a negligible effect on tactics. The gyroscope increased its range, but to no more than that at which battles were now expected to be fought. Tactical exercises took care to keep battleships out of torpedo range, but this presented few problems. The heater merely maintained the position, for gun range increased to keep ahead of torpedo range. Not until the immediate pre-war years did the latter compare with the former, as it had done in the 1870s. Even when the problem of range was overcome, however, the torpedo still suffered from its nature as a 'one-blow' weapon. It lacked the velocity of the gun-shell, and could not be fired in comparable numbers. Despite its undoubted power, therefore, the problems of delivering this power effectively relegated the torpedo to a secondary position, from where it could never dictate tactics.[1]

Although the increasing range of the torpedo was undoubtedly a consideration in the expectation that major sea battles would be fought from ever greater distances, there is no evidence that the

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1. Despite the various views stated by Egerton report, 13 Jan 1900, Vernon 1900; ADM 189/20. For Fleet tactics see 'Report on Operations of the Combined Channel Home and Cruiser Squadrons, 1902' NID 670. H.J. May 'comments' on above, and 'Remarks on the relative value of Stern and Quarter Torpedo fire'; NID 671. DNI comments on 'Tactical Exercises, 1902' in NID 699. May 'Comments on Tactical Exercises, 1903'; NID 720. 'Precis of Strategical War Game at R.N. College, Greenwich: North Sea' 1902; NID 675.

torpedo was influential in causing this trend: nor is there any evidence to suggest that the torpedo had any influence in terminating the expectation of the 'mêlée' as the normal mode of naval battle. On the contrary, the torpedo was seen as a useful weapon in that particular context. The decisive weapon of the battleship was the gun: the torpedo was at its most effective in other contexts. This was a matter to be explored quite separately, in an atmosphere completely divorced from the technical development of the weapon.

(b) Underwater Discharge.

The Torpedo Committee had envisaged a considerable future for the torpedo as a weapon for sea-going use, while Fisher had been ardent in his praises of 'the most resistless and revolutionary weapon of naval warfare that has ever been introduced'.[1] The Board shared Fisher's faith, with rather less than his fervour. Hood, for instance, was 'quite satisfied with regard to the importance of the Whitehead torpedo as a weapon in combats at sea, particularly when discharged from a submerged tube'.[2] It was this latter consideration which became a major pre-occupation of the 1870s and 1880s. While some torpedoists were concerned mainly with using the weapon in any fashion, it became an article of faith among the majority that the development of underwater discharge was the key to the most effective use of the Whitehead torpedo.

This belief stemmed mainly from the expectation of close action for both battleships and torpedo vessels, which would expose the torpedoes on deck to the danger of explosion by gun-fire. In view of the pre-occupation with the ram, it was natural for early attention to focus on bow discharge, particularly after the adoption of faster torpedoes in 1876 obviated the dangers of over-running. The Germans and Italians adopted this system, which was used in H.M.S. Polyphemus. It was also intended to use the idea in major warships; the battleship Inflexible was therefore fitted appropriately

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1. Fisher to Phipps Hornby, 10 Feb 1876; Phipps Hornby Mss, Phi 121b.
2. Hood minute, 17 Dec 1877. Boys minute 12 Dec 1877; 'Foreign Torpedo Warfare' Printed pamphlet, Naval Library.

and carried out extensive trials early in 1882. Some damage was caused to torpedoes by the hydro-pneumatic impulse necessary to enable them to clear the ship, but there was no deflection problem. Fisher was enthusiastic.

> Putting aside the fact that when a torpedo is fired ahead in line with the keel, it is in effect making the ram so many hundred yards long without risking damage to your own ship from the collision - putting that great advantage aside - there remains the very important fact that no allowance has to be made in the plans adopted on board the Duilio, Dandolo, Heligoland, Ziethen etc, for deflection, whereas in any plan of ejecting the torpedo from inboard on the broadside (whether above or below water) every degree of training, every alteration in speed, and every difference in impulse, necessitates a different amount of deflection which has to be determined by a series of experiments for which few ships can find suitable time and opportunity unless perhaps some months in commission.[1]

The attention bestowed on Fisher aroused the jealousy of the Captain of Vernon, W.E. Gordon, who was already annoyed that he had been given no information on ships' designs, although it was his duty to advise on the fitting of underwater discharge systems.[2] Fisher's habitual praise of Whitehead appeared to imply a slur on Vernon, while the Controller, Brandreth, had no desire to replace the Woolwich system by the Whitehead.[3] There were, therefore, considerable differences of opinion between the experts, though most of it centred around the merits of the Whitehead discharge system, compared with Woolwich. On the importance of underwater fire, however, there was no difference, and the development of torpedo cruisers was

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1. Fisher report, 22 Mar 1882; ADM 116/224.
2. Gordon minute, 20 April 1882; ibid.
3. Brandreth minute, 15 June 1882; ibid.

held up until the technical difficulties of this mode of discharge were solved. Extensive trials by the Polyphemus were expected to resolve matters;[1] in fact the delay was to be much longer than anybody anticipated at this stage.

Despite the apparent attraction of bow discharge, the exhaustive experimental work which followed during the 1880s was devoted almost entirely to the perfection of a broadside underwater discharge system. This was an extremely difficult technical problem, and the emphasis placed on it probably reflects the increasing importance of the gun rather than the ram, the torpedo following rather than leading tactical developments. Initial tests, conducted in October 1882 by Commander W.H. May, were not encouraging. The torpedo was held in position as it was discharged by a groove and bracket fixed on a protecting shield bar, rather than the full-scale shield suggested by the Torpedo Committee. This improved system, however, was still useless at speeds above eight knots, while strengthening the equipment failed to prevent damage. The power of the water pressing along the ship's side was simply too much, and tore the torpedo away from its fittings as it was fired.[2]

The DNC (Barnaby)[3] was convinced that the whole business was a waste of time,[4] while Woolwich asserted quite categorically that torpedoes could not be discharged from broadside tubes.[5] However, the First Naval Lord, Key, and the Civil Lord, Rendel, were keen on

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1. Key minute, 28 April 1882. Brandreth minute, 15 Jan 1882; ibid.
2. May report, 12 Oct 1882; ibid.
3. Sir Nathaniel Barnaby (1829-1915), Head of Admiralty Construction Board, 1870-72. Chief Naval Architect, 1872-75, Director of Naval construction, 1875-85.
4. Barnaby minute, 5 Jan 1883; ADM 116/224.
5. Superintendent Royal Laboratory report, 22 Dec 1884; ibid.

the project. As a result, Portsmouth and Chatham dockyards were ordered to begin preliminary work on gauging water-pressures, to acquire the basic knowledge needed to overcome the problem.[1] No firm results were however achieved.[2]

Key, nevertheless, refused to be discouraged, although the complexity of the problem was too much for the First Naval Lord to supervise matters personally. A committee was accordingly established to 'enquire into and report on the plan or plans they would recommend for trial as likely to prove effective for the ejection of torpedoes from submarine tubes on the broadside when the ship is proceeding at a high rate of speed such as 14 knots and upwards'. Woolwich, the Torpedo store and the DNC sent experts to assist Eardley-Wilmot,[3] Wilson and Gallwey, the naval torpedo experts.[4] Virtually all the torpedo expertise of the British armed services was therefore concentrated on the question of underwater discharge in the early 1880s. Not until the late 1880s was the problem solved, and by then the declining importance of the ram and mêlée as significant factors in naval warfare had rendered the question largely superfluous. In the meantime, it was a considerable distraction from the efforts of the later 1880s to improve the torpedo itself.

May's experiments in the Polyphemus continued, with a suggestion that if the torpedo and shield came out simultaneously, the dangerous

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1. Key minute, 12 Jan 1883; ibid.
2. Report by Chief Engineer, Portsmouth, 19 Jan 1883; ibid.
3. Assistant to the DNO.
4. Key minute, 28 Feb 1883; ibid.

vibration of the shield bar would be overcome.[1] When this failed, a systematic evaluation of water pressures was made. The breakthrough, however, came not from this, but from a process of trial and error, for by November 1884, the use of an experimental perforated shield bar appeared to make possible discharges from ships steaming at a speed of 17 knots.[2]

This success in experiment was not matched by service experience. In 1885, the cruiser H.M.S. Mersey was fitted both with this system and with a new system devised by Philip Watts[3] of the DNC's department. This provided for a bell-shaped orifice in the ship's side to allow some leeway for the tail of the torpedo, preventing it from hitting the ship as the water pressure caught it on exit from the tube.[4] Neither scheme prevented damage to the torpedo's tail when used at speeds above 12 knots, and even when increased shield protection was provided to give effective discharge, there was still a mammoth deflection rate of 21° for every knot of speed.[5]

By early 1887 further fruitless experiments caused doubts to be expressed by Admiral Willes, the C-in-C Portsmouth, who had observed the efforts in his harbour.[6] However, the torpedoists Fisher and Wilson now held sway in Whitehall, so the experiments continued.[7] Wilson, who as ADT was directly responsible for the

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1. May report, 9 Nov 1882; ibid.
2. Summary of Report of the Committee on Submerged Torpedo Discharge. Vernon 1884 ADM 189/4.
3. Sir Philip Watts (1846-1926) Naval Architect in private industry and government. Director of DNC 1902-12.
4. Vernon 1885; ADM 189/5.
5. Report of Submerged Torpedo Discharge Committee, 18 Feb 1887; ADM 116/290.
6. Willes minute 19 Feb 1887, ibid.
7. Fisher minute 19 Feb 1887, Wilson minute 29 April 1887; ibid.

trials, showed considerable drive and energy. He even went so far as to conduct some trial runs when all others were concentrating on preparations for the 1887 Jubilee Review,[1] and then proposed that no less than thirteen vessels, including the new battleships Victoria, Sans Pareil, Trafalgar and Nile, should be fitted with underwater tubes, pending the anticipated successful outcome of his work. 'I consider the question of submerged discharge by far the most important torpedo question of the day. It is the answer from the torpedo side to the QF and so far as I see the only answer possible'. It was necessary to press on and develop it before the foreigner. He claimed that 'the torpedoes have now for a long time been discharged time after time, without the slightest injury at the highest speed.'[2]

By this, however, he meant only 15 knots, and further serious shortcomings were admitted in his report of November 1887. During the course of 1887 316 torpedo runs had been made, and many of these had been wildly erratic. Some fired at a range of 400 yards had missed a 100 yard target by as much as 200 yards. Although there had been no accidents, accuracy therefore still left much to be desired. Extra ballast improved the accuracy of the Mk IV Fiume, but this torpedo was too weak to withstand the strain of underwater discharge. 'As to the general question of submerged discharge, although these trials do not exhibit such progress as was anticipated, the committee [under Wilson, on underwater discharge] are unanimous

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1. Wilson minute 20 June 1887; ibid.
2. Wilson minute, 27 April 1887; ibid.

in attaching the greatest importance to obtaining a satisfactory method of submerged discharge, chiefly on account of the protection afforded against gunfire, and they would call attention to the fact that the question of submerged discharge is now being worked out by Mr Whitehead for the Italian government, and the committee recommend that every effort should be made to obtain success.'[1] This was, however, an expression of hope rather than the exposition of any real achievements in the sphere of technical progress.

Nevertheless, Wilson was determined to pursue the matter. He urged that the new belted cruisers should be equipped with tubes, pending the successful development of the appropriate fittings. He recognised that at least two years would probably elapse before underwater discharge was possible at high speeds, but pointed out that even under present conditions, it was quite feasible at speeds of up to 15 knots.

> Actions will not always be fought at high speed nor will full speed always be available. It is also just when full speed cannot be obtained that ships of the belted cruiser class are more likely to be brought to action by a superior force, and it is then that submerged tubes would be most valuable. It is quite possible, in a hotly contested engagement, that every gun and above-water torpedo tube in a belted cruiser may be disabled by the fire of shells and QF guns, while the ship remains perfectly efficient and manageable. If this occurred, a heavy responsibility would rest on those who had recommended the withdrawal of the only weapons which are protected from gun-fire and likely to remain efficient as long as the ship floats.'[2]

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1. Report of Submerged Torpedo Discharge Committee, 28 Nov 1887; ibid.
2. Wilson minute, 6 Dec 1887; ibid.

This somewhat extravagant tactical thesis formed the basis for his claims to more Admiralty money.

The Civil Lord, Forward, and the Controller, Graham, strongly opposed further experiments, arguing that trials had begun in 1881, the committee had been working since 1883, and yet no achievements had been noted since 1885. Nor was there any indication of potential progress.[1] The DNC, Sir William White,[2] saw no need for urgency, but was prepared to sanction the fitting of underwater tubes in the Mersey, Victoria and a belted cruiser. If the expected progress was made, then the ships to be built in 1888-9 could be suitably fitted.[3] The problem was that faced by all research projects which have gone astray. Progress had been disappointing, with no evidence that any more could be expected. The choice was whether to cut already considerable losses, or persevere at the risk of losing even more money. In the event, the naval officers carried the day. Hood, for instance, argued that the torpedo was best used when passing other vessels at speed.[4] The tactical importance ascribed to underwater discharge dictated the continuation of experiments.

1888 saw some progress, with deflection rates being at least more or less constant.[5] In the following year, more experiments settled the issue. Although curtailed by the manoeuvres, these

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1. Graham minute, 13 Dec 1887, Forward minute 17 Dec 1887; ibid .
2. Sir William Henry White (1845-1913) Naval architect in private industry and government service, before becoming DNC 1885-1902.
3. White minute, 10 Dec 1887; ibid.
4. Hood minute, 15 Mar 1888; ibid .
5. Vernon 1888; ADM 189/8.

nevertheless produced enough evidence. At 16 knots, the Mersey was able to report a deflection rate of a mere 3°. In December 1889, no less than 90% of trial shots were within 45 yards of the centre of a target at 400 yards. The fittings which had thus proved so successful were adopted in February 1890. Vernon noted approvingly; 'The immense advantage in these days of QF guns of placing the torpedoes under absolute protection is everywhere admitted, so that there can be now no question as to the advantage of placing the torpedo discharges below water wherever the available space will admit.'[1] This system, although evolved too late to be incorporated into the ships of the 1888-89 programme, was nevertheless sufficiently sound to last into the war. This was adequate testimony to the hard and efficient work of the Submerged Torpedo Discharge Committee.

The matter was complicated by the development of the 18in torpedo, which initially made the new system obsolete virtually as soon as it was adopted. Not until November 1891 was it adapted sufficiently to take the new torpedoes.[2] This was however a speedy process compared with the decade of hard work which had developed the principles on which the original system had been designed.

The work on underwater discharge followed a similar pattern to that of the TDC, and much of it was pursued contemporaneously, also under Wilson's direction. There was none of the spectacular progress made in Fiume, but steady, dogged progress demonstrated considerable

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1. Vernon 1889; ADM 189/9.
2. Vernon 1891; ADM 189/11.

technical ability. Indeed, the eventual result of this effort proved superior to Whitehead's system of underwater discharge.[1] Vernon therefore showed that it could match Whitehead when the effort was made and when work did not suffer from the doctrinaire determination to eliminate his competition, which had caused the fiasco of the TDC. That the effort was made, and made with such consistent energy, was a tribute to the dynamism of Wilson.

Whether, in fact, such an effort should have been made, is another question. This reflects the differing priorities of Britain and the other powers. For the latter, the coastal TB was a sufficient weapon, while for the former, the value of the torpedo depended on its suitability for use from sea-going vessels. If the torpedo were to be justified, as the torpedoists felt themselves obliged to justify it, it had to be in the context of capital ship warfare, and this, in the tactical context of the 1880s involved underwater discharge. This explains the enthusiasm of Wilson and Fisher for this particular aspect of torpedo warfare.

It was this enthusiasm alone, which saved the project in the late 1880s, when justifiable doubts began to assail the non-torpedoists. The only justification which Wilson could claim for his determination to continue the work, was faith in his own ability to bring matters to a successful conclusion. It was a faith which was justified in technical terms. The changing tactical conditions of the 1890s however, when the melee was finally disappearing as a tactical concept and giving way to longer range gunnery engagements, called into

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1. Report of Committee on Whitehead's system of Submerged Discharge, 28 April 1890. Enclosure to Vernon 1890; ADM 189/10.

question the wisdom of the policy at the moment of its technical success. The episode exemplifies the complexities of reconciling tactics and material at a time when both were evolving with an unprecedented speed.

CHAPTER THREE - COUNTERING THE WEAPON

(a) Nets

Every increase in the power and effectiveness of the torpedo emphasised the importance of the protective measures which were necessary to counter the menace. During the American Civil War, casualties from underwater attack had been incurred by the Federal Navy mainly while blockading the Confederate coasts. The power thus given to the blockaded fleet, and the levelling nature of the torpedo, were both factors which sharply accentuated the need for the Royal Navy to be prepared against this new danger.

The Torpedo Committee had conducted experiments with nets hung from booms rigged over the ship's side, so that the torpedo was intercepted and stopped at a safe distance.[1] Vernon continued with this work,[2] and in 1876 a system was sent to the Mediterranean fleet for trial by serving officers. Reports, however, were unfavourable. Such a defence was possible only in fair weather and smooth water, when travelling at reduced speed. Even under these limited conditions, gunfire was masked, speed impeded, turning power seriously affected, and screws likely to be fouled by damaged netting. Nor were these disadvantages offset by the effectiveness of the netting under perfect conditions.[3]

Captain Fisher, for instance, was contemptuous that 'this committee' should fail to understand that Whitehead's torpedo could

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1. Final Report of the Torpedo Committee 28 July 1887; ADM 116/163.
2. Bradford op cit (London; John Murray, 1923) p.50.
3. Report of Vice-Admiral Drummond, 27 Dec 1876; Rear Admiral Rice, 6 Dec 1876; Captains Bowden-Smith, 8 Dec 1876; Baird 9 Dec 1876, Culme-Seymour, 9 Dec 1876; the Duke of Edinburgh, 21 Dec 1876;

and would go clean through any nets. He argued that the safest form of defence lay in the provision of gunboats as defensive auxiliaries.[1] Captain George Tryon[2] agreed:

> I believe the real defence of a fleet composed of ships of a value far beyond the millions they cost, some of them representing no inconsiderable portion of the whole force of a country, is a bright look-out. Such a fleet should be covered by a number of look out vessels, divided into an inshore and an outshore squadron, composed of very fast, lightly-armed vessels, commanding a radius of 50 miles.

An efficient defence was possible if sufficient auxiliaries of this sort were provided, and everything floating near the enemy's coasts were destroyed. The nets, however, were roundly condemned:

> Any defence attached to a ship under weigh that impedes the speed, that blinds his fire, that is liable to injury by shot or shell or collision, and then to fall astern and foul the screws is open to the gravest objections, and the defence proposed has these defects to their fullest extent.

He emphasised speed, handiness and watertight sub-division, and concluded by encapsulating a philosophy in a statement of tactical opinion:

> We must rely on the naval architect to devise for us ships that are little liable to total destruction by torpedoes, and we, provided with all the latest methods of destruction, must consider the attack, believing when that is settled it will at sea also provide the best defence for the ships placed in our charge.[3]

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1. Fisher report, 7 Dec 1876; ibid.
2. Vice-Admiral Sir George Tryon (1832-93). Private Secretary to the First Lord 1871-74. Secretary of the Admiralty 1882-84. An expert on signals and fleet manoeuvres. Lost in H.M.S. Victoria 1893.
3. Tryon report, 9 Dec 1876; ADM 116/169.

Tryon's approach to the general question of naval warfare was eminently sound. Passive defence is basically a second-best course of action which can never achieve the ultimate aim of defeating the main forces of the enemy. Hence the enthusiasm with which the torpedoists themselves endorsed the torpedo as an offensive weapon for the Royal Navy to use. The fact was, however, that some form of defence was also necessary. Naval architects consistently failed to produce unsinkable ships, and they came under no pressure to do so, while the problem of suitable auxiliary vessels was far greater than Tryon imagined. Netting remained the only alternative and the search for an adequate sea-going net defence therefore continued. The Controller, Vice-Admiral Stewart, wanted to continue trials of both netting and iron gratings.[1] Hood, now Second Naval Lord, was as meticulous as ever. He outlined three major points to be decided. Could the nets be maintained by an ironclad at speed; how effective were the nets against torpedoes; and how likely were the screws to be fouled? Experiments could clarify the first two points, but the third question could be answered only at the risk of breaking propellers and damaging engines. Since any system of ropes and nets entailed this risk, he proposed testing a system of hinged iron gratings. It was hoped that this sort of protective arrangement would sink immediately on being damaged, rather than entangle itself in the screws.[2]

The DNO, Rear Admiral Boys, vigorously championed netting, and attempted to refute the criticisms made of it. He claimed that there was no reason why a well-designed net protection should

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1. Stewart minute, 1 Mar 1877; ibid.
2. Hood minute, 2 Mar 1877; ibid.

interfere with gunfire, why a powerful ironclad such as the Hercules should have her speed reduced by nets, or why an ironclad's big and powerful screws should be disabled by netting and ropes. Fixed defences were far more reliable than vessels to catch the torpedo boats, and while torpedoes could inflict fatal injury on ships' bottoms, netting protection could prevent this. He urged more work, and warned that if no progress were made 'we shall then have to face the fact that existing ships must go into action entirely unprotected and liable to be disabled by a torpedo fired from a most insignificant vessel'.[1]

Barnaby, however, differed entirely with his colleagues. He agreed that ships could not be made proof against torpedoes, agreed with Hood that trials of screw entanglements would entail serious risk of damage, and maintained that even if screws were not damaged by them, loss of speed would inevitably follow. He therefore agreed with the Mediterranean fleet officers that 'the proper defence is to be found in auxiliary vessels'. This was where he urged that attention should be directed.[2] Barnaby's adamant opposition to netting was however overruled by the Admiralty Board, and extensive net experiments were accordingly begun.

Throughout January and February 1877, while the debate continued, attempts were made to construct a system of net defences which could be maintained at sea. Portsmouth, Vernon and Excellent all failed

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1. Boys minute, 4 Jan 1877; ibid.
2. Barnaby minute, 20 Feb. 1877; ibid.

and their reports were consequently not illuminating.[1] Boys and Hood then urged a trial of iron gratings,[2] for which there was much enthusiasm from Captain Arthur of Vernon[3]. There is however no record of whether these trials were actually held.

By about 1880 failure had greeted all attempts to arrange suitable netting for use at sea. Vernon, for instance, now expected five knots to be the maximum speed at which ships could steam with nets out. By now, too, netting was thoroughly unpopular in the fleet and exercised as little as possible, while its advocates were limited to Whitehall and Vernon. The latter inevitably took defence against torpedoes as its departmental responsibility, and therefore found itself advocating measures which found little favour in the fleet.

> I fear it [netting] has not been made the permanent and standing defence that it might, and in my opinion, should be ..... If the same amount of expense, weight and stowage that is now spent on upper masts, yards and sails, were devoted to net defence, and the same attention given to their manipulation, an excellent, efficient and quickly managed defence would, I am sure, result; and the spreading or taking in of the nets in ironclads be as proud and a much more useful evolution than sending up top-gallant yards and masts.[4]

Work continued and in 1883 the Board visited Portsmouth to observe the trials of a new system of net protection devised by Excellent and Vernon.[5]

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1. Report of the Captain of the Steam Reserve, 8 Feb 1877; ibid.
2. Boys minute, 28 Feb 1877, Hood minute, n.d.; ibid.
3. Arthur report, 16 Feb 1877; ibid.
4. Vernon 1881; ADM 189/1.
5. The Captain of the latter was now Fisher.

This 'Torpedo Defence Committee' 'confidently anticipate/d_7 the possibility of keeping, not only the broadside nets in position when the ship is in motion, but also those protecting the bow and stern'.[1] Subsequent tests in a force six wind in the Mediterranean proved these expectations to be over-optimistic,[2] but the demonstration convinced the Board. In 1883, new and building ships were ordered to be equipped with the stores and fittings for regular rather than improvised net protection, and annual exercises were stipulated.[3]

The persistently unsatisfactory nature of netting, however, soon necessitated the establishment of another committee in September 1885, on which Vernon and Excellent were represented. This time it was finally recognised that netting was not practical for ships going into action. It was however still considered invaluable while ships were at anchor or blockading at slow speed, particularly at night, 'when torpedo boats will seize every opportunity of an unguarded moment to attack'. The committee claimed that within these limitations, netting was effective and easily rigged,[4] though the contradiction of this opinion by two sea-going officers again revealed the differences within the service.[5] Experiments continued.[6]

Netting became increasingly sophisticated and expensive. The Victoria's protection, for instance, cost £2200.[7] The effectiveness

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1. Vernon 1883; ADM 189/3.
2. Vernon 1884; ADM 189/4.
3. Vernon 1883; ADM 189/3.
4. Report by Captain R.E. Tracy, 6 Jan 1886; ADM 116/275.
5. Report by Captains Bridge, 9 June 1886, and Brent, 23 Jan 1886, ibid.
6. Fisher minute, 17 Dec 1886; ibid.
7. Vernon 1888; ADM 189/8.

of this form of defence was brought into question in 1890, when Vernon experimented with a form of net-cutter invented by the Italian, Bellemo. In these trials, 75% of torpedoes equipped with this device went straight through nets.[1] In the meantime, Captain A.K. Wilson, of Vernon, had developed an even better cutter, which was recommended for service use under the name 'Pioneer'.[2] This development raised awkward problems. If Vernon were unable to produce a net which could resist the new cutters, then 'the whole question of the practicability of carrying nets at all will have to be faced'.[3] Furthermore, torpedoes now ran at 24 feet underwater, while nets extended to a depth of only 20 feet.

Extensive trials were conducted in 1893 on a variety of strengthened nets. Captain W.H. Hall of Vernon discontinued them in September of that year, concluding that a weight increase in the nets of even 50% would still leave the problem as acute as ever, and would still render net protection effective only when the ship was stationary.[4]

The Controller, Fisher, ordered cruiser net fittings to be stood over and the useless bow and stern defences of battleships to be discarded.[5] This was a somewhat indecisive step, especially since nothing was done until 1905 to provide nets of sufficient depth to counter the torpedo menace.[6] In other words, the defence against

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1. Vernon 1891; ADM 189/11.
2. Vernon 1892; ADM 189/12.
3. ibid.
4. Hall report, 26 Sept 1893. Vernon 1893; ADM 189/13.
5. Fisher minute, 28 Oct 1893; ibid.
6. Vernon 1905; ADM 189/25.

torpedoes was neglected for a full fifteen years, and this at a time when the 18in and gyroscoped torpedoes were increasing the menace enormously. Even then, the most strengthened and improved booms were capable of use only in absolutely calm weather.[1] In the meantime, Captain Durnford of Vernon, who had emerged as the service's leading torpedoist, urged that more effort should be made;[2] the Board seemed resigned to the ineffectiveness of netting;[3] opinion in the Fleet, as usual, varied widely.[4]

The advent of the heater torpedo added urgency to the work, and extensive tests were conducted between 1908 and 1913.[5] It was in vain. Effective netting systems were too heavy for use by ships, and the Queen Elizabeths were not fitted with them.[6] By the outbreak of war, therefore, torpedo advances had led to the abandonment of nets, despite Vernon's advocacy. Opinion had always been divided, and Tryon's objections were revived when netting was introduced into the Grand Fleet during the war. Admiral Bradford, for instance, informed the Admiralty that the 'protection afforded by nets is illusory and as ill adapted for defence as sail power is for progression',[7] an opinion strikingly vindicated by actual experience.[8]

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1. Beresford report 12 Mar 1904 (when C-in-C Channel) Vernon 1904 ADM 189/24.
2. Durnford to Noel 23 Mar 1898, Noel Mss, NOE 1A; Durnford to Noel, 11 May 1898; ibid NOE 2.
3. Spencer to Culme-Seymour, 12 Feb 1895; Spencer Mss, Spencer 7.
4. See pp. 82-3, note 5 p. 87.
5. Vernon 1910-13; ADM 189/30-33.
6. Vernon 1913; ADM 189/33.
7. Bradford to Admiralty, 21 Dec 1914; ADM 1/8407.
8. See p. 298.

Tryon's philosophy held good for the entire period. Effective passive protection by nets could only cripple the fleet's mobility and offensive power. Even for the hazardous and passive duty of blockade, there were differences within the fleet as to the utility of netting. In fact, the answer to the problems of anti-torpedo protection lay, as the Torpedo Committee had suggested, in the improved and strengthened underwater construction of the ships themselves. Admiralty action in this respect was, however less than adequate.

(b) Underwater Protection

The Federal Navy in the American Civil War had already experienced the effects of underwater explosions on large ships. The British had no such direct experience so that both the Royal Engineers who were responsible for coastal defences, and the Royal Navy, which seemed likely to assume in war a role comparable with that of the Federal Navy, had much to learn. The Engineers took the first initiative and conducted a series of practical investigations into the effectiveness of such explosions caused by defensive passive mining. The Royal Navy meanwhile conducted its own experiments, the Admiralty Torpedo Committee experimenting with a target section resembling a ship, and finding the effects of the explosion devastating.[2] In 1876, however, full-scale trials were conducted by a committee of two R.E. Officers, the W.O. Chemist F.A. Abel, and the naval officers Hall, Singer and Houston Stewart. The 950 ton paddle-wheel sloop Oberon was fitted with an outer skin resembling that of the powerful battleship Hercules. Explosions were then detonated at varying distances from her, and the effects measured and analysed. The committee was careful to make allowances for the different structure of the Oberon and the circumstances of the trials, and its conclusions were all the more important because of this exhaustiveness.

It was decided that while the explosion of a 500lb ground mine directly under a ship would be fatal, the successful use of such a weapon was precluded by the difficulty of ensuring that it exploded

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1. Report on Torpedo Experiments at Weston-Super-Mare, 7 Dec 1872; Phipps Hornby Mss, Phi 121a.
2. See pp. 23-4.

in the right place at the right time. Contact mines were more likely to ensure damage or destruction. For instance, 'a Harvey torpedo loaded with gunpowder (66lbs) will inflict serious and perhaps fatal injury on any ship at present afloat, if exploded at a depth of not less than nine feet, and within three feet of the outer bottom'. A 33lb charge would inflict serious and perhaps fatal damage, even a 20lb charge could blow a hole through both skins of a vessel, and 'it is improbable that any thickness of armour could be placed on the underwater portion of a vessel would prevent the side being seriously damaged by contact torpedoes'. The only hope, it was concluded, lay in sub-division, especially of the engine and boiler rooms, and in the addition of numerous longitudinal watertight bulkheads. 'Such arrangements, even if carried out to the fullest possible extent, can however, only afford a very imperfect protection to the motive power of a vessel from a very large torpedo exploded underneath'.[1]

These pessimistic findings were contemporaneous with the results of trials held at Carlscrona in Sweden. In 1874, the Swedes proposed an exchange of information, and the Admiralty agreed readily, on the grounds that the information would leak out anyway.[2] This attitude is in marked contrast to the secrecy which developed later.

British representatives therefore observed the Swedish experiments, and obtained a translation of an exhaustive report of the proceedings, which took two years. The Swedes too began from a position of

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1. Committee on '<u>Oberon</u> Trials' 30 Nov 1876; Printed Pamphlet, Naval Library.
2. Proposal by Swedish Government to Admiralty, 18 May 1874; Boys minute, 29 May 1874; ADM 1/6314..

complete ignorance, and worked systematically from first principles. The most important factors were clearly shown to be the proximity of the charge to the target and the depth underwater, rather than the size of the explosion. For instance, armour-plating could resist explosions above water, which shattered much thicker submerged armour. Even allowing for the doubtful ability of the available weapons to deliver the explosive at the right place, the final conclusions echoed the gloomy prognostications of the Oberon committee.

> The successful explosion ... will cause any ship such serious injury that it can only be saved from sinking by means of an efficient system of water-tight and perfectly serviceable bulkheads, while it will probably be compelled to retire as speedily as possible, and be put hors de combat.[1]

This was the state of knowledge in the late 1870s and early 1880s, and is reflected in the often gloomy expectations of the ironclad's future in this period.[2] Not until December 1886 did further experiments take place, and these were not even designed to test the sort of protection advocated by the Torpedo Committee. The old ironclad Resistance, fitted out to represent the structure of a modern ship, was the guinea pig for experiments to discover the distance from a ship at which a torpedo explosion would not inflict injury; the value of coal protection; and the damage which a very large explosion could inflict at 30 feet. The first series of trials proved conclusively that a 16in torpedo, delivered against a ship's side, was devastating. The 93¼lb gun-cotton charge started

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1. Conclusions of the Commission on Experiments with Submarine Mines, 1 July 1877; AIM 116/180.
2. See p. 174, 777, 186.

the outer skin, forced in the wing passage bulkhead by 22 feet and pulverised the coal which was placed between the skin and the bulkhead. The ship took a 5^{o} list immediately, and had to be run aground to prevent her sinking. It was seven months before she was fit for renewed trials.[1]

These took place in June 1887. Preliminary tests showed that the vessel was quite safe from explosions 30 feet from its side. Tests with coal protection then followed. Coal bunkered in the normal way next to the ship's skin did nothing to mitigate the damage from a heavy explosion; water poured through holes in shattered bulkheads. However when coal was stored in the wing passage with an empty space between bulkhead and ship's skin the effect of the explosion was markedly diminished. Here at least was an indication of <u>some</u> progress, and experiments were planned to investigate the question.[2] These, however did not take place, and the trials which had begun to offer a glimmer of hope, were quite inexplicably never concluded.

Underwater protection was debated in the limited circles interested, but very little was actually done. Barnaby pursued a policy of watertight subdivision,[3] a course in which such eminent naval architects as J. Scott Russell[4] supported him.[5] The <u>Inflexible</u>, for instance, was given a double bottom, double side and 89 water-tight compartments, which were expected to prevent serious leakage,

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1. <u>Vernon</u> 1886; ADM 189/6.
2. <u>Vernon</u> 1887; ADM 189/7.
3. Barnaby memo, Nov 1875; Phipps Hornby Mss. Phi 109.
4. John Scott Russell (1808-82) Ship-builder and designer. Builder of Great Eastern.
5. Russell in discussion on Barnaby's paper, 'On Some Recent Designs for Ships of War for the Royal Navy' <u>INA</u> XXV (March, 1874) 12-13.

'except where there is some such severe injury as can be inflicted by shot ram or torpedo'.[1] This was the crux of the matter. Barnaby did not believe that ships' bottoms could be defended against explosions, for the latter could always be increased commensurate with any structural development. In the last resort, he considered the torpedo irresistible, and he received strong backing for his advocacy of torpedo catchers.

> I contend that the defence against the ram and the torpedo must be sought for, not in the construction of the ship alone, or mainly, but also, and chiefly, in the proper grouping of the forces at the point of attack. Each costly ironclad ought to be defended against the torpedo and the ram by smaller, numerous but less important parts of the general forces.[2]

Barnaby's predecessor as Chief Constructor, Sir Edward Reed, was meanwhile extolling the virtues of a strong inner bottom.[3] This contention was the basis of a rather acrimonious dispute with Barnaby and the retired Admiral Sir George Elliot. Not that the latter two agreed with each other. The debate was three-cornered. Barnaby had little faith in underwater protection, and although he favoured cellular sub-division, preferred to put his faith in defence by auxiliary vessels.[2] Reed favoured auxiliary vessels,[4] but put some trust in underwater protection. He proposed an armoured deck or an armoured inner bottom completely covering the bottom of the ship, with a sub-divided gap between that and the outer bottom. The latter would take the explosion, which would expend its energy in the gap between the two decks. The inner bottom would be

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1. Barnaby memo, Nov 1875; Phipps Hornby Mss, Phi 109.
2. Barnaby, 'On Some Ships of War' INA XXVII (April, 1876) 1-6.
3. Reed comment on Noel paper. 'Certain Points of Importance in the Construction of Ships of War' INA XXIV(Mar 1883) 1-10, 13.
4. Reed comment INA XXVII (April 1876) 9-10.

sufficiently strong to resist the remaining destructive forces. He claimed that no decrease in the ship's speed would be necessary as a result of this design.[1] On the other hand, his critics argued that the weight of armour would be prohibitive,[2] and the Admiralty rejected his plan in January 1885 because the flooding of the space between the two bottoms was expected to upset the stability of the ship.[3]

All condemned protective nets, which could only impede speed and manoeuvrability. Elliot believed not only this, but that auxiliaries too were useless. He argued that some torpedo boats would always get through and that the torpedo would play a role in fleet actions at sea. Protection was therefore essential and, he believed, possible. By fixing a 'crinolene' of metal grating some 6-8 feet from the ship's side, he suggested that a cushion of water would be formed between ship and explosion, without affecting speed or manoeuvrability.[4]

Reed attacked Elliot's idea vigorously, arguing that such a depth of water would have no effect in diminishing the force of the explosion. Elliot used a similar argument to oppose Reed's plan. In a sense, both were right. Space was needed to absorb the explosion, 6-8 feet was hardly enough, neither of them provided enough space, and Reed's armour was of doubtful practicability in

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1. Elliot, A Treatise on Future Naval Battles and How to Fight them. (London, Sampson Low, Marston, Searle and Rivington, 1885)p.102-103.
2. Noel comment on Reed's paper 'Strengthening the Navy' RUSI XXVII (Nov 1884) 1024-26.
3. IND 18387 Jan 1885. Also Oscar Parks British Battleships (London Seeley Service & Co. Ltd., 1957) pp 326-27.
4. Elliot, op cit p. 100-102.

terms of construction and stability in ships of that size.[1] The principle on which they both worked, that of keeping the explosion at a distance from the main body of the ship, foreshadowed the dreadnought protective systems and bulging of 20 or 30 years later.

Nevertheless no experiments were made on these lines, and Admiralty thinking was more than a little complacent. Sir William White continued the policy of subdivision initiated by Barnaby. Ships were fitted with double bottoms, the inner skin being 3-4 feet from the outer skin. Above the turn of the bilge, the inner skin worked up vertically, forming 'Wing spaces'. Everything was subdivided, although the engines and boilers inevitably occupied much space. White never pretended that a torpedo attack could be kept out of either the outer or inner skin, and he certainly never provided the space between the two skins, or the armoured strength in the second skin, which was necessary to withstand the explosion. His claim was that the subdivision would keep the ship afloat after the damage was done, and he supported his case with the evidence of the Vanguard, which had stayed afloat for 70 minutes after being rammed.[2]

This contention was seriously challenged after the loss of the Victoria. She too had been designed as virtually unsinkable and her

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1. Elliot and Reed in discussion on Reed's paper 'What are the most urgent measures that should be taken for strengthening H.M. Navy' RUSI XXVIII (Nov 1884), 1016-18, 1047-48.
2. White, Naval Architecture 1894, Printed Pamphlet, Naval Library. White memorandum 'Remarks on the Character and Dimensions of Battleships' 30 Nov 1892 Noel Mss NOE 13. White 'Modern Warships' Speech at the Mansion House, Jan 1887; Printed Pamphlet, Naval Library.

sudden capsizing came as 'a terrible revelation'.[1] In January 1894, Captain A.K. Wilson claimed in a lecture to a group of naval officers at Malta that the design was fundamentally wrong, since the preponderance of fore-and-aft partitions, particularly in the boiler rooms, led to a loss of stability when too many compartments on one side of the ship were flooded. He also exposed the misconception that bulkheads could be pierced with watertight doors and still remain water-right. In an emergency, of course, there would never be sufficient time actually to close these doors. He advocated transverse bulkheads, which should be carried to the upper deck, with all doors above the waterline. Boiler rooms should stretch across the ship, to distribute any flooding to all sides of the ship. Ammunition should be hoisted up directly to the guns, instead of being carried the length of the ship and preventing the construction of water-tight transverse bulkheads.[2]

Wilson's suggestions received a warm welcome from his audience,[3] but White defended his designs. He pointed out that longitudinal bulkheads could be nothing but good, for they limited the area exposed to flooding.[4] White <u>did</u> fail to ensure an adequate balance of longitudinal and lateral bulkheading. On the question of watertight doors, he had attempted to limit their number, but had been overwhelmed with complaints that this was too inconvenient

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1. Lieutenant Bush (no further identification) to Phipps Hornby, 12 Jan 1894; Phipps Hornby Mss Phi 120d.
2. Wilson Lecture to Malta Naval and Military Society. 1 Nov 1894; Printed Pamphlet, Naval Library.
3. Bush to Phipps Hornby, 12 Jan 1894; Phipps Hornby Mss, Phi 120d.
4. White memorandum 'Report on Watertight Sub-division in Battleships' 25 May 1894; Noel Mss NOE 13.

for working the ship.

> On all grounds the Naval Architect desires to diminish the number of doors, but experience shows that habitability, ventilation and ease of communications under protection in warships, are matters of no less importance than water-tight sub-division ..... It is clear ..... that no radical change is desired by the Service afloat, either in the numbers, arrangement, or means of working water-tight doors.[1]

White's task was therefore made all the more difficult by the service for which he worked. The prevailing attitude towards sub-division was summarised by Fisher. 'It's so d------d inconvenient! Nothing but pokey little spaces everywhere!' But as Fisher wisely added, 'It's not magnificent but it's War!'[2] The Service was certainly not prepared to face the realities of war needs, as a committee of enquiry into the collision of the cruiser Prince George and the battleship Hannibal, discovered in 1903. The many water-tight doors had been polished so vigorously that they were no longer water-tight. Sluice and drain valves, and other water-tight fittings, were not maintained efficiently, and water consequently penetrated the supposedly water-tight bulkheads in a large number of places.[3]

The DNC was not, therefore, working under the sort of directives which would enable him to solve the problem, nor did

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1. White memorandum 'Report on Watertight Sub-Division in Battleships' 6 Sept 1896; Noel Mss, NOE 13.
2. Fisher to Churchill, 13 Nov 1911. Quoted in Randolph Churchill Winston S. Churchill (London, Heinemann 1969) Vol. II Companion Part 2 1907-11 p. 1332.
3. Report of Committee of Enquiry into the Condition of Water-tight Compartments on H.M.S. Prince George, 28 Nov 1903; Barlow Mss BAR II.

the Navy take his efforts at all seriously. The result was that the battleships of the 1890s were highly vulnerable. The effectiveness of the bulkheading which White introduced was vitiated by the extravagant use of water-tight doors. At the same time, however, he seriously weakened his ships by piercing the bulkheads with pipes and valves. He claimed that the joints were made water-tight,[1] but this would not prevent damage to them in the event of explosions. Lack of concern and designers' errors continued to produce what might have been a dangerous situation in the event of war. Only Vernon was concerned. 'Much attention continues to be bestowed by the Torpedo School on the best means of resisting an attack by torpedoes.'[2] This attention however, never resulted in any practical action, and was probably nothing more than the expression of vague hopes. Whitehall did not share Vernon's concern.

Not until 1903 was any positive action taken. The Controller, W.H. May, minuted White's successor as DNC, Philip Watts.

> I shall be glad if you will seriously consider the question of reducing, and if possible nullifying the effects of an 18in Whitehead torpedo exploding in contact with the bottom of a ship. Considering the far-reaching effect of such an explosion on the structure of ships as at present built, the enormous cost of modern ships, and the increasing range and improved accuracy of the torpedo, I am now firmly impressed with the view that we should make every effort to safeguard our ships from the destructive effect of torpedoes. I look upon this problem as by far the most important that the Designer has to overcome, and I consider

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1. White, 'Modern Warships' Speech at the Mansion House, Jan 1887 Printed Pamphlet, Naval Library.
2. Vernon 1897; ADM 180/17.

> no trouble or expense should be spared in carrying out experiments that may possibly lead to the protection of a large ship from such an explosion.[1]

The suggestions flowed in. Captain Egerton of Vernon proposed a light outer skin, perhaps even of wood, with an empty space between it and the actual bottom of the ship, thereby keeping the explosion away from the vessel.[2] The ADNO, Captain H.B. Jackson suggested that the ideal answer might be the construction of an armour plate of sufficient strength to withstand the explosion, but he recognised the huge weight that this would involve, and concentrated on minimising the effect of the explosion. This would be best achieved by keeping the explosion away from the ship, and by employing coal to absorb the rush of gases and distribute its effects. He, at least, remembered the Resistance experiments. Finally, if the armoured deck were discontinued above the third inner skin, the gases would be able to escape upwards instead of being forced against the ship's side.[3]

Watts himself favoured experiments on armour plate, and the relative capacity of coal and water to absorb or transmit the explosion. He warned against increasing keel sizes, because of the problem of deck spaces,[4] His ADNC, Berry, proposed that a 'target' of water, dry corn pith, cellulose and coal should be constructed on the Belleisle to test these ideas.[5]

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1. May to Watts, June 1902; ADM 1/7687.
2. Egerton minute, 7 Nov 1902; ibid.
3. Jackson minute, 8 Nov 1902; ibid.
4. Watts minute, 17 Dec 1902; ibid.
5. Berry minute, 24 Jan 1903; ibid.

May was optimistic when all these suggestions flowed in. He noted that the Resistance experiments had ended when good results seemed likely, and that it appeared possible to design a ship capable of sustaining and resisting torpedo explosions.[1] The First Lord, Selborne, shared his hopes. 'I believe the experiment to be the most important we have yet tried'.[2] Great pains were taken to ensure a realistic explosion against the target,[3] but the results were disappointing. Four armour plates were driven in by the explosion, the framing and plating was broken up, the dividing bulkhead cracked, and the armour shelf carried away. Water penetrated the boilers, one of which was moved bodily 25 feet. The cellulose stuffing was blown away, the water ineffective, and the coal merely held its own. Watts reported: 'Generally, the damage done to the structure of the target is such that it is apparently impossible with plates and angles of the sizes at present in use and with our own present system of rivetting to construct a side capable of withstanding the explosion of such a large charge of guncotton'.[4] Egerton proposed strengthening the wing bulkhead, and filling all the compartments with coal.[5]

May, however, had had enough. 'I regret it very much, but I fear we must accept the position that with our present knowledge it is not possible to make a ship unsinkable against the attacks

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1. May minute, 26 Jan 1903; ibid.
2. Selborne minute, 1 Feb 1903; ibid.
3. Constructor Tupper minute, 19 May 1903; Lieutenant Ogilvy minute 21 May 1903; ibid.
4. Watts report, 1 Oct 1903; ibid.
5. Captain Ogilvy of Vernon, 21 Oct 1903; ibid.

of the 18in Whitehead torpedo, without going to a prohibitive size.' Further experiments, he concluded, were hardly worth the cost.[1]

This was a major error of judgement. It is true that the effect on the target was devastating. Yet only one explosion had been tried, and this was against a compendium of water, cellulose, coal and air. Coal had performed reasonably, but the other packings had failed. Indeed, it is possible that the other packings had worked against the coal, thereby diminishing its effectiveness.[2] To consider a problem so urgent that 'no trouble or expense should be spared', then to test, unsystematically, all the possibilities at the same time, so that one cancelled out the other, and finally to give up, is hardly the most likely way to solve the problem. There had at least been some sort of system to the Resistance trials. There was none to the Belleisle trials. Both were given up far too early, but the latter never had a hope of success.

It was the spectacular fate of the battleships mined in the Russo-Japanese War which gave the decisive impetus to the solution of the problem. H.M.S. Dreadnought was intended to be able to resist all underwater attack. Fisher, now First Sea Lord, was determined to eliminate the pipes and valves which had pierced the transverse bulkheads of White's ships and thereby weakened the effectiveness of their internal watertight protection. The Dreadnought however, incorporated still more improvements. The

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1. May minute, 7 Dec 1903; ibid.
2. Watts report, 1 Oct 1903; ibid.

British Naval Attache in the Far East, Captain W.C. Pakenham, observed that the battleships had been sunk not by the direct effect of the mines, but by the explosion of their magazines, which, being in direct contact with the side of the ship, had been detonated by the mines. At the same time, he noted the effectiveness of the system[1] in the Russian battleship Tsarevitch, which was similar to Jackson's proposal for the main armoured deck to curve down over the magazines. As a result of this information, it was proposed to place the magazines and boilers clear of the ship's sides and protected by an extension of the armoured deck, forming a complete armoured longitudinal bulkhead. A gap between the bulkhead and the outer skin would probably absorb most of the explosion.[2]

Experiments appeared to show that two inches of armour on the bulkheads was quite sufficient.[3] This was just as well; a further two inches of underwater protection would have involved an extra displacement of 900 tons. This would have been unacceptable, and the protection would consequently have had to be provided at the expense of the armour already allocated to the redoubts and turrets. Underwater defences had already been provided by limiting the upper works; more could not be provided without weakening the vessel as a gunnery warship.[4]

The principle of this mode of construction was sound enough,

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1. See Appendix One, p. 342.
2. Pakenham & Noel, 25 Aug 1904; Pakenham to Admiralty 27 Sept 1904, 29 Sept 1904; Noel Mss, NOE 8. Fisher Papers ed P.K. Kemp (Navy Records Society, London 1968) I 78.
3. Notes for Parliamentary Secretary. Memorandum by Lord Tweedmouth n.d.; Tweedmouth Mss.
4. Report of Committee on Designs 21 Feb 1905. Kemp op cit I 204-05.

based on an assessment of the nature and behaviour of underwater explosions. It was adopted as a standard fitting for all dreadnoughts, though there were some variations in its practical application. On some, only parts such as the turrets were defended, while on others, continuous longitudinal bulkheads were built along the whole of the ship's length. The maximum protection was achieved in the Queen Elizabeth class dreadnoughts which incorporated a 2 inch armour belt ten feet from the ship's side, stretching from stern to stern.[1] The Admiralty claimed that this protection served well,[2] and up to a point it did. H.M.S. Marlborough, torpedoed at Jutland, suffered flooded boilers, but her magazines remained intact behind their armour. The latter were, however, 22 feet from the explosion.[3] Had the distance been less, the results might have been different.

Indeed, nobody suggested that the system was either perfect or gave the best protection. The priorities were not, however, in doubt. Jellicoe observed:

> The main feature of British ships is a superior weight of metal fixed and ... the corresponding disadvantages are much inferior protection on the side for the gun positions, conning towers, internally against torpedo explosion, and in some cases inferior speed. We may be right in giving greater prominence to offensive qualities, and I believe we are right, but we may be wrong and in an important matter of this sort we ought not I think to assume that we are entirely right ... the inferiority of the protection of the British ship against gun and torpedoes is very striking. This is undoubtedly the weak point in the design of our ships. Further, the Germans have far more complete inner armour protection against torpedoes than we have.[4]

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1. See Appendix Two p. 343.
2. Capital Ships 1905-18. DNC Memorandum, Jan 1918; ADM 116/1428.
3. Damage by Mine or Torpedo to Unbulged Vessel, ibid.
4. Jellicoe to Churchill, 14 July 1914; Jellicoe Mss. Add Mss 48990.

In other words, protection was provided only when it did not militate against speed and gunnery, those offensive qualities of the Fisher ideal. Underwater protection was a comparatively low priority. Nevertheless, the problem was not as simple as that. The scale and difficulties were always increasing. As Bacon pointed out, even if protection were devised against a 200lb charge, bigger torpedoes would be developed. What protection was possible against a 500lb mine?[1] It was a genuine dilemma, which was aggravated by the problem of docking. If ships were widened so that the magazines were well inboard, there would be no dock of sufficient size to accomodate the vastly enlarged ships.

Naval architects outside the service had meanwhile been applying themselves to the problem, but were not consulted. The issue came to the fore in 1914, by which time the range and power of the torpedo had increased considerably. T.G. Owens praised the introduction of longitudinal bulkheads, but pointed out that 15 feet between the armour and the explosion was the minimum safe distance, and it was this distance which was more important than the thickness of the armour involved. The Admiralty, in fact, was sailing close to the wind in their defensive precautions. Owens proposed a curved explosion bulkhead, with air and coal spaces for defence.[2] Professor H.J. Biles suggested that battleships could be protected against underwater attack, provided that the Admiralty was prepared to sacrifice two knots of speed.[3] Sir Philip Watts also believed

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1. Bacon Note, Kemp op cit I 146.
2. T.G. Owens, 'Some Questions relating to Battleship Design' INA LVI (April 1914) 1-23.
3. H.J. Biles 'On the Protection of Battleship from Submarine Attack' INA LVI (July 1914) 257-262.

that the provision of sufficient inner spaces would give adequate protection,[1] Professor Hovgaard reasoned that curved bulkheads were far more suitable shapes for receiving the shock of an explosion.[2]

This formidable array of experts voiced doubts which were reflected by the new DNC, Sir Eustace Tennyson d'Eyncourt.[3] The considerable additional cost and weight of the Queen Elizabeth's underwater protection meanwhile raised questions about its value and effectiveness, and experiments were sanctioned in February 1913. The old battleship Hood was converted to resemble the internal construction of the Queen Elizabeths, and experiments were conducted on her, between February and May 1914.

The results were discussed at a Conference in September 1914, when it was decided that a system of empty and filled compartments backed by a strong water-tight bulkhead set back from the ship's side, was the solution to the problem of underwater protection. Further experiments were necessary on the detailed application of these principles but 'the urgency of war requirements .... made it impossible to follow up the question at the time'.[4] Prima facie, this is an astonishing statement. Surely, war made further information all the more necessary? The answer lies in the inadequacy of dock facilities and the pressure on ship-building resources.[5] D'Eyncourt had superintended the Hood trials and

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1. Watts comment on ibid.
2. Hovgaard comment on ibid.
3. Sir Eustace H.W. Tennyson d'Eyncourt (1868-1951) Naval Architect with private industry before becoming DNC 1912-23.
4. Experiments on the Underwater Protection of Warships 1913-17, DNC memo, April 1918; ADM 116/5118.
5. See p. 302-3.

pressed the work with vigour, but the war had overtaken the experiments. The DNC found himself experimenting with new protective methods on ships actually engaged in war.

The Hood trials provided the information on which the development of 'bulging' was based, while the war provided the urgency which swept aside considerations of size and cost.[1] The principle behind bulging, that the explosion should be kept at maximum distance from the ship by the addition of a separate outer skin, was firmly rooted in Elliot's crinolene and the whole concept of double bottoms. In a sense, the gap on the dreadnoughts between armoured bulkhead and the ship's side was a form of bilge. However, the sheer size of torpedo explosive power now necessitated an additional skin outside the ship's hull. The first public recognition of this came in 1912 from Admiral Sir Sydney Eardley Wilmot, in his fictional pamphlet 'The Battle of the North Sea'.[2] Official action was inevitably slower, but the despatch with which the Hood trials were conducted indicates that the DNC was neither loath to take action, nor unreceptive to new ideas. The gap, however, between taking a decision and seeing it put into practice, was as long as it took to build a new class of warship. By 1914, therefore, torpedo development had outpaced ship construction, despite d'Eyncourt's attempts to counter the menace.

It could not be argued that any serious attempt had been made, prior to the Dreadnought, to provide the navy with a battleship which could meet Tryon's requirements. The issues were side

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1. See p. 300-301.
2. Eardley Wilmot 'The Battle of the North Sea', Printed Pamphlet Naval Library.

stepped by officers and architects, and the spasmodic experiments displayed a lamentable lack of sustained or analytical work, which reflected the low priority assigned to the issue. Only with the Dreadnought was it seriously considered possible to build an unsinkable ship, but even then the priorities were such that the principles which made this possible were not applied. Therefore, although the dreadnoughts were unlikely to share the sudden fate of their predecessors in the Russo-Japanese War, the Russian flag-ship the Petropavlovsk having blown up and sunk with spectacular and horrifying speed on being struck by a mine, they were not unsinkable because it was believed that the precautions necessary to ensure this, would seriously weaken their speed or capacity as gun-vessels. Limitations on dock-space and money were a serious problem, but both were overcome when the need was recognised in 1914-18.

The fact is that underwater protection was a comparatively low priority, and the question was consistently shelved because it appeared to involve a fundamental change in the nature and therefore the role of the battleship. That protection was possible without radically upsetting the traditional patterns of naval warfare, was proved by d'Eyncourt's work during the war.[1] That his efforts were not matched by the preceding Boards of Admiralty was a major and unnecessary omission which cost the navy heavily. It was a provision which could and should have been made.

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1. See pp. 298-303.

CHAPTER FOUR - THE FOREIGN CONTEXT

(a). Foreign Wars

The technical development of the Whitehead torpedo and the appropriate counter-measures, took place virtually in a strategic and tactical vacuum. Necessity had played no part in the process, for the entire period was one of peace for Britain. The result was a complete absence of war experience, from which the effectiveness of the weapon could be judged.

In the entire pre-war period, the Royal Navy fired only one torpedo in anger. It was also the first Whitehead ever to be used. On 29th May 1877, the cruiser H.M.S. Shah was engaged with the Peruvian rebel and pirate ship Huascar, off the South American coast. 2½ hours of gunnery had achieved nothing, so in desperation the Shah fired a torpedo. The enemy turned away at 11 knots, and the torpedo, which was capable of only 11 knots, missed.[1]

This lack of first-hand experience emphasised the importance of foreign developments, the most significant of which took place in the Black Sea in 1877-78. Russia used small steam launches across the Sea, so that they could attack the Turkish fleet by night as it lay at anchor. After several failures, the Russians claimed a success on the night of Jan 27-28, 1878.[2] The Turkish admiral, Hobart Pasha, denied this vigorously,[3] but the Russian navy was convinced, and so were many French and German commentators.[4]

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1. H.W. Wilson Ironclads in Action (2 vols. 6th ed, London, Sampson, Low Marston and Company, 1898), I, p. 307-11.
2. Wilson ibid . I, p. 286-304.
3. Hobart Pasha 'The Torpedo Scare' Blackwood's CXXXVII (June 1885) 737-47.
4. See Lieutenant Arnault 'The Employment of TBs against Ships' trans E. Meryon, RUSI XXIII (1879), 1038-56; 'On TB Tactics' trans T. Brassey, RUSI XXIV (1880), 713-18.

Not until 1891 was the Whitehead torpedo successfully employed again, when the insurgent Chilean ironclad Blanco Encalado was surprised and sunk by two government torpedo vessels as she lay at anchor. One out of the six torpedoes, fired at point-blank range, was sufficient to destroy the unprepared Blanco. The confusion surrounding the facts of 1877-78, had vitiated much of the value of the experience, and the Blanco episode did little to increase knowledge.

> Once more, as in all minor struggles, we have exceptional circumstances, which would not be likely to recur in a European conflict. For an ironclad to be at anchor without nets, without launches to protect her, without a searchlight, and with a very insufficiently trained crew on the top of all this, points to a singular carelessness on the part of her commander ... If captains choose to imperil their ships as Captain Corri imperilled the Blanco, then they will lose them. But French or English ironclads are not likely to be in open waters without taking the most elementary precautions.[1]

Similar doubts surrounded the sinking in 1894 of the rebel Brazilian ironclad Aquibadan, by a government torpedo boat. The ship was anchored with no net protection, and her gunnery was atrocious. The major problem was not in sinking the ironclad, but as in 1877-78, in finding her in the darkness. Once discovered, her doom was certain.[2]

Events in the Sino-Japanese War of 1894-95 led to widely differing conclusions. The Chinese warships at the battle of the

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1. Wilson op cit II, 21-29; also William Laird Clowes 'Naval Episodes of the Chilean Civil War' The Naval Annual 1892, 129-52.
2. ibid, pp. 43-49.

Yalu jettisoned their torpedoes for fear of an explosion, while the performance of the single Chinese TB was hardly impressive. Of three torpedoes fired at a crippled Japanese merchant ship, one failed to run, one missed and the other dived under her. Some observers, including the official NID report, could and did argue that this showed the torpedo to be useless.[1] However, the moral effect of the presence of two Chinese TBs was sufficient to persuade the Japanese to stand off during the night, while the attack of the Japanese TBs on the Chinese fleet anchored in Wei-Hei-Wei harbour, was noted with admiration in Whitehall. Despite extreme cold and violent weather, the assault was pressed home successfully.[2] Lord Spencer noted that the destruction wrought by torpedoes was 'a splendid object lesson and would open the eyes of many people who did not realise what torpedoes can do ... the most powerful armoured ships are as vulnerable as a corvette, nor do they know how useless with modern inventions their nets are.'[3] On the other hand, the Chinese defences had been demoralised and disorganised.

Even in this major naval war of the nineteenth century therefore, there was reason to be sceptical of the value of the information gained. Exceptional circumstances and the 'want of discipline or peculiar habits' of the foreigner,[4] rendered all these minor wars of very little value. The Russo-Japanese War of 1904-05 was rather

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1. Phipps Hornby 'The Yalu Action'. USM X (Nov 1894) 137-41; Laird Clowes 'The Naval War between China and Japan', the Naval Annual 1895, 90-126; 'Lessons from the War,' ibid, 126-144, NID commenting in 'Modern Naval Operations' NID 582.
2. Captain W.S. Henderson and Lieutenant F.S. Fitzherbert, 'Wei-Mei-Wei' NID 582.
3. Spencer to Culme Seymour, 12 Feb 1895; Spencer Mss, Spencer 7.
4. Captain Cyprian Bridge comment, RUSI XXV (1881) 316-42.

different and its results are noted elsewhere.[1] In the nineteenth century, however, the naval officer in search of a serious assessment of the torpedo would have to look elsewhere. It was this lack of useful information which gave foreign opinion and the manoeuvres of all navies their peculiar significance.

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1. See pp. 167-171.

(b) Russia and Germany

Russia possessed no Whitehead torpedoes before 1875, and her powers in torpedo warfare stemmed almost entirely from the exigencies of the war with Turkey. Not until Austria cut off supplies during that war did Russia develop her own torpedo-manufacturing capability. It was in 1878, too, that Russia acquired her armada of over 100 TBs, built by Messrs. Yarrow and Thorneycroft. Their hurried construction was reflected in the primitive single-screw propulsion system and the resultant difficulties of manoeuvring, but the Russians placed great faith in them as a result of their successes in war.[1]

'We cannot' explained a Russian admiral, 'owing to our poverty and climate, have a powerful or effectively manned fleet, but we feel that torpedo warfare, conducted by a staff of practically instructed officers and men, puts us on a level at a comparatively small cost, with the most powerful nations, so far as defensive war is concerned'.[2] It was this reasoning which led to the situation described by the naval attache in 1882:

> The tendency in the Russian service is as it appears to me, to consider gunnery as only a secondary importance, torpedoes holding the first place in their estimation, and being eagerly taken up by the naval officers, into whose hands even the military engineers are resigning their share ... The torpedo service is the most popular ... because it is encouraged and supported by the authorities ... because /there are opportunities for/ acts of dash and gallantry ... and lastly, the pay of all

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1. Report of naval attache, Captain Rice, 10 July 1880; 'Foreign Torpedo Warfare', Printed Pamphlet, Naval Library.
2. ibid.

ranks is nearly doubled.[1]

An official TB manual, produced in 1879, aroused great interest by advocating a role in formal, rather than sporadic partisan warfare, for the new vessel. Leading Russian naval theoreticians now talked freely of TBs surrounding and attacking the enemy fleets by day. Nevertheless, a clear distinction was still drawn between 'coastal' and 'high' seas. The Russians expected all operations to take place in coastal waters, where they would either be blockaded by a superior fleet or would support an amphibious or land operations. The TB, ideal as it was for coastal operations, fitted easily into this sort of strategy.[2]

It was for precisely this reason that the TB was not suitable for the Royal Navy. Nevertheless, the Russian manoeuvres were relevant to the British because they were based on precisely this type of warfare that the Royal Navy would have to contend in the event of hostilities. Although their lack of realism detracted from their value, much was instructive.

In 1884, a bombardment of Cronstadt was simulated. In 'the most interesting part of the whole attack' six TBs dashed out to attack the bombarding fleet. The naval attache, Captain Henry Kane, commented: 'It might have been done in war with a fair chance of success, as the boats were covered in smoke for a good part of the way. How many machine-guns the ships mounted I do not know, but certainly not many as the fire was by no means brisk. There

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1. Report of naval attache, Captain Beaumont, n.d.; Vernon 1882; ADM 189/2.
2. Captain Dubassov lecture at Cronstadt, trans J.W. Maury, 23 May 1885; FIC 97.

were no nets or other defences around the ships'. Similarly, an attack by the TBs on an anchored fleet gave the impression that considerable losses could be expected by the blockaders. However, the fleet action which ended the exercises was a chaotic shambles, and gave no guide to the capabilities of the TBs in this role.

Kane was wisely sceptical. He noted that steam tactics had been completely neglected because of the obsession with TBs. 'The officers are enchanted with the TBs generally, they say that during the fortnight, they would have blown up all the large ships, and that ironclads are no longer of any use; but that must be taken for what it is worth, torpedoes are their strong point and they make the most of it'. Ironclads were 'set up' for torpedo attacks, often being anchored without nets, while TBs were often under fire for as long as three-quarters of an hour without being deemed <u>hors de combat</u>.[1]

Nevertheless, the peculiar Russian conditions were eminently suited to TB warfare, for the waters were mainly calm and sheltered, and the islands and rocks with which they were dotted afforded excellent cover for small launches.[2] The implications were there for Whitehall to see. While Kane was correct in emphasising the unreal conduct of the manoeuvres he and his superiors failed to realise the difficulties which the Royal Navy could well encounter if it were to operate as seemed very likely in the unique circumstances of Russian home waters.

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1. Kane report, 'Russian Manoeuvres in the Baltic', 3 Sept 1884; FIC 50.
2. See also 'Russian Baltic Manoeuvres, 1882, 1883, 1884'; FIC 77. 'Russian Manoeuvres in the Gulf of Finland'; FIC 85.

For much of the 1870s the Whitehead was regarded with some scepticism in Germany.

> Opinion [was] adverse to the use of the fish torpedo invented by Messrs. Luppis and Whitehead, because from its small speed it is so liable to be acted on by currents that the chance of hitting a vessel would be very small. They are, equally, adverse to Harvey's torpedo because though excellent for day service, it could not in their opinion, be used at night with any amount of certainty.[1]

This opinion is an interesting contrast to the optimism of British naval officers,[2] and it persisted until 1878. In that year, the new Minister of Marine, General Stosch, re-organised the Torpedo School at Friedrichsort, and poured money into it.[3]

This was certainly needed. Captain Tirpitz,[4] the Captain of the torpedo vessel Ziethen and the leader of the 'torpedo' faction, 'began, so to speak, from nothing at all, and often worked partly as a tinker with my own hands, making myself apparatus.'[5] His work certainly earned the commendation of the British naval attache, who in 1882 reported that three or four years of continuous and systematic experiments with the Whitehead torpedo had put the Germans well ahead of the Russians, although 'not all officers were aware of this or unanimous as to its benefit'.[6]

The main pre-occupation was discharge from armoured ship, as

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1. Colonel Stotherd 'Report on Outrigger TBs' 17 Oct 1871; ADM 1/6241.
2. See pp. 26-7.
3. Report of naval attache Commander Grenfell, 10 Aug 1878; 'Foreign Torpedo Warfare'. Printed Pamphlet, Naval Library.
4. Admiral Alfred von Tirpitz 1849-1930. State Secretary of the Imperial Naval Office 1897-1916.
5. Tirpitz, My Memoirs (2 vols, London, Hurst and Blackett Ltd.) I 36
6. Beaumont report, Dec 1882. Vernon 1884; ADM 189/4.

in the Royal Navy,[1] but the TB found advocates after the Russo-Turkish War.[2] In 1882, the TBs so impressed the new Minister Caprivi, that they took part in the fleet manoeuvres which followed.[3] In 1885, their performance was particularly impressive. The ironclad fleet was hove to off the Jade, a full 40 miles from Wilhelmshaven, believing that in a moderately fresh wind the TBs would be unable to come out. However, the TBs did come out and several battleships were adjudicated sunk before their crews were even awake. 'I think that anecdote is peculiarly instructive, because it is exactly what might happen during real war. Officers will get tired and worn out, and will be glad now and again to take things easy', observed Kane.[4]

The TB had therefore taken root as the main agent of the torpedo in these two northern European countries, while the activities of their navies had shown that a British fleet operating in their waters would be subjected to harassment which would make its task, at the least, dangerous. As a coastal weapon, the TB had obvious potential. The evidence appeared to show that it could be ignored only at England's peril.

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1. Tirpitz, op cit, I, 40-41.
2. 'On TB tactics', trans Brassey, RUSI XXIV (1880), 713-18.
3. Tirpitz, op cit, I, 41-42.
4. Kane report, 'German Naval Manoeuvres 1884', 3 Nov 1884; FIC 59.

(c) France

Information from foreign wars was scanty, while Russia and Germany could, with some justification, be discounted as major threats to British sea-power. France, however, was the traditional rival and the likeliest enemy. She could not be ignored.

The French initially lacked the enthusiasm of the Russians or the systematic dedication of the Germans. Advocates of the torpedo were few and their arguments tentative.[1] Nevertheless, by April 1884, the French TBs had been sufficiently developed to take part in fleet exercises. Three 45 ton 108 foot vessels accompanied the fleet to sea in a gale, though not without considerable discomfort; 'the question of cooking is of no importance if the boats are forced against the sea, because there is so much shaking, caused by the vibration, that even a crew of the most inured sailors are not in a fit state to appreciate a colossal meal'.[2] This faint praise was intended to promote the cause of the TB, and the enthusiasm of its advocates was increased by a major tactical breakthrough in the exercises of June 1884.

The French fleet was attacked by a flotilla of TBs as it was steamed from Toulon to Tangiers. This was the first time that a fleet had been attacked while under weigh, and the importance of this event was not minimised by the prior knowledge of the squadron's course and speed. Furthermore, the lesson was obvious. Despite

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1. Kane report, 26 June 1884, Vernon 1884; ADM 189/4. Precis of early Jeune Ecole theories by Captain R.N. Custance 'Preliminary Remarks' in FIC 108.
2. Le Temps report, quoted in Vernon 1884; ADM 189/4.

the brilliant moonlight, the TBs were within 1000 yards before being sighted, and by travelling at 18 knots were within a torpedo range of 400 yards after only 30-40 seconds under fire. Captain Markham of Vernon noted: 'We can imagine what would be the result of a flotilla of TBs unexpectedly attacking a hostile squadron by night.'[1]

This was the background to the publication by the French naval writer Gabriel Charmes, in 1884, of Les torpilleurs autonomes et l'avenir de la marine. In this, he claimed that TBs were capable of sailing on the open seas and contesting those waters with major warships. Slow ironclads, he argued, could be overwhelmed by numbers of TBs. 'nous sommes donc a la veille d'une revolution maritime qui remplacera les grandes masses actuelles par des quantites de batiments de dimensions diverses.'[2] The point was emphasised in three articles in the Revue des deux mondes in the winter of 1884-5, while 1886 saw the exposition in La Reforme de la Marine of the theory of naval warfare whose adherents became known as the Jeune Ecole.

Charmes argued that the British Empire could be brought down by the destruction of her commerce, which new developments in naval warfare now made possible. Steam cruisers would devastate British trade routes where sailing vessels had in the past been brought to bay. An essential subsidiary argument, however, was that a force of gunboats and TBs could challenge and if necessary destroy British

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1. Vernon 1884; ADM 189/4.
2. Gabriel Charmes, Les torpilleurs autonomes et l'avenir de la marine (Paris 1885) p. 25.

ironclads. Large numbers could roam the Channel, the North Sea, the Baltic and the Mediterranean, devastating merchant shipping and overwhelming such warships as opposed them.[1] The ADNI, Custance,[2] noted with some concern that it was now claimed that TBs could defeat battleships by day. 'Is this not a new idea?' he asked.[3] Even though the Jeune Ecole intended TBs to be used mainly by night and in thick weather, the theory now was that the ironclads, on which the power of the Royal Navy was based, were so vulnerable as to be useless.

It was an open secret that the brain behind Charmes' literary skills was Captain Hyacinthe Aube.[4] When he became Minister of Marine in 1886, he had the opportunity to put his ideas into practice. The Torpedo School was transferred from the isolation of Boyardville in Brittany to the centre of activity at Toulon, where an independent torpedo factory was established, matched by a separate torpedo department in Paris. Aube revised the content of torpedo officers training courses, so that the Whitehead torpedo replaced chemistry and electricity as the main object of training.[5]

A series of tests was undertaken to prove his theories. An old floating battery was subjected to an explosion, which sank it. Custance, a convinced big-ship man who followed events with interest,

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1. Charmes La Reforme de la Marine (Paris 1886).
2. Admiral Sir Reginald N. Custance (1847-1935). ADNI 1886-90, DNI 1899-1902, Second-in-Command Channel Fleet 1907-08, retired from the Service 1908.
3. Custance to Phipps Hornby, n.d.; Phipps Hornby Mss Phi 120b.
4. P.H. Colomb 'Naval Reform' RUSI XXXI (1887), 767-86.
5. Vernon 1886; ADM 189/6. Hall minute 22 Jan 1886, 10 April 1886; Kane report 13 May 1886; ADM I/6827.

doubted the value of this exercise. Vernon on the other hand was convinced, clearly a straightforward clash of belief, which was evident again in observing seagoing torpedo experiments. A TB fired torpedoes at the battleship Richelieu, to test the widely held belief that a bow wave would deflect a torpedo. At 400 yards range, the Richelieu was hit, despite a speed of 15 knots. Le Yacht, organ of the Jeune Ecole, and Vernon, were satisfied. Custance again was sceptical. The exercise may have been feasible in smooth seas, but there was no indication that a torpedo could be fired accurately, if at all, in rough waters.[1]

Seaworthiness and habitability on the open seas were essential factors if the TB were to live up to the expectations of its advocates, and it was to investigate this that a TB sailed from Brest to Toulon. Her captain, Lieutenant Leroi, who was to become a leading Jeune Ecole theorist, was optimistic, although the best praise he could muster was faint enough. Reasonable comfort was quite possible, life never absolutely wretched, nobody sick, the fatigue not extreme, the damp not intolerable, not much sea was shipped and the rolling never really dangerous. Custance made the perfectly fair inference that things could not have been much worse. Aube and Leroi, however, chose to be satisfied.[2]

Having established these basic facts to his own satisfaction, Aube then embarked on a series of manoeuvres designed to test the capabilities of the TB in action. The results were anything but

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1. Vernon 1886; ADM 189/5. Custance 'Remarks'; FIC 108.
2. Leroi report, Naval Annual 1886, 146-152. Custance 'Remarks' FIC 108.

inspiring. TBs completely failed to prevent the bombardment of Toulon by ironclads, when squally weather reduced their speed to almost nothing. Night operations against the blockading squadron showed that the ironclads would be in some danger, but in more extended tasks the TB failed. For instance in one operation 20 TBs attempted to intercept a squadron of ironclads as it rounded Cape Corse. Only one TB even found the ironclads, which proceeded at high speed without lights, while the TBs were visible for miles owing to the clouds of smoke and sparks which they emitted. The squadron should subsequently have been attacked as it lay at anchor in Ajaccio harbour, but the TBs, exhausted from the effort of interception, found an 'ordinary fresh Mediterranean breeze' too much for them. Similar disappointment awaited an attempt to intercept a squadron passing between Ibiza and Majorca. The TB could see very little by day and nothing by night, while after only 77 hours steaming was reduced to a mere 11 knots, attempts to work up speed resulting merely in clouds of smoke and sparks.

The French sailors had no doubts about the correct interpretation of events. Prior to the maneouvres, they had been led to believe that a vessel attacked by TBs was doomed, for 'if not sunk initially, it would be struck such a violent blow that its crew would be killed in a sudden and mysterious manner'. The TBs had, however, performed abysmally, seldom reaching their target and often breaking down. Consequently, 'men who formerly held TBs in the greatest dread now profess to have the greatest contempt for them'.[1]

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1. 'French Naval Manoeuvres in the Mediterranean 1887'; NID 130.

The Jeune Ecole, however, far from being discomfited, was quite pleased.[1] Fresh exercises in 1887 were therefore designed not to investigate whether the TB could be used, but what sort of TB was necessary. Results were no better than the previous year. A convoy made the passage between Toulon and Algiers, and TBs based on Ajaccio and Port Mahon were ordered to attack it. Despite the fact that the convoy's speed was deliberately restricted to 10 knots to facilitate the attack, the TBs failed to make the interception because of bad weather, and after only one day at sea were in such danger of sinking, that they were obliged to run for shelter.[2]

A change of government brought the exercises to a premature conclusion, leaving many questions unanswered. For instance, Very lights were used to indicate the firing of a torpedo. Custance observed with some justice that this rule assumed that torpedoes could actually be fired at sea, 'which is to assume the solution of a problem very far from being solved'. In fact, French experience showed that in practice things were far from easy. With her head to the sea, a TB could not fire at all, and waves often caused sufficient sheering to induce inaccuracy when firing from leeward. Even in calm waters, deflection of up to 15^{o} was often caused merely by the shaking and vibration of the TB.[3]

If these questions were unanswered, there could be no doubt

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1. 'Les experiences maritimes de 1886'; Printed Pamphlet, Naval Library.
2. 'French Naval Manoeuvres in the Mediterranean 1887'; NID 130.
3. Custance 'Remarks'; ibid.

that the 'TB in open seas is a much exaggerated weapon of offence'.[1] On only one occasion in the 1880s did it appear to offer a substantial threat. In 1889, a squadron of ironclads representing a blockading fleet was attacked apparently successfully as it lay at anchor by night off St. Vaast. But look-outs had not been employed by the defence, and since torpedoes had not been fired the effectiveness of net protection could not be gauged. Furthermore, there was no guarantee that torpedoes could have been aimed accurately, even if they could have been fired at all in the prevailing weather. On the other hand, neither the wildness of defensive gunnery nor the strain of a 'strict look-out' were taken into account.[2] With so many imponderables, the value of this exercise was strictly limited.

Continued shortcomings in the capabilities of the <u>défence mobile</u> could not be concealed. In the same year, an ironclad squadron representing an Italian fleet was ordered to ravage the coasts of the South of France. This it did so effectively that the manoeuvres were hastily called off before the inadequacies of the <u>défence mobile</u> were revealed too starkly.[3] Similar fiascoes followed in 1892 and 1893.

Indeed the TB threat of 1890 would appear to have been grossly exaggerated if the evidence of the French manoeuvres is taken into account. The exercises themselves varied from the routine to the

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1. Lord George Hamilton to Vezey Hamilton, 9 May 1887; Vezey Hamilton Mss, VHM 9.
2. 'French Naval Manoeuvres 1889'; NID 213.
3. <u>ibid</u>.

most bizarrely unrealistic, such as the 'forcing' of Toulon harbour in 1891. The TBs performed poorly, both in manoeuvres and in training. Torpedo target practice in 1892, for instance, 'appears to show great ignorance on the part of the TB's crew in the management of their weapon'. The same pattern was evident in 1893. On one occasion a TB fired seven torpedoes at a target. Of these, one passed astern and one ahead, one missed only narrowly, one stopped half-way, one deflected, one sank immediately and one hit after travelling on the surface.[1]

Attempts to make the TB a sea-going threat to the battleship were discredited by the very manoeuvres designed to prove Aube's thesis, while in its very reduced role as a harbour and coast defence vessel, the capabilities claimed by its advocates were never demonstrated in practice. The TB was repeatedly in difficulties merely in steaming on the high seas, which dramatically reduced its claimed speed. By night, when it was reputed to be at its deadliest, the TB was often unable even to find the enemy. Even in its most limited role of coast defence, it was pathetically inadequate, mainly because the standard of the French TB force seemed to be in permanent decline after Aube's departure.

Custance therefore had good grounds for disparaging the TB threat. The critical point was how often the TB could deliver its deadly weapon, and the evidence from France supported the contention that this would be infrequent. The pathetic displays

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1. 'French Naval Manoeuvres 1891'; NID 281, 'French Naval Manoeuvres, 1892'; NID 329. 'French Naval Manoeuvres 1893'; NID 369.

of the 1890s reinforced this opinion. On this evidence, Custance and his successor, Captain Cyprian Bridge,[1] were fully justified. Their arguments met with considerable opposition in the 1890s, however, when the TB became the bogey of the Royal Navy. In this decade, first-hand evidence from the manoeuvres of the British fleet was available, and this assumed a primary importance.

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1. Admiral Sir Cyprian Bridge (1839-1924). Joined Service 1853 and became C-in-C China Fleet before retiring in 1904. A widely read naval thinker who wrote extensively on Service matters.

CHAPTER FIVE - THE WEAPON IN ACTION

(a) The Naval Manoeuvres: the 1880s.

Information about foreign wars was scanty and unreliable, and bore little relation to a major European conflict. The value of the Russian manoeuvres lay in their context and their illustration of a potential threat, but the intentions and assumptions of the participants obviated much of their value. The French, too, contrived their exercises, so that although the more obvious limitations of the TB were emphasised, many points remained at issue. A correct assessment of the danger of the TB could be based only on much more extensive information, free of the bias which intruded upon foreign exercises. Direct experience and first-hand knowledge were necessary.

In the early 1880s, both these elements were minimal. Fleet manoeuvres simulating war situations were quite unknown. Naval exercises took the form of 'evolutions' or 'tactics' which were concerned entirely with handling fleets of large steam vessels. Critics doubted the value of these exercises,[1] but were less than fair to such men as Sir Geoffrey Phipps Hornby, who were making pioneer studies of the problems arising from the introduction of steam. Indeed, many admirals neglected even these evolutions. For instance, in 1877, Fisher wrote; 'No one in the Mediterranean has the faintest notion of it ..... astonished at apathy in all quarters ..... and ignorance and want of interest .....'[2]

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1. Sir Reginald Bacon, From 1900 Onwards (London; Hutchinson & Co. Ltd, 1940) p. 23.
2. Fisher to Phipps Hornby, 6 Mar 1877; Phipps Hornby Mss Phi 120a.

With this general lack of interest in tactical questions, it is hardly surprising that no attempt was made to evaluate the potential of the TB. This was left to the initiative of individual officers, few of whom displayed any concern. Although a few experiments were made in 1881 and 1883, when ships' boats attacked anchored ironclads, the Whitehead torpedo was not used, and reports of this sort of activity seldom gained any readers outside Vernon.[1]

Despite the early attention given to the torpedo, the TB was a weapon shunned by the Royal Navy, and not until 1884 were any of them exercised together. In that year, the torpedo depot ship Hecla and its TBswere taken to Berehaven by Admiral the Duke of Edinburgh. After a chaotic commissioning, they were exercised for a full fortnight. Edinburgh was anything but enthusiastic. Although the TBs were safe enough in a moderate sea, he reported; 'It cannot, however, be considered that they are in any way sea-going craft'. Flooding of the lower decks often made them uninhabitable, swamping was a constant risk, while coal and water supplies limited their radius of action to no more than 50 miles. They were therefore unlikely to be suitable for the blockade. The dangers of TB attack against the blockading force could not on the other hand, be ignored. Torpedo practice, for instance, had given good results, while TBs had been difficult to detect at night. Even when discovered, there were still dangers. 'How far machine-gun fire could be depended on to stop a torpedo attack delivered simultaneously by eight boats is doubtful, the men would be under great excitement, firing with a weapon they had never before used in the dark.'[2] This report is

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1. Vernon 1881; ADM 189/1. Vernon 1883; ADM 189/3.
2. Author's emphasis. Edinburgh report, 4 July 1884, Vernon 1884 ADM 189/4.

peculiarly instructive, because it illuminated all the problems of 'the TB issue'. Later manoeuvres virtually repeated the difficulties, without suggesting solutions.

This, then, was the somewhat rudimentary state of knowledge of the extent of the TB threat at the time of the diplomatic crisis of March 1885, when war with Russia seemed imminent, and the Fleet was preparing to go to the Baltic. This crisis was a fortunate event for the Royal Navy, for the first full-scale fleet manoeuvres were held as a direct consequence. When the prospect of hostilities receded, the Admiralty was faced with the problem of occupying the 'menagerie of unruly and curiously assorted ships',[1] which had been assembled under Phipps Hornby. Thomas Brassey,[2] the Civil Lord, suggested a review, but Phipps Hornby objected. The First Lord, Northbrook, reflecting the growing significance of the weapon, suggested 'experiments on attack and defence with Whitehead torpedoes'.[3] The First Naval Lord, Sir Cooper Key, eventually agreed to exercises. He 'objected as a rule to sham fights - they were apt to lead people astray. But he was much in favour of exercising officers and men constantly in handling both ships and TBs.' The fleet was therefore sent off to Ireland to exercise.[4] With such limited intentions, and in such a purely fortuitous manner, did fleet manoeuvres begin.

By now, the TB was <u>the</u> issue of the day. Rear Admiral E.R.

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1. Army and Navy Gazette 13 June 1885.
2. Thomas Brassey, first Earl (1836-1918). Civil Lord of Admiralty 1880-4, Parliamentary Secretary 1884-5. Founded Brassey's Naval Annual, Wrote widely on naval matters.
3. Brassey & Phipps Hornby discussions, 3 May 1885, Mrs Fred Egerton, <u>Admiral Sir G. Phipps Hornby</u> (Edinburgh and London; Wm. Blackwood and Sons, 1896) p. 349.
4. E.R. Fremantle, 'Ironclads and Torpedo Flotillas' <u>Nineteenth Century</u> XVIII 1885, pp. 657-73.

Fremantle noted with dismay that ideas similar to those of Charmes were being whispered in the fleet by younger officers,[1] and Hornby's instructions for the 'Evolutionary' cruise reflected the prominence of the subject. He was ordered to investigate the defence of harbours by TBs and submarine mines; the best means of defending anchored ships against TB attacks; the attack by TBs on enemy harbours; and the attack and defence of ships at sea with particular reference to the TB.[2] Northbrook himself took a personal interest in the question of auxiliary vessels and the Polyphemus, with which the Board was particularly concerned.[3] All these were the problems which a British fleet would face were it in the Baltic, and for which the navy was quite unprepared. Now, they were at least under investigation.

Hornby proceeded to Berehaven, where he spent two days constructing a boom and defensive batteries. Even Brassey, an apologist for the official line, admitted; 'It is open to doubt whether it would be practicable to execute such an operation in the presence of an enemy'.[4] This strong, carefully prepared defence was then attacked at a pre-selected time by a motley collection of boats of varying size. Hardly surprisingly the attack failed. Observers could not fail to note the shortcomings of an exercise which appeared superficially to justify the operation of improvising a safe base on the enemy coast. One torpedo officer commented; 'It would

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1. See note 4 p. 130.
2. Phipps Hornby 'Report on Various Points defined by Their Lordships as the Objects of the Cruise', 23 July 1885; ADM 1/6761.
3. Northbrook to Phipps Hornby, 23 May 1885, 31 July 1885; Phipps Hornby Mss, Phi 120b.
4. Brassey, 'Naval Incidents 1885', the Navy Annual, 1886, p. 117.

appear possible that on a dark night, a skilful and determined enemy might have got through the defences and reached the fleet'.[1] Once again, even Brassey was sceptical: 'An attack in actual war, in bad weather, on a dark night, against a blockaded squadron worn out with constant alarms, is another matter.'[2] The highlight of the Berehaven sojourn was the testing of the strength of the boom defence. The much vaunted torpedo-ram Polyphemus rammed and shattered it, while the efforts of the defending TBs to stave off the charge were skilfully evaded.

Experiments the following week in Blacksod Bay followed a similar pattern, while practice attacks by TBs on ships at sea led to some ominous conclusions. Although attacks from the stern could be cut up by gunfire as the ship steamed away, it was 'very possible that even in the daytime, a ship with such a weak bow fire as the /10,000 ton broadside armed ironclad/ Minotaur might be destroyed by TBs'. This impression was emphasised by the lack of suitable anti-TB armament, which was restricted to case-shot, and by the excellent target-practice of the TBs. Interestingly though, Hornby failed to note that while the quality of torpedo practice against a stationary target at 300 yards was impressive enough, this gave no indication of potential against a moving target.

Hornby concluded that a defensive system involving mines, booms and TBs was necessary for effective harbour defence. TB attacks

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1. Lieutenant F.T. Hamilton, Log of the Berehaven Operations. Tudor Hamilton Mss, HTN 105.
2. Brassey, Annual, 1886, p. 124.

would.be held off by the booms, which would be defended from ironclad and ram attack by the mines. However, in view of the serious doubts cast on the realism of the defences he had employed, it was unfortunate that he omitted any reference to the practicability of speedily improvising a sound defence on the enemy's coast.

His remarks on the TBs were curiously muddled. Their failure against the Polyphemus led him to argue that they were better suited for offence than defence, which in turn led to the conclusion that they were suitable for the blockade. This was quite illogical, for a particular tactical inadequacy in no way predisposes a vessel to a broad strategic role. Indeed, every other comment indicated that the TB was best used by the blockaded force rather than the blockader. It had the 'suggestive' capacity of appearing suddenly in the night, to attack the blockading squadrons, but lacked the seaworthiness to keep the seas. 'They have done what they were never intended to do, viz., accompany a squadron at sea. They have accomplished the voyage only through the pluck of the men that were in them, and at the cost of great fatigue and considerable suffering ..... I presume these boats will never be so hazarded again.' The logical conclusion, of the necessity for an investigation of the threat of the TB to the blockading squadron, was not drawn.[1]

Hornby's subordinates were more logical. Captain Dale, who had commanded one of the 'blockading' squadron, for instance,

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1. Phipps Hornby, 'Report' and 'Report on Various Points defined by Their Lordships as the Objects of the Cruise', 23 July 1885. These two despatches contain a narrative of events and the Admiral's own opinions ADM 1/6761.

emphasised the dangers posed by the torpedo vessel. Such was the threat, that the blockade would be virtually impossible unless a suitable vessel could be constructed to protect the ironclads from TB attack. He suggested 'a torpedo-vessel, self contained, capable of keeping the sea, with the same high speed as the TB, and the power to destroy them'. This proposal was seconded by Phipps Hornby's Flag Captain, J.A. Fisher.[1]

In some respects, these manoeuvres were a vindication of official policy, as some members of the Board were not slow to point out. TBs were as unseaworthy as the Admiralty had insisted. Sir William White observed that the specifications advanced by Dale approximated to 'a very close description of the Rattlesnake' class,[2] torpedo-catchers, which had recently been ordered, while the new First Naval Lord, Hood, noted that the Scout, another recent addition to the fleet, would be excellent for the outer blockade ring.[3] However, these correct inferences were a justification of only very recent changes of policy, for the Rattlesnakes were adopted virtually under the pressure of war, and were certainly not ready in 1885. The lessons of the manoeuvres could easily have been the lessons of war, and the teaching would certainly have been a costly business. Custance wrote with some justice: 'The Evolutionary Squadron was the greatest expose ever made of our utter unpreparedness and inadequacy in ships, guns, torpedoes and TBs.'[4] Nevertheless,

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1. Dale report, 4 July 1885, Fisher report, 22 July 1885; ibid.
2. Comment on Dale report, nd; ibid.
3. Hood minute, 26 July 1885; ADM 1/6761.
4. Custance to Phipps Hornby, 21 May 1885; Phipps Hornby Mss, Phi 120b.

despite all their shortcomings and Hornby's confused interpretation, the manoeuvres made reasonably explicit the principles underlying the role of the Rattlesnake and the TB. Equally, however, these exercises were only preliminary. Hood suggested that it would be advisable for similar exercises to take place every summer,[1] and from this remark began the regular fleet manoeuvres of the succeeding years.

The following year, both the Reserve and Channel Squadrons exercised at Berehaven, noting the difficulty of accurately estimating defence capabilities, particularly since some of the attackers showed a marked reluctance to be placed hors de combat.[2] The difficulties of realism in exercises were illustrated by operations at Milford Haven. The port was defended by the army and attacked by the navy, and the results were still being debated a year later. The navy claimed a success, which was strenuously denied by the army, with accusations of cheating. Certainly the naval commander appears to have shown an unwonted contempt for the defences.[3]

The experiences of the Duke of Edinburgh in the same year were rather more useful, because he employed TBs in his blockade of the Greek coast. Five were used as an inshore patrol, but this was possible only because the weather was good and the crews were able to rest on the ironclads by day. He reported that they were

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1. Hood minute 26 July 1885; ADM 1/6761. Vice Admiral Hewett report 27 October 1886, ADM 1/6812.
2. Admiral Baird report, 2 Aug 1886; ADM 1/6841.
3. 'Report of W.O. Committee on the Milford Haven Naval and Military Operations 1886', ADM 1/6888.

incapable 'of facing the ordinary contingencies of the weather', a point emphasised when two of them all but sank in transit to Malta, in weather no worse than that of normal Channel and Atlantic conditions. He criticised the arguments for a 'seagoing TB', because the result would be to lose the advantage of size without finding genuine seaworthiness. Two separate types of vessel were necessary. One should be the smallest which could be hoisted on board ship; the other the smallest vessel that could keep the sea. One should be about 100 feet long; the other 300 tons.[1] Again, practical experience justified official policy, as it was developing. Again, it was practical experience which could have been gained earlier.

1887 was a momentous year, in that for the first time the manoeuvres involved a scheme of campaign, arranged by the First Naval Lord and the DNI to resemble an actual war.[2] The results of these exercises went far to counter the apparent lessons of the French experiences and those of 1885-86, that the TB was over-rated. Rear Admiral Fremantle's squadron was intercepted and attacked by patrolling TBs as it passed the Straits of Dover. Two ironclads came under simultaneous attack from three TBs. Fremantle observed that it was 'not unreasonable to suppose that both the Black Prince and the Iron Duke would have sustained some damage in actual warfare'. Another squadron was intercepted as it was forcing the North Channel

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1. Report by C-in-C Mediterranean on the blockade of the Greek coast, 9 Nov 1886; NID 120.
2. Admiral the Hon E.R. Fremantle, The Navy as I have known it (London; Cassell & Co. Ltd. 1904) p. 327.

again on a clear night, with full moon and smooth water. The difficulties of shooting at a small fast object were deemed sufficient to give the advantage to the TBs, an interesting judgement in view of later developments. Whatever the merits of this opinion, there could be no doubt that the TBs had succeeded in intercepting and attacking, a feat which the French had found impossible.[1] The torpedoists rejoiced; 'We don't appear to have much difficulty, so I think an Englishman is as good as a Frenchman yet'.[2] Weather conditions had, however, been exceptionally favourable to the TBs, and accounted for their ability to work up full speed.

Despite the lessons of 1885 it was not until 1888 that the fundamental tenet of British sea-power, the blockade, was thoroughly tested. Berehaven and Lough Swilly were blockaded, with TBs featured prominently on both sides. The results were clear; the blockade could be broken with ease, and TBs were quite unsuitable for blockade work. There was unanimity that 'torpedo-catchers' were necessary, both because of their seaworthiness and to counter 'these dangerous little craft the blockaded TBs [which] were a source of constant anxiety and annoyance to the blockaded force during the night'. The assertions that TBs were useless for blockade work belied their success on the open seas in the previous year. While this was fair enough, no attempt had been made to assess their capacity for success in harassing the blockade. Yet without such an attempt it was meaningless to assert, as did the

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1. 'The Naval Manoeuvres of 1887' NID narrative and Fremantle's report, 9 Aug 1887; NID 137.
2. Gallway to Phipps Hornby, 30 Nov 1887; Phipps Hornby Mss, Phi 120b.

Committee of the Three Admirals, that the blockade was still feasible.[1]

The problem of deciding on the relative effectiveness of gun and torpedo had hardly been considered. In order to gain a success, TBs were obliged actually to fire their torpedoes, which were fitted with collapsible warheads. Ships, on the other hand, merely had to hold the TB under fire for a certain length of time. In 1887, it had been three minutes at 2000 yards range; in 1889 it was two minutes at the same range. The torpedoist Lieutenant Jackson claimed that two minutes at 200 yards would be more realistic, whereas Admiral Tryon believed that 90 seconds at 1000 yards was quite enough. He pointed out that 30 seconds under fire would mean a TB's certain destruction, and he assumed that the rule was intended to encourage TBs, by giving them a better chance than it was realistic to expect.[2] This argument assumed however that 30 seconds of fire would be accurate and the evidence indicates that this was a very optimistic assumption. One observer noted that ship 'fired' in all directions, 'so that friends suffered more than foes, a thing that will often happen in actual torpedo engagements'.[3] A junior gunnery officer wrote that 'on this occasion I must confess that guns had to take a back seat'. Not only were TBs invisible at over 100 yards, but 'hitting them was out of the question, save by chance, as it was exceedingly difficult to judge distance, and aligning them on the sights was more so, and, further, after the

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1. 'The Naval Manoeuvres 1888' NID narrative, with reports of Admirals Baird and Rowley, and the umpires. NID 179. Also, 'Report of Committee of the Three Admirals on the 1888 manoeuvres'. Copy in Noel Mss, NOE 15c.
2. Jackson report, 23 Aug 1888, NID 179. Tryon report, 1 Aug 1891, NID 215.
3. Rear Admiral J.N. East, 'Naval Manoeuvres 1888' USM. Vol. 1 1888, 563-571.

first-round one's eyes were so dazzled by flashes from rifles that one could see nothing'. Firing was therefore hopelessly wild. 'What to most of our minds, and to mine especially has been proved, is that a blockade by ironclads in the old sense of the term is impossible.'[1] Equally though, the TBs had failed to secure any hits with their torpedoes, although the blockading ships were steaming at a mere two-three knots with lights on (for the benefit of passing mercantile ships). This was emphasised by nobody, while many favoured net protection against the deadly and apparently inevitable torpedo blow. Netting, however, caused even more problems. It might provide protection against the torpedo, but the slow speed forced upon the encumbered ships exposed them to ram attacks which 'appears to me to be an awkward predicament'.[2]

These difficult problems were shelved in the following year, when TBs were obliged to undertake the sort of tasks set them by Aube, and heavy seas foiled attacks by TBs on ironclads at sea.[3] Rear Admiral Mayne encapsulated the prevailing mood in a letter to the Times. 'The only use of TBs is for the defence of harbours, and their going to sea with the squadron and rushing about the Channel in the way they have done lately, is absurd.'[4] He was indeed correct, but would have been far better employed criticising manoeuvre schemes which failed to investigate TB capabilities in their deadliest role, and one where the Royal Navy was likely to encounter them. As it was, the TBs incurred general contempt.

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1. Lieutenant Wolfe-Murray to Phipps Hornby, 11 Aug 1888; Phipps Hornby Mss, Phi 120c.
2. Captain Lambton report, 17 Oct 1887; ADM 1/6911.
3. 'The 1889 Manoeuvres' NID 215.
4. Rear Admiral R.C. Mayne. Letter to the Times 20 Sept 1889.

As a sea-going vessel, as an instrument of the blockade and as an offensive weapon for the Royal Navy, the TB indeed had no place, and this contempt was justified. This assertion, however, was used to obscure the very real threat which the TB posed in its more limited role as the scourge of the blockade. This threat was not explored, while the question of the relative effectiveness of gun and torpedo was ignored. That the TB was a weapon of limitation, nobody would deny; the failure of the manoeuvres was that they did little to elucidate its power within these limitations.

(b) The Naval Manoeuvres: the 1890s

Although the TB threat posed by the Jeune Ecole was largely discounted by the late 1880s, the French set about restoring the menace. Longer, more seaworthy TBs were adopted and stationed in fortified harbours along the Channel coast. The manoeuvres of 1890 were accordingly designed to test the extent of the threatened danger.

A flotilla of nine TBs was based in Alderney, while two fleets operated from Plymouth and Portland in defence of trade in the Channel. This therefore was a direct reflection of the likely strategic situation in the event of war. What followed, however, confounded all expectations. Under the daring leadership of Commander Barry and Lieutenant F.C.D. Sturdee[1], the TBs dashed across the Channel and surprised Sir George Tryon's fleet as it lay at anchor in Plymouth Sound. Thereafter, they roamed the Channel, marauded the Cornish and Devon coast, and obliged Tryon to withdraw his fleet to the Scillies.

Controversy followed. The results of the Plymouth attack were never decided. While the TBs claimed to have made six hits, Tryon claimed that gunfire would have destroyed them all. The umpires were unable to reconcile conflicting evidence, for it was impossible to decide which ironclad had fired on which TB, and therefore, which TBs had survived the gunfire for long enough to

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1. Admiral Sir F.C. Doveton Sturdee, 1st Bart (1859-1925) Joined Service 1871, on Staff of Vernon 1889-93, victor of the Falkland Islands 1914.

make the attack. Tryon raised even more fundamental questions, for he claimed that the attack had been made before the outbreak of hostilities 'under circumstances that appear to show that one side and a limited number of officers read the instructions to justify the operation, whereas a majority read them as actually denying it'. While superficially plausible, however, these arguments were undermined by the fact that Tryon had himself ordered his fleet to be prepared to defend itself, so he was evidently relying on neither the army harbour defences nor the regulations for protection. He also argued that the attack was quite unrealistic, in that the TBs knew the precise position and strength of their target, and that there would be no hindrance in getting there or returning. Despite this lengthy explanation for the TBs' successes, Tryon then claimed that it had been a complete failure anyway.

Other criticisms of the TBs were more legitimate than this collection of contradictions. There was no doubt that too many rules were bent. Two TBs for instance, sheltered in 'neutral' waters on the Cornish coast; a ship was 'torpedoed' in the safety of 'neutral' Plymouth Sound; Tryon's colliers were 'sunk' in 'neutral' Falmouth.[1] J.R. Thursfield of the Times was particularly critical of this aspect of affairs, writing that the TB officers 'behaved in the spirit of Mr Midshipman Easy rather than naval officers engaged in the discharge of serious and responsible duties', and handled their boats in a 'spirit of reckless and not very scrupulous rowdyism'.[2]

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1. NID narrative and Tryon report, 28 Aug 1890; NID 252. Tryon's criticisms of the WO were not included in the official report, but a draft is in ADM/7009.
2. The Times 20 Aug 1890.

This was not the prevailing opinion in the fleet however. Barry received 'a most complimentary letter' from one observer, who praised Sturdee's performance.[1] Tryon himself paid generous tribute to the spirit of his attackers, while Captains Reginald Custance and Cyprian Bridge, the arch-opponents of the TB, praised Sturdee's achievements.[2] These were indeed considerable, for one TB had travelled no less than 420 miles. Despite his prejudices, it was Bridge himself who felt obliged to conclude in the official NID report: 'a result of the 1890 manoeuvres is, that the opinions on the effective radius of TB action will have to be reconsidered'.[3] The Times observed that the Channel was now open to TB attack[4] while Tryon admitted that 'TBs will act to the great disadvantage to the one who requires [traverse of the Channel] the most'. Furthermore, the TB was a weapon which the Royal Navy could use only with great restraint, for any vessels in the Channel were most likely to be English, and could not be torpedoed without prior identification. Such restraints would not affect the French.[5] The TB issue had been resurrected, and the danger carried to the British coastline not by theory, but by the actual activities of British vessels.

The 1891 manoeuvres were therefore planned to investigate the implications of the menace and how far it could be neutralised by counter-measures which were seen by the Board as the answer to the

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1. Barry to Sturdee, 19 Aug, 1890; Sturdee Mss.
2. Bridge to Custance, 22 Aug 1890; Bridge Mss, BRI 18.
3. NID narrative; NID 252.
4. The Times, 20 Aug 1890.
5. Tryon report, 28 Aug, 1890; NID 252. Also, Tryon to Joint Naval and Military Committee on Defence, 11 Sept 1890; Vezey Hamilton Mss. VHM 9.

problem[1]. Captain Samuel Long was therefore given a force of three cruisers, representing a squadron, escorted by six torpedo-gunboats. These ships 'operated' in St. George's Channel, while twenty TBs harassed them from the Irish coast. The circumstances were therefore again intended to resemble as closely as possible the English Channel coast under threat from French TB bases.

Long used three of the gunboats to escort the cruisers, while the others hunted the TBs. This squadron proceeded up and down the Channel at high speed, occasionally anchoring in sheltered bays with torpedo netting rigged. The dark cloudy skies made ideal conditions for TB operations, but the difficulty of judging speed, course and distance foiled all but one attack, by a TB which was adjudicated out of action anyway.[2] Despite the harassing of the 'catchers', a successful attack was made on the squadron while it was anchored in Luce Bay.[3]

These exercises led to a considerable divergence of views between the torpedoists and their opponents. Bridge noted contemptuously that the TBs cut a poor figure when offensive action was taken against them.[4] His NID report referred to the usefulness of a separate force of catchers, while Thursfield, writing with semi-official authority in Brassey, argued that such a force would constitute an adequate defence.[5] It was from this

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1. Bridge to Custance, 22 Aug, 1890; Bridge Mss, BRI 18.
2. Commanded by Lieutenant A.L. Duff, later Admiral Sir Alexander Duff.
3. By Lieutenant L. Bayly, later Admiral Sir Lewis Bayly, Commander in Chief Western Approaches, 1915-18.
4. Bridge to Custance, 14 Aug 1891; Bridge Mss, BRI 18.
5. Thursfield, 'British Naval Manoeuvres, 1891' Brassey, 1892.

interpretation of these manoeuvres that there grew the concept of 'catching' as a distinct activity, which was to dictate the employment of the torpedo-boat destroyer until just before the Great War. The torpedoists, however, debated every premise on which this concept was based. They claimed that it was not the catchers which prevented effective action, but inherent navigational problems. The catchers had indeed signally failed to prevent them coming out and operating, while defensive gunfire had been noticeably wild. Captain John Durnford, the TB commander, was quite pleased with the performance of his boats, despite the handicaps of small numbers, short nights and the rule which forbade the TBs to torpedo catchers.[1] The debate had therefore begun, and 1892 was to sharpen the conflict.

In that year, south and east Ireland were given to the Blue side, and west Ireland and Britain to the Red side. The superior red squadron was ordered to divide on leaving Berehaven, and, after circumnavigating Ireland in two separate squadrons in opposite directions, rendezvous between the Mull of Galloway and the Isle of Man.[2] Its commander, Admiral Fitzroy, had a healthy respect for the TB. He had seen enough of them 'to greatly increase my respect for them in smooth waters, engines and boilers in good order and where ably commanded, under these circumstances they are terrible weapons, if several on a dark night attack a ship at speed from

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1. NID narrative for description of manoeuvres. Also reports of Admiral Erskine 10 Aug, 1891 and Captain Durnford 11 Aug 1891; NID 288.

2. NID narrative; NID 332.

different directions ... perhaps two boats will be lost, but so will the ship'.[1] In order to minimise his fleet's exposure to this danger, the fast squadron took the shorter but more dangerous southern approach, while the slower squadron took the much longer but less dangerous northern approach, where the danger was limited to the Northern Channel. Fear of the TB therefore had the effect of delaying the rendezvous for 48 hours, while the slow squadron went on its long but safe journey.

In the event, the TBs were quite ineffective. Sturdee patrolled with four TBs off Oversay and Lough Foyle, but rough seas prevented an attack on the ironclads, and his force was unable to raise its speed above 11 knots. The rendezvous was made safely and the combined squadrons then proceeded to neutralise the minefield behind which the Blue Fleet was hiding in Belfast Lough. Strong feelings were aroused here. Attackers and defenders exchanged bitter words and angry blows as the boats of the opposing forces met at the minefield. The torpedoists resented the rules which forbade them to attack the ships which, artificially immune from danger, were steadily reducing the defences,[2] while Bridge and his associates derided the apparently defensive policy[3] which Durnford's boats had no choice but to pursue.

Thursfield noted that 'although the tactical results of the disposition of the Blue squadron were magnificent, their strategical

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1. Fitzroy to Phipps Hornby, 21 Aug 1892; Phipps Hornby Mss, Phi 120d.
2. NID narrative; NID 332.
3. Bridge to Custance, 11 Aug 1892; Bridge Mss.

effect was immense and might in actual war have been decisive'.[1] While true in itself, however, this comment begged the question: If the TB were indeed tactically useless then this should surely be reflected in its influence on the strategy of the opposition? It was in other words, Admiral Fitzroy's exaggerated expectation of the TBs' capabilities rather than their actual powers which was responsible for the immense influence they exerted on the manoeuvres. Had he based his plans on a more accurate estimate of their capabilities, as demonstrated in practice, it is possible that his conclusions would have been different. Bridge meanwhile was not slow to emphasise tactical inadequacies, such as the exhausting effect on the TBs of carrying out a scouting role. They should, he observed, be used only against a specific known target.[2]

Sturdee was incensed by this denigration of the TB, which he ascribed to apathy, and prejudice against a new weapon. He complained of rules which deliberately aggravated TB weaknesses, of the gross overestimation of gunnery, the catchers and the powers of net protection, of the competitive nature of the manoeuvres, which prevented the development of TB tactics, and of the long days and short nights of an English summer which gave no indication of the perils facing ironclads in the long thick, dark, winter nights of the Channel.[3] Bridge would have none of this. Referring to the problem of good weather and clear nights, which hampered the TB, he

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1. Thursfield 'British Naval Manoeuvres, 1892'; Brassey 1893.
2. NID narrative; NID 252. Bridge to Custance, 20 October, 1892; Bridge Mss, BRI 18.
3. Sturdee report, 16 Aug, 1892; NID 332.

wrote: 'Until the torpedo enthusiasts obtain the power mysteriously vouchsafed to Joshua - one does not see how that can be avoided in July and August'.[1]

This was hardly a fair or rational response, but the merits of the matter were by now secondary considerations. Bridge and his disciples were involved in a departmental rather than a strategic or tactical debate. The torpedoists were, by the very nature of their position, urging the merits of their weapon. This appeared to imply a demand for its extensive employment, and by implication, a strategy based on its use. By virtue of the limited circumstances in which the TB was useful, such a strategy could only be defensive. The TB was essentially the weapon of the power which had lost command of the seas, and by appearing to anticipate this eventuality, and by appearing to advocate a strategy which was quite contrary to the traditions of the Royal Navy, the torpedoists aroused the wrath of the 'traditional' school. 'A little ring of torpedo /illegible/ is running', observed Bridge. He was determined to resist their ideas.[2]

The same differences persisted the following year. The relationship of strategy to tactics was again misconceived. 'One of the objects of the manoeuvres is to form as close an estimate as possible of the influence which TBs will have on the proceedings of fleets operating in waters near which the boats are stationed. If the movements of the Red fleet can be so impeded by the action of

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1. Bridge to Custance, 3 Oct, 1892; Bridge Mss, BRI 18.
2. Bridge to Custance; ibid. For Bridge's general fears, Bridge to Custance, 20 October, 1892; ibid.

the Blue TBs that the junction of the fleet is rendered impracticable, or is much delayed, the Blue fleets will have a chance of falling upon one of the Red fleets when by itself'.[1] This, however, was precisely the sort of hypothesis which the manoeuvres were unlikely to test. The strategic effect exercised by the TBs during the exercises merely reflected the individual judgement of the Admirals concerned. Their prior estimate of this would dictate the course of the manoeuvres, rather than the manoeuvres shedding light on strategy. The latter was best decided taking into account tactical possibilities, but the manoeuvres could not be and were not intended to test the tactics on which the strategy was based. By their very nature therefore, the manoeuvres could be of only limited value, even if they were analysed dispassionately.

Thus, Admiral Fitzroy again displayed his apprehensions about the TB. While 300 miles from the nearest enemy, he was caught in a fog, and immediately hove to, with lights out.[2] The delay occasioned by this, together with a wide detour which he took in order to avoid the Red TBs, prevented him from securing a winning advantage. On the other hand, the experiences of the opposing fleet gave grounds for some justification of his fears. One squadron lost three ships to a torpedo attack made under cover of fog; the other was intercepted by a flotilla of TBs under Lieutenant R.H. Bacon, and lost two ships.[3] Fitzroy was most impressed. What would happen if the French fleet were pursued to within 30 miles of Cherbourg? If the enemy were chased to the breakwater, then their

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1. NID narrative; NID 372.
2. Lieutenant Bruce to Phipps Hornby, 5 Aug, 1894; Phipps Hornby Mss, Phi 120d.
3. NID narrative; NID 372.

TBs would torpedo the British ships, and the admiral would be abused for foolhardiness; if the pursuit were called off, he would be accused of cowardice. 'Lord Nelson did not allow for TBs', Fitzroy observed in perplexity.[1]

In fact, Bacon's success was due to sheer luck, and disproved none of the previously held assumptions. He was patrolling between Belfast and Mull of Galloway, when the ironclads attempted to pass the straits. Despite the darkness of the night, they made no attempt to conceal their presence. With lights blazing, they relied on speed and gunnery to shake off any attack. Unfortunately, they steered straight for Bacon, oblivious of his presence. Had the ironclads taken any other course the TBs would have been quite incapable of intercepting because of the rough weather.[2]

Thursfield was quick to point to the high casualty rate among TBs. They had been eliminated at the rate of four per day[3] and had 'suppressed themselves by their own temerity'.[4] How far this was an accurate assessment of TB losses is difficult to determine, for gunnery had again been wild. On one occasion, an ironclad squadron claimed to have destroyed 22 TBs when only eight had actually participated in the attack. Wave crests were peppered liberally regardless of the presence or otherwise of a target.[5] What was abundantly clear was that TBs had inflicted losses on the enemy, while the catchers which should have prevented this had been

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1. Fitzroy to Phipps Hornby, 18 Sept 1893; Phipps Hornby Mss, Phi 120d.
2. NID narrative; NID 372.
3. The rules allowed TBs to come back into action after 48 hours.
4. Thursfield 'British Naval Manoeuvres, 1893' - Brassey 1894.
5. Durnford report 18 Aug 1893; NID 372.

completely useless. Admiral Fairfax commented:

> The gunboats have proved themselves so inefficient, and so entirely unsuited for the purpose for which they were designed, that I think it my duty to bring the fact prominently before the notice of Their Lordships.[1]

The TBs lost much of their reputation in 1894, however. Fitzroy was ordered to rendezvous two squadrons in the Irish Sea, while subject to harassing TB attacks. This time his approach was bold and it paid off. He steered up St. George's Channel at high speed and with lights extinguished. Lieutenant Charles Madden,[2] commanding the patrolling TBs, lacked Bacon's good fortune. Despite approaching to within 300 yards, the ironclads' high speed frustrated attack. The NID narrative remarked: 'From this it seems permissible to infer that high speed will be of itself no unimportant protection to ships traversing at night narrow waters infested by TBs.'

Failure also met the attempts of the Belfast TBs to attack Fitzroy's other squadron. Nor did Fitzroy's own TBs distinguish themselves. They were ordered from Queenstown to attack three enemy cruisers, which had been seen in Blacksod Bay. Despite the careful definition of their objective, they found and attacked three ships of their own side,[3] so that 'we were more of us torpedoed by our own boats'.[4] Thursfield referred somewhat sarcastically to the

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1. Fairfax report, 12 Aug, 1893; ibid.
2. Admiral Sir Charles E. Madden, COS to Commander in Chief Grand Fleet 1914-1916, Second in Command Grand Fleet 1917-1919, First Sea Lord 1927-1930.
3. NID narrative; NID 401.
4. Lieutenant Bruce to Phipps Hornby, 11 Aug, 1894; Phipps Hornby Mss, Phi 120d.

'awkward habit of mistaking friend for foe'.[1]

Undeniably, the TB suffered from certain weaknesses, but, equally, the catcher had failed abysmally to end the menace. Great hopes were therefore pinned on the torpedo-boat destroyer, the first of which appeared in 1894. The Havock and the Hornet were given initial trials in May 1894,[2] and their good showing was confirmed by the tactical exercises of 1895, in which Captain A.K. Wilson investigated the effectiveness of a dozen TBDs in suppressing TB activity. He concluded that, although the TBDs were unable to keep station with the fleet, they were most effective when constituting a separate force off the mouths of the TB harbours. In this role, they made it extremely difficult for the TBs to leave harbour, hampering them to such an extent that the TB flotilla was virtually neutralised.[3] One officer noted: 'The impression left on my mind ... was that all the present types of TB are obsolete, and that probably no more will ever be built ... boats of the size of the destroyer will take their place in every navy.'[4]

The 1896 manoeuvres appeared to reinforce this impression. A squadron based on Berehaven was ordered to observe a squadron in Milford Haven, and prevent it from escaping and proceeding to Lough Swilly. The blockaders therefore cruised in the Irish Sea, while TBDs protected them from TB attacks by operating off Milford and screening Galloway, Holyhead and Loch Ryan. The TBs operated at sea for only one day, and in that time failed to achieve anything.[5]

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1. Thursfield; Brassey 1894 85.
2. Digest of report on trials of the Havock and Hornet. Enclosure to Vernon 1894; ADM 189/4.
3. Report by Captain A.K. Wilson, 22 Aug, 1895; NID 446.
4. Charles Cleig 'Torpedo Squadron Manoeuvres 1895'; Brassey 1896.
5. NID narrative; NID 474.

Thursfield was ecstatic. The game was up for the TB, he asserted. The TBD had beaten it out of the field.[1] Things were, however, by no means so straightforward. The weather had been mainly responsible for curtailing the TBs. Lieutenant Richmond, for instance, leaving Milford Haven, was caught in a squall and finished up off Aberystwyth.[2] Only three TBs had fallen victim to the TBDs. The DNI, Captain Beaumont, noted perceptively that although the TBs experienced great difficulty in finding their target, the TBDs found equal difficulty in finding the TBs;[3] nor was TBD gunnery necessarily any more effective than that of battleship, because of the vibrations caused by high speed.[4]

Nevertheless, the TBD was a considerable blow to the TB. In 1899, for instance, Lieutenant Duff reported that his TBs had been effectively neutralised, for they were unable to leave harbour without the TBDs pouncing on them. Commander de Robeck,[5] who commanded the TBDs, was well pleased with his vessels. Although they were unable to keep the seas for more than three days at a time, this was not a serious limitation in view of the restricted cross-Channel use which was anticipated for them,[6] By 1900 the TB was no longer the menace which it had been at the beginning of the decade, for it appeared to have been eliminated and replaced by the TBD. The manoeuvres, however, on which so much energy had been expended, left many other points anything but clear.

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1. Thursfield, 'British Naval Manoeuvres 1896': Brassey 1897.
2. Richmond diary June 1896; Richmond Mss, RIC 1/4.
3. NID narrative; NID 474.
4. Report of Captain Norcock, nd; ibid
5. Admiral Sir John M. de Robeck (1862-1928), 1912 Admiral of Patrols, late Commander in Chief at the Dardanelles.
6. Duff report 4 Aug, 1899. De Robeck report 5 Aug 1899; NID 556.

(c) The Naval Manoeuvres: Evaluation

Just how valuable were the manoeuvres, how much was learnt from them, and what were their shortcomings? An Admiralty memorandum of 1892 defined their objectives:

> The automobile torpedo has been used more than once in war. The single instance in which it succeeded in destroying the ship attacked was when it was one of five, launched from two vessels of 730 tons. The TB especially constructed to discharge automobile torpedoes is the only element of naval material generally adopted which has never been submitted to a war test of any kind. The absence of even a limited experience of their behaviour in real hostilities, and the fact that they form a large element every year of the naval material of many states, render it desirable, and indeed necessary, to arrive at as exact an estimate of the value of the TB as experimental operations in peace time can supply. Peace exercises can give no idea, or at best only a very imperfect idea, of the value in actual combat of material never tried in war. From these exercises, however, we may draw more or less instructive inferences concerning some indispensable operations which in all wars are much more common than actually fighting, and which must be successfully conducted to give a fair chance of success. These considerations explain the frequency with which TBs are employed in the summer manoeuvres.[1]

These exercises were not popular in the fleet. Lieutenant Richmond wrote: 'I shall not be sorry when these manoeuvres, this waste of time, is over'.[2] Another officer commented: 'There was only one thing for which these manoeuvres were pre-eminently distinguished, and that was ... acres of foolscap and paper precautions'.[3] Richmond bemoaned the lack of critical analysis, and the preponderance of

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1. Introduction to NID narrative; NID 332.
2. Richmond diary, 1891; Richmond Mss, RIC 1/2.
3. Lieutenant Bruce to Phipps Hornby, 11 Aug, 1894; Phipps Hornby Mss, Phi 120d.

tables of statistics, which could only deter the average naval officer from reading the NID reports.[1] The NID narrative did, however, often include some instructive general comments, particularly when written by Bridge, who saw his task as the education of the service in general strategic ideas.[2] The problem was that few ever read the reports. As A.K. Wilson wrote of the 1902 manoeuvres: 'If I make /the report/ very long, nobody will read it. I don't suppose many will now'.[3] Furthermore, even for those who took their profession seriously, there was no forum or encouragement for systematic study and careful discussion.

Admiral Noel, for instance, remained a firm believer in the efficacy of torpedo attack, and during the 1899 Mediterranean exercises he defended his fleet by heaving to and hoisting out nets, relying on the darkness of the night. Although invisibility was a genuine asset, Custance, who had by then succeeded Bridge at the NID, was unhappy. 'The unfortunate battleship seems to be looked upon as fair game for the TBs, but I never see any arrangements made for hunting the TBs, which to my mind is the only safe policy'.[4] Flag Officers disagreed completely on the merits of netting or offered no views at all. The First Lord, Goschen remarked: 'Some of the observations offered /in response to an Admiralty questionnaire/ remind me of the constant phrase in a little piece called the 'pantomime rehearsal'. 'It will be all right on the night', so why discuss such questions? 'No opinion submitted'. 'It will be all

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1. Richmond memo 'Remarks on Tactical Exercises 1902'; Richmond Mss, RIC 4/2/A2.
2. Bridge to Custance, 10 Nov 1890; Bridge Mss, BRI 18.
3. Wilson to Noel, 29 July 1902; Noel Mss, NOE 15c.
4. Custance to Noel, 27 Oct, 1899; Noel Mss, NOE 3.

right on the night of battle'.[1]

This confusion was reflected in the manoeuvres of 1900. Admiral Ranson deliberately held back his TBs, while using his cruisers to eliminate the TBD force of Admiral Noel. Noel, for his part, believed that it was because of the TBDs that Ranson's TBs had not been used.[2] Confusion of cross-purposes was illustrated again in 1901. Noel this time sent his TBDs to find and launch a mass attack on Admiral Wilson's fleet, while Noel proceeded at slow speed, with lights extinguished to avoid a night attack by his opponent's TBDs. Wilson, however, was quite uninterested in the torpedo question, and was intent on winning the manoeuvres by using his TBds to ravage commerce.

> The umpires
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> regretted that no opportunity was found during the manoeuvres of ascertaining the value of an attack by TBDs and TBs in force on a battle fleet, though often prevailing misty and foggy weather would seem to have been especially favourable for such an attack, if either of the fleets could have been quickly informed of each other's movements'.[3]

There was however, equal point to the comments of J.R. Thursfield, who referred to a 'dismal altemation of purpose and disposition [by Noel] ... There is no virtue in keeping the seas, if keeping the seas means skulking and scuttling away from possible torpedo craft as soon as the night comes on'.[4]

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1. Goschen minute, 28 Jan, 1900; ADM 1/7405B.
2. Ranson report, 6 Aug, 1900. Noel report, 11 Aug, 1900; NID 596.
3. NID narrative. Noel report 10 Aug, 1901, Umpires' report; NID 641.
4. Thursfield, 'British Naval Manoeuvres 1901'; Brassey 1902.

In some respects, the manoeuvres were valuable. The Jeune Ecole theories were dethroned, for it is difficult to escape the conclusions of Bridge, Custance and Thursfield that the inherent limitations of the TB were too great for it to become a major element of naval warfare. It was a specialised weapon of offence, and therefore vulnerable to countermeasures. Its radius of action was limited to the distance it could cover between dusk and dawn, for daylight exposed it to retribution. Rough weather limited that radius still further, while any time spent searching for a target merely used up time and exhausted both boats and crew.[1]

The torpedoists argued that the short nights and clear weather of the manoeuvres did not give the TBs a chance to show how deadly they were in favourable conditions. Yet this argument was self-defeating, for when the weather was bad, and therefore more suitable, the TBs experienced great difficulty in putting to sea and operating at all, while battleships were often able to steam past TBs which were wrestling with heavy seas. This was the paradox of the TB. Good weather enabled it to operate; yet good weather also exposed it to countermeasures and gunfire. Bad weather gave it invisibility, yet reduced its speed and hindered its vision. The destroyer, which became in effect a larger and better TB, overcame some of these problems, but the essential paradox remained.

If this was indeed the main lesson of the manoeuvres, then it belied the great prominence given to the role of 'catching'. The torpedo gunboats were repeatedly shown to be quite inadequate in

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1. This argument was best formulated by Thursfield, 'British Naval Manoeuvres 1893' Brassey 1894.

speed, while the TBD seldom achieved the high success rate which its capabilities suggested was likely. It was the inadequacy of the TBs which played the major part in limiting their success, rather than the 'offensive' alternative favoured in Whitehall.

Furthermore, one major problem was neglected. The blockade was the fundamental of British naval strategy, but only in 1888 was it tested. The experiences of this year should logically have led to a major investigation of the difficulties inherent in this operation, but it was not attempted again until 1902 when the Mediterranean and Channel Squadrons exercised.

> The special object in view, in drawing up the scheme of the 1902 combined manoeuvres, was to endeavour to ascertain what risks are involved in keeping such a close watch on a fleet in a defended port, as to ensure bringing it to action if it issues therefrom. This object was selected because it is a consideration of the risks taken in conjunction with the amount of mischief the enemy's fleet is capable of doing while at large, and the relative strength of the two fleets, that must determine whether it is better to bring an enemy to action in the immediate neighbourhood of his port, or adopt some other line of strategy involving less risk to our own ships, but giving him greater chances of evasion.

TBDs acted as the inshore blockade force, while the battleships were held well back out of range of torpedo attack. In two nights of skirmishing, half the 14 blockading destroyers were lost, and on the third night the blockade itself was broken with ease. While the participating flag officers and the NID commentary noted the extreme difficulties involved,[1] none were as vigorous and correct as J.R. Thursfield who condemned the TBD as a 'broken reed' when

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1. NID narrative; NID 690.

used in the blockade role.[1] The blockade remained, despite the very obvious problems.

These were general lessons which could be drawn from the manoeuvres. The crux of the TB argument, however, lay in the relative delivery capabilities of gun and torpedo. Strategic lessons can be drawn only in the context of tactical knowledge, while general conclusions are just as easily reached by theory. The manoeuvres were designed to illustrate general lessons, and serve in a training rather than an investigatory role. This was their main weakness, and goes far to explain why they could never resolve the TB issue, even had the Navy been willing or able to debate the whole matter dispassionately.

The rules for putting TBs out of action did anything but encourage a fair assessment of the power of gunnery. Battleship officers concerned themselves entirely with noting the times for which they held TBs under fire, and seldom with accuracy of gunfire. Promiscuous gunnery was a constant and justified complaint of the torpedoists, as was the absurdity of rules which made the catchers invulnerable to torpedo attack. Timings were often disputed, but the main fault of such a system was that it assumed that the given period of fire would indeed be accurate and sufficient to destroy the attacker.

The gunnery rules therefore assumed a relatively high degree of efficiency, and material provision for such an attainment was indeed quite good. Machine-guns and quick-firing guns were the two main elements of anti-TB protection. The volley-firing Nordenfelt MG

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1. Thursfield 'Mediterranean Manoeuvres of 1902'; Brassey 1903.

had been adopted after extensive tests at Plymouth in 1880, which gave rise to great hopes, the MG could apparently penetrate a TB's boilers at 750 yards. The main intention, however, was to develop rapidity of fire at short range with the MG, while the QF penetrated and shattered the attacker at longer ranges. The 6 pdr QF could penetrate a 3 in. solid-steel plate at 600 yards, although its volume of fire was by comparison a mere 12 rounds per minute. A variety of other calibres followed in the 1890s.[1]

Whether this weaponry could be employed effectively was entirely another matter. The MGs had been tested by one of them being mounted on a ship, and steering at a slow and steady speed towards a target ship while firing continuously. A large number of hits were scored, but this was misleading. All the hits were scored at a distance of less than 500 yards, which was well within torpedo range. Opinion against the TB in an open daylight attack upon the battleship was therefore formed upon experiments which did not in the least justify it.[2] Furthermore, the destructive capabilities of the QF were tested by firing against the broadside of a TB target, a larger and more vulnerable object than would be faced in the event of a TB attack.[3] And it was not until 1892 that smokeless powder was introduced, giving the visibility that was necessary for accurate gunfire.[4]

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1. For an exposition of Admiralty policy on the adoption of QF and MG fire. 'Why have we no revolving guns in the Navy?' USM MCCCLXXXV (May 1885), 443-57.
2. Also E.P. Gallway 'The Use of Torpedoes in War' RUSI XXIX (Mar 1885) 483-4.
3. Report on Shoeburyness Trials. Appendix to Vernon 1895; ADM 189/15.
4. First Lord's Statement Explanatory of the Naval Estimates, 1891.

In any event, accuracy was not a distinctive feature of naval gunnery, not least because practice was rare. Captain Markham noted in 1881: 'I was much struck by the inability possessed by the officers in controlling or in stopping the fire of the men, for with heavy guns, rifles and gatlings being discharged at the same moment, it is a matter of impossibility for bugle sounds to be heard or officers' orders attended to'.[1] Three years later, Captain A.K. Wilson experimented with a target of canvas, rigged to resemble a TB. In the deceptive light of a moon appearing intermittently between passing clouds, there were several false sightings. Eventually, a total of 49 rounds of case shot, 198 Nordenfelt, 395 Gardiner and 582 rifle rounds were fired without result.[2]

The Polyphemus carried out gunnery trials in 1885 which led to the conclusion that good, trained gunners on a calm sea could disable a TB at 400-1300 yards.[3] Good trained gunners were, however, few and far between, and battles were seldom fought on a calm sea in perfect visibility. Nor did gunnery improve. Eight years later, Sturdee noted that a target practice at a range of 900-1500 yards, the Rattlesnake had secured four hits out of a total of 155 rounds of 3-pdr fire and 225 rounds of Nordenfelt fire.[4] The 1893 Vernon report observed with considerable restraint: 'Judging from the night firing practice carried out periodically, I am inclined to think that, in these rules, we overrate the value of gunfire as a means of

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1. Markham report, 9 Sept, 1881. Appendix to Vernon 1881; ADM 189/1.
2. Wilson report, n.d. Enclosure to Vernon 1885; ADM 189/5.
3. Markham report, n.d., Vernon 1885; ADM 189/5.
4. Sturdee report, n.d.; NID 332.

stopping TBs in practice'.[1]

In any event, not until Sir Percy Scott invented his 'dotter' device in 1898, could the problem of rolling be overcome, and even this device was useless without the contemporaneous invention of elevating wheels. With these fittings, the gun could be elevated and depressed to allow for the roll of the ship. Until these inventions were available, QF gunfire would be either spasmodic, depending on the roll of the ship for correct elevation, or rapid, in which case the roll caused inaccuracy. It could not be both fast and accurate. Nor, until Scott, was gunnery practiced sufficiently to reach a high degree of efficiency.[2]

Great faith was placed in the TBD flotillas, but it is doubtful if their battle efficiency was ever adequate. For instance, the Plymouth boats were allowed a mere ten rounds per quarter, to fire at ranges of 500-1000 yards while steaming at 10-15 knots. Much of the work was devoted merely to teaching crews to handle their vessels.[3] Only four out of 24 hours cruising per week were spent on night work, and there was no practice at navigating without lights. Some flotillas did night passages to fill up the number of hours they were obliged to operate by night.[4]

Only in the early 1900s was the inadequacy of naval gunnery remedied. In 1903, the prize-firing returns for QFs, taken at 12

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1. Vernon 1893: ADM 189/13.
2. See Peter Padfield Aim Straight(London: Hodder & Stoughton 1966) 80-81.
3. Orders for Plymouth TBDs, 1896 and 1897; ADM 1/7281, ADM 1/7325.
4. Lord Keyes Adventures Ashore and Afloat (London: George G. Harrap, 1939) p 213.

knots against a target measuring 17 ft. by 20 ft. at a range of 1500 yards, returned only a 22-28% percentage of hits, with only 12% for the TBDs. The First Lord, Lord Selborne, described these facts as 'a matter of grave concern', and a Board meeting of April 1904 decided to issue a circular to the fleets, asking for suggestions to improve gunnery. The response of a joint committee of officers from the Mediterranean and Channel Fleet, chaired by Custance, produced an interesting report on the state of naval gunnery:

> The arrangements and organisation to meet a serious torpedo attack which now obtain in the service are inadequate, and the ships' companies are not sufficiently practiced in working the guns and searchlights under these conditions. Against such an attack, the successful defence of a ship by her own guns alone would require the most careful organisation and control; this can only be elaborated by systematic trial. Our present arrangements are founded largely on opinions only, and these vary considerably because they are not founded upon sufficient practical data.

A supplementary report elaborated on this picture of neglect by pointing out that secondary armament was generally neglected with no aiming apparatus, unsuitable sights and second-rate crews. Destroyer gunnery suffered from vibrating gun platforms, low freeboard, the danger of the telescope cutting the layer's eye, the quick motion of the gun platform and lack of training.

This is a fair description of the state of Royal Navy gunnery in the preceding 20 years of the TB threat, and only now, under the pressure of Scott, Jellicoe and Fisher was it being remedied. Some officers still employed the argument that there was little point in

practice, because firing in actual war would take place in circumstances when sighting was bad anyway, but Scott insisted on practice, and Lord Charles Beresford noted that his ships were now paying some attention to QF gunnery by night. Attitudes were changing, and in 1904 Jellicoe was able to observe that fleet gunnery had at last improved, albeit only by 5%.[1]

The problem of the control and effectiveness of gunnery was still a major issue. Improved target practice was one thing; to apply the same accuracy under difficult and dangerous pressures was quite another. The question was raised in May 1904 by a junior officer in the Mediterranean Fleet. Lord Charles Beresford forwarded his paper, and in November 1904 the fleet was asked for its opinions. Extensive experiments in the Mediterranean were duly reported to Whitehall.

Jellicoe was completely pessimistic. He argued that little reliance could be placed on QFs as a defence against torpedo attack when torpedo ranges had been 400-600 yards. With increasing torpedo ranges, this belief was reinforced. Night firing, he argued, could never rely on anything other than luck, no matter how much it was practiced. He advocated, therefore, a reliance on invisibility and TBD protection. The expenditure of £10,000 was sanctioned on a fire-control system developed by Lord Charles Beresford, but Jellicoe remained gloomy: 'If ships are sent into waters menaced

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1. Prize-firing returns 1903, Selborne minute 10 April 1904, Board minute 28 April 1904, Report of Joint Mediterranean and Channel Fleet Committee 31 May, 1904. Supplementary Report 14 July, 1904, Captain Foley report, n.d., Scott minute, 20 January 1905, Beresford report, 26 Sept, 1904, Jellicoe Report, 10 May, 1905; ADM 1/7834.

by torpedo craft and are attacked by them, they will certainly suffer heavy losses. The real defence against torpedo craft is invisibility, and this it is submitted cannot be too strongly insisted on'.[1]

This opinion is in sharp contradiction of the facile judgements of the 1890s, reviving the fears and uncertainties of the 1880s. While the latter had been based on uncertainty and ignorance however the new fears of the 1900s reflected extensive practical testing of the capabilities of the weaponry available. These showed that the assumptions of the 1890s were completely fallacious, and that gunnery, as Sturdee had contended, was grossly overestimated. The major failing of the 1890s was that no systematic effort was made to test the gunnery hypothesis on which the manoeuvres were based. At the same time, the competitive nature of the manoeuvres tended to discourage the gunners from attempting such an analysis, for they were likely to lose in prestige if this were done. Only the torpedoists made any tests, which for this reason would not be considered seriously by the gunners. In this respect, the manoeuvres served to confuse the issues instead of elucidating them.

Nevertheless, if the gunnery rules caused one form of misinterpretation, the torpedoists did not help their case by misrepresentation and exaggeration. Hundreds of practice torpedo runs were carried out annually.[2] These, however, were not tests of battle capability, but of mechanical order. Success merely proved

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1. 'How to Defend a Battleship against Torpedo Craft in a Fleet Action'. Enclosure to Beresford report, 26 May 1904. Fleet circular 23 Nov 1904. Reports from Mediterranean 21 Jan 1905, 10 Mar, 1905. Jellicoe minute 9 June 1905, 16 Sept, 1905; ADM 1/7836.
2. See Vernon reports.

that the torpedoes worked, yet the torpedoists believed that they indicated a high degree of prowess. In the manoeuvres themselves the torpedoes had to be actually and successfully fired against their targets, and this feat was seldom accomplished. Yet the torpedoists blamed this on unrealistic conditions and quoted instances of success against known anchored targets. In fact, for all their shortcomings, the manoeuvres were far more realistic than the annual exercises at Corfu, and the boisterous weather which so often foiled the TBs was a factor unaffected by rules or bias in manoeuvre dispositions.

The manoeuvres, therefore, should have provided an opportunity to clarify the facts on the effectiveness of anti-TB gunnery. In fact, the issue was avoided, except when the torpedoists exchanged bitter words with the 'offensive' school. This, however, was hardly the likeliest context in which to resolve genuine difficulties. On the other hand, while this vital issue was consistently shelved, the limitations and difficulties of torpedo craft were consistently emphasised. It was a lesson which the 'offensive' school emphasised, and which was to be illustrated in the only experience of serious war which involved a major power before the Great War. The manoeuvres suffered from many faults but the main points of the arguments advanced by Bridge and his associates that the torpedo boat suffered from certain unescapable limitations were undeniable.

(d) The Test of War: The Far East 1904-5.

The Russo-Japanese War of 1904-5 forms an interesting postscript to the manoeuvres of the nineteenth century. It was the first serious war since the appearance of the torpedo threat and one in which the Japanese made extensive use of the TB. The results of their activities in the heat of actual war are particularly interesting in the light of the debate of the preceding two decades and as a prelude to the War of 1914-18.

The Japanese had put a great deal of effort into the preparation of their torpedo flotillas, and opened the war by using them in a surprise attack on the Russian fleet at Port Arthur. 'The first great torpedo attack in naval history, made with all the advantages of weather as perfect as winter could offer and at the outbreak of war by a high-spirited and devoted personnel against an enemy at anchor, demoralised, ill-prepared and exposed as much as a fleet could be' secured only three hits out of nineteen torpedoes fired. The very small defence patrol sufficed to throw the flotillas into confusion, while heavy searchlight and gunnery activity forced the later attacks to be delivered at too great a range. It compared badly with the apparent success of Sturdee's attack on Plymouth in 1890.

The exceptionally favourable circumstances of this attack were hardly likely to be repeated, and most torpedo activity occurred under more difficult conditions. It had been argued that the torpedo would be a deadly weapon when used against a beaten enemy by night.

A realistic assessment of the capabilities of anti-TB gunnery would certainly tend to support the idea that defence by gunfire alone would not be enough. The 'offensive' school, however, pointed to the very small number of successes obtained against ships at sea. The experiences of the Russo-Japanese War tended to confirm this argument.

On the night of 24-25 June, 1904, Japanese torpedo flotillas fired 67 weapons, all in vain, against the retreating Russian fleet. After the Battle of the Yellow Sea, 74 torpedoes were fired, again unsuccessfully, as the Russians again retreated through the night. The main failure lay in lack of co-ordination between the flotillas, with a consequent sacrifice of the advantage of numbers, but it was apparent that there had been a serious under-estimate of the problems of judging speed, course and distance when under heavy gunfire (however inaccurate) and blinded by the glare of searchlights and shell splashes.

The disappointing performance of the flotillas earned them a public rebuke from the Naval HQ, which urged greater determination. It was not, however, determination which was lacking. The point was that the difficulties of securing torpedo hits were far greater than had been anticipated. Even when the crippled Russian battleship Sevastapol lay anchored outside Port Arthur, only three hits were scored in six attacks involving a total of 124 torpedoes. Again, the demoralised and battered Russian fleet escaping from the debacle of Tsu-shima, offered a theoretically perfect target. The stormy weather conditions prevented 14 of the 53 Japanese vessels

from even finding the enemy. Only four out of 87 torpedoes actually hit. Again, there was poor co-ordination of effort.

The TB was a weapon of immense power, if it could obtain a hit. This power obliged the attacked fleet to take evasive action, which in every case resulted in scattering and confusion. On the other hand, the power which caused this chaos was rarely applied. Demoralisation and disorganisation, rather than destruction, were therefore the main consequences of torpedo attack. Hence the interesting reversal of torpedo theories. Far from being a decisive weapon suitable for the coup de grace, the torpedo emerged as a weapon suitable for an initial demoralising role, preparatory to the decisive gun battle.[1]

The various factions in the Royal Navy took their usual less subtle views, using the evidence as it suited them. Captain Murray Sueter, for instance, claimed that the torpedo had done considerable damage and should be rated as a major weapon.[2] Custance, now a Rear Admiral, claimed that the percentage of successful torpedo attacks was infinitesmal, and that the torpedo could be disregarded.[3] Cyprian Bridge was less dogmatic but no less penetrating for all that. He observed that the failure of the Japanese, with all their skill and courage, boded ill for any other country which attempted to use TBs.

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1. Quotations and narrative are from the unpublished Admiralty War Staff History, Maritime Operations in the Russo-Japanese War 1904-05 by Julian Corbett and Rear Admiral Sir Edmond Slade; NID 944. The conclusions and lessons drawn, and the analysis of the TBD in action, are essentially a precis of their perceptive judgement.
2. Sueter, The Evolution of the Submarine Boat, Mine and Torpedo, (Portsmouth: Griffin and Company Limited, 1907) p 318-25.
3. Custance 'The Whitehead Torpedo in War', Lecture to War College, 11 June, 1914; Keyes Mss.

He also remarked that the TBs were hampered by bad weather and lack of scouts, and had consequently been unable to launch their attacks. Many factors were necessary for a good TB attack, and these factors had to be supplied by other vessels, such as scouts. He then posed the major question of whether torpedo activities should be allowed to dictate strategy, or whether they should be restricted to minor operations of a special character. 'It is desirable to avoid entrance into a vicious circle, in which the necessity of defending and redefending that which of its very nature ought to rely on its powers of offence, and of providing accessories to the torpedo craft, would compel us to construct a force only to be employed on rare occasions, if at all.'[1] It was a sound philosophical point, and reinforced his opposition to specialist strategies which had motivated his consistent opposition to the TB.

His logic was impeccable. Gunnery had been overestimated just as greatly as the torpedoists had exaggerated their capacity to score hits with their weapons. The capacity of gunnery to hit was clearly demonstrated to be as minimal as contemporary gunnery experiments had indicated, but its capacity to unnerve was a factor previously discounted by the torpedoists. That it was a very real factor could no longer be denied. Above all, the insistence by Bridge and his school on the limited seaworthiness of the TB was clearly vindicated by the Russo-Japanese War, and this had been the one clear lesson of the manoeuvres. Despite these limitations, however, the TB could not be ignored. The war had done nothing

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1. Bridge 'The Russo-Japanese Naval Campaign of 1904' Brassey 1905.

to alter an increasing awareness that defence was based mainly on a reliance on the inadequacy of the attack. It was hardly a sound basis for safety and thoroughly justified Jellicoe's gloomy prognostications.

CHAPTER SIX - SERVICE REACTION

(a) The 1880s.

British naval thinking could not of course remain indifferent to the implications of the improving capabilities of the torpedo. While Whitehead and Woolwich competed to produce an increasingly devastating weapon therefore the Royal Navy, aided by its observation of the weapon in action in foreign and British manoeuvres, attempted to develop and clarify its tactical and strategic thinking and come to terms with the torpedo's likely effect on the exercise of British sea power.

Initially, however, before the manoeuvres of the 1880s and 1890s provided a basis for discussion, confusion predominated. While Fisher of Vernon pressed for the replacement of the ram by the torpedo on ironclads[1], most commentators anticipated the Whitehead replacing the Harvey as a defensive auxiliary and a deterrent to the would-be rammer; many more regarded it with great suspicion in any role.[2]

Partly because of the difficulty of adapting the torpedo to effective use from battleships and partly because of the unique nature and capability of the new weapon, attempts were made from the outset to develop a special vessel solely for the purpose of employing the torpedo. The first specially designated 'torpedo vessel' was ordered in June 1872. The Vesuvius was a low freeboard

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1. Fisher to Phipps Hornby, 10 Feb 1876: Phipps Hornby Mss, Phi 121b.
2. Eg. Lieutenant G.H.U. Noel, 'Gun Ram and Torpedo 1874' Printed Pamphlet, Naval Library.

vessel of 260 tons and 9¾ knots speed, which Lieutenant W.H. Hall described as 'suitable for the use intended' but generally too slow.[1] For what, however, was she intended? Her limited capabilities restricted her role to surprise night attacks in coastal waters, a fact which emphasised the peculiarly British dilemma. The Whitehead torpedo was undoubtedly most suitable for these conditions, but was it in British interests to develop a capability for this sort of activity?

Russia obviously had an interest in developing her resources for coastal warfare.[2] Germany too, could hardly expect to play a dominant naval role, while France could reasonably expect blockade. For Britain, the question was different. To his own rhetorical question, 'a quoi peut servir une marine?' the Frenchman, Admiral Jurien de la Graviere replied with a precise definition of the role of the Royal Navy, namely, 'a occuper les grandes voies maritimes'. The command of the seas could not, however, be gained by vessels of the type favoured by continental countries. Hence the official line:

> We hold that for the British navy, sea going vessels, capable of cruising with our squadron, are far more necessary than mere harbour defence boats ... A great navy like that of England can only be rendered complete by an eclectic and comprehensive policy. We must not rely exclusively on the turret or the broadside, on monster guns or light armaments, on torpedoes or on rams, but every naval weapon and every class of fighting ship must be included in due proportion in our programme of construction.

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1. IND 18125 20 June, 1872.
2. See pp. 114-115.
3. 'English and Foreign Opinions on the Types of Warship best adapted for Modern Naval Warfare.' Memo probably by Brassey nd but probably early 1880s; Printed Pamphlet, Naval Library.

British attention was therefore concentrated on the development of the sea-going torpedo vessel, although in the hands of an enemy this same weapon inevitably posed a danger to British ironclad squadrons. 'In dark nights, in fog or heavy weather, and in the smoke and confusion of a naval engagement, it would be difficult to resist the attack of a swarm of such puny antagonists'.[1] For this reason, the British torpedo vessel was expected to play both an offensive and a defensive role. 'The assailants [i.e. the enemy torpedo vessels] ought to be brought to bay, before they could get within striking distance of the ironclads, by consorts, armed, like the attacking vessels, with the ram and with the torpedo, and which must, like them, run the risk of being sunk'.[2]

It was the search for this type of vessel which resulted in the creation of the remarkable Polyphemus. Barnaby reported in September 1874

> that a design has been prepared for a ship to use torpedoes at a high speed. In the Vesuvius, noiselessness and comparative invisibility were depended upon. The present design is for a ship capable of operating wherever an ironclad could, and to be able to maintain speed equal to that of the fastest ironclad for eight to ten hours, and to be armoured at the waterline ... capable of operating with perfect safety and in whatever weather the ironclads could fight.[3]

The Polyphemus experienced a lengthy gestation period. The Controller completely opposed special torpedo vessels, and there

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1. ibid,
2. Barnaby lecture, 'On Some Ships of War'. INA XXVII (April 1876) 1-6
3. Barnaby minute 26 Sept 1874; ADM 138/66.

was considerable support for the contention that instead of constructing purpose built vessels, fast merchant vessels could be equipped with torpedoes in an emergency.[1] Not until January 1877 was Barnaby's original plan approved,[2] and not until February 1878 was construction begun.[3] Even then, the vessel's unique design caused such construction problems that it was four years before she was launched, while teething problems prevented any assessment of her until 1885. In this year, she played a spectacular part in the manoeuvres[4] and crossed the stormy Bay of Biscay. Her captain, Jeffreys, was delighted. He reported that she 'behaved remarkably well' on her voyage, although she was virtually submerged most of the time, and her speed of 6-8 knots fell well short of the 17 she was capable of making in good conditions.[5] Whether this extraordinary vessel would have realised the high expectations of those who sailed in her is problematic; for one thing, the practicability of discharging torpedoes from her underwater tubes was still uncertain. Her main significance lies in the fact that she represented a bold experiment by a navy whose tradition dictated that others should set the pace in new developments. The Polyphemus was a daring attempt to exploit the new weapon for the benefit of the Royal Navy. As with the adoption of the Whitehead, the Navy was found wanting in neither originality nor boldness.

For all Barnaby's enthusiasm however, the Polyphemus was the

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1. Controller minute, 9 Dec 1874; ibid.
2. Board decision, 30 Jan, 1877; ibid.
3. Polyphemus Ship's Book; ADM 136/4.
4. See p. 132.
5. Jeffreys report, 8 April, 1886; ADM 138/66.

only auxiliary torpedo vessel to be built in the 1870s. This was a decade of extreme economy, and the minor vessels of the Royal Navy had an enormous variety of tasks to perform, such as patrolling colonial waters and trade routes and carrying despatches. Furthermore, considerations of cost and radius of action resulted in an emphasis on sail-power and seaworthiness[1] which inevitably precluded those qualities of speed and manoeuverability necessary for the use of the torpedo. This was understandable. Less so however, was the refusal to employ torpedoes from these vessels. Although Barnaby showed a considerable grasp of the situation, and although torpedoes could not help but make small vessels more useful and powerful, there was a general refusal to employ anything but guns as the main weapon. The torpedo armaments of foreign auxiliary vessels were held to be unnecessarily heavy, while it was not considered necessary for the Royal Navy to change its traditional weapons.

By the 1880s, however, naval opinion was coming increasingly to recognise the threat of the torpedo.[2] In discussions at the RUSI, only Captain Cyprian Bridge, foreshadowing the philosophy and faith which he was to preach as DNI in the 1890s, rejected outright fears that the blockade would no longer be feasible. More advanced thinkers, notably Captain R.H. Harris, anticipated revolutionary changes as a consequence of the torpedo. In 1882, Harris urged the

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1. Cooper Key memo, 23 Oct, 1884; ADM 1/7254.
2. Fremantle 'Naval Tactics on the Open Sea with the Existing Types of Vessels and Weapons' RUSI XXIV, (1880) 1-60. Long 'A Study of the Tactics of Naval Blockade as affected by Modern Weapons' RUSI XXXV (1881) 316-43. Barnaby 'Battleships - A Forecast' RUSI XXVII (1883) 127-33.

construction of sea-going 18 knot torpedo boats to guard the fleet, and in the following year, declared:

> We are not justified in presuming that a fleet battle of today would be won or lost by artillery alone; on the contrary, we have ample evidence that the impact of the ram, and the shock of the torpedo, must play a very important part in the melee which must surely ensue during a hotly contested naval action ... it is even possible that armoured vessels of a large size may at some future time completely succumb to greater developments of torpedo vessels.[1]

Nor was this general opinion disputed officially. Northbrook expressed the prevailing opinion of the Board thus:

> In the opinion of some, no mean authorities on naval construction, the system of torpedo attack will before long be developed in such a way as to permit the use in naval engagements of ships very much less costly than first-class line-of-battle ships. Of course, no ship armed with torpedoes can take the place of an ironclad in an attack upon fortifications, or in similar work, but as regards service in the Channel, there are those whose opinion I much respect who think that the class of torpedo-rams we now propose to build may perform service equal to that performed by some of the armour-plated ships.[2]

The vessels to which he referred were one of a number of proposals under consideration by the Board in the 1880s, for the Admiralty was fully aware of the power of the torpedo and, under the vigorous direction of the First Naval Lord, Cooper Key, continued its search for a suitable vessel to employ it. There were, however, two problems. Firstly the difficulties of the 1870s were again

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1. Harris 'Maritime Power and its Probable Employment in War' with Brassey comments RUSI XXVII (April 1883) 413-39. Also Harris 'The Necessity of Supplementing Armoured Ships by Vessels of other Types' RUSI XXVII (June 1881) 25-39.
2. Hansard 3rd ser., CCXC, 661-2 (10 July, 1884).

apparent, for a torpedo vessel would have to combine both torpedo and sailing qualities. The two requirements were contradictory. A cruising vessel was too big to be an effective TB; a TB was too small to cruise long distances on the high seas. Secondly, there was some confusion about the role of the torpedo vessels. Despite the fact that all the arguments and fears concerned the efficacy of the blockade in the face of the torpedo, the pre-occupation was not in finding suitable vessels to protect this operation, but in the development of vessels for fleet operations on the high seas.

These two factors featured prominently in Board deliberations during the 1880s. Whatever the shortcomings of the debate, it cannot be said that the implications of the torpedo were neglected during the period of the Northbrook administration. Cooper Key at least had a clear idea of what he wanted.

> I am strongly impressed with the necessity of providing another description of torpedo-vessel differing from and in addition to, those already built or building. We require seagoing torpedo-vessels to be attached to any squadron, which would be capable of accompanying the squadron to any distance in any weather - vessels that, having sufficient speed to overtake an ironclad, would not receive her fire when approaching or passing her, to launch a torpedo if her waterline and vitals were protected by a steel deck ... torpedoes to be discharged below water, or otherwise she would be incapable of running the gauntlet of an enemy's fire ... 16 knots speed ... sufficient coal to accompany the fleet ... no squadron can be considered as efficient without one or two such vessels being attached ...'[1]

The realisation of this vision was, however, less than easy. When in December 1881 Key pursued his idea of a 'cheap Polyphemus',

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1. Colomb, op cit p. 447.

Barnaby observed that the cost would be at least £100,000, and proposed a cheaper alternative of carrying TBs in merchant ships. Key was adamant: 'the construction of a class of unarmoured vessels to be attached to, and operate with, an armoured fleet, is a necessity'. In April 1882, therefore, Barnaby proposed a 300 ft., 3150 ton, 16 knot vessel. This design pleased Key, but the DNO, Captain Herbert, pointed out that although admirably suited for ocean cruising with the fleet, it was far too big for torpedo work. At the same time, the practicalities of underwater discharge, which was considered an essential feature of any ship intended to use torpedo, had still to be resolved.[1]

The eventual decision reflected these problems. In December 1882, the Board decided on the construction of a 'Protected Sea-going Torpedo Vessel of 16 knots speed', the Mersey, together with a sister-ship, the Severn. These were vessels of 2900 tons, and demonstrably too big for their role as torpedo ships. On the other hand, their size was virtually dictated by their utility as commerce protectors, for they were intended to be used as gun vessels if underwater torpedo projection were found to be impossible; and when this proved to be so, the two ships were indeed deployed with the gun as their major weapon. Another attempt, in February 1883, resulted in the construction of the Scout, which was officially designated a 'torpedo cruiser' 'for the employment of the Whitehead torpedo and with seagoing qualities.'[2] Equally obviously, however, she was too big for her torpedo role.

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1. Exchange of minutes between Key, Barnaby and Herbert between Dec 1881 and May 1882: ADM 138/80.
2. Campbell-Bannerman (Parliamentary Secretary to the Admiralty) Hansard 3rd ser., CCLXXXVI 376, (20 Mar 1884).

Recognising these shortcomings, Key pressed for small fast sea-going torpedo-vessels of the type suggested by Harris, capable of dashing in with the torpedo or protecting British ironclad fleets from a similar attack. Yet even then he expected the size of this vessel to be 1200 tons, with a radius of action of 2800 miles.[1] Captain George Tryon observed with approval that this vessel would combine the qualities of sea-going gun-, torpedo- despatch and general utility vessel, although a trifle too large for work against TBs by night.[2] His praise in fact exposed the problems which bedevilled the formulation of ship-construction policy. His caveat was precisely the weakness which was most vital, and caused most directly by the attempt to combine too many qualities in one vessel. Nor was the solution of this problem made any easier by the steadily increasing pressure for the adoption of the TB. This reached a peak in the winter of 1884-5, when in November 1884, the RUSI gave an enthusiastic response to a speech by Alfred Yarrow extolling the virtues of his TBs.[3] Any proposal for increasing the Royal Navy's limited number of TBs (20 in 1884) however met with firm opposition in the Admiralty. The inherent characteristics of the vessel limited its role to that of coast defence and any proposal for adopting the TB was considered to imply that the Royal Navy itself should assume that function.[4] This was anathema to the spirit of the Service. 'I consider' wrote Key 'that any additional sum voted by Parliament for the Navy should be applied to the increase

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1. Key, 21 Mar 1883; ADM 138/97.
2. Tryon, 9 April, 1883; ibid.
3. Yarrow 'Torpedo Boats' RUSI XXVIII (March 1885) 617-28.
4. Hall 'Defences of Foreign Arsenals' 30 June, 1884. Key minute 4 July, 1884; ADM 1/6716.

of the power of our sea-going fleet, and to improve the efficiency of the personnel of the Navy rather than to the provision of a Naval Force for defensive purposes only'.[1]

The role which the TB was likely to assume therefore invariably predisposed many officers to condemn the vessel out of hand, and was at the root of the thinking of the anti-torpedo school led by Cyprian Bridge in the 1890s. The torpedoists struggled to find a suitable function and justification for the new boats, A.K. Wilson for instance experimenting in the Mediterranean with the torpedo depot ship Hecla as a mother vessel, from which the TBs could attack the enemy in his home waters.[2] It was clear however that the TB had no place in Admiralty thinking, which was entirely concerned with fleet actions and the future of the large armoured ship.

This was of course perfectly logical, and far more justified than the arguments of the TB advocates, who following the example of Yarrow, were merely stating that Britain should match foreign ship-building in the 'new' weapon regardless of requirement. In resisting the demand for British TBs however, the Admiralty failed to take account of the very real dangers which foreign TBs would pose to a British fleet engaged in the blockade. Given the hallowed and unquestioned place of the blockade in naval thinking and mythology, this was precisely the sort of operation which the Royal Navy was most likely to undertake; it was the sort of

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1. Key memo commenting on 'Recommendations of the Committee on the Defence of Mercantile Ports', 19 Jan 1883; W.O. 110/8.
2. Wilson report, 1 June, 1881; ADM 1/6567.

operation which most exposed ironclads to the TB menace: and it was precisely the eventuality against which no provision was made. As late as November 1884, Thorneycrofts proposed a design for a 320 ton, 200 ft., 18 knot TB catcher ideally suited for the close protection of the ironclad fleet. It was rejected by the Naval Lords Hopkins and Richards, on the grounds that its cruising capabilities were inadequate.[1]

The only person who seems to have grasped the essence of the problem was Captain W.H. Hall now of the Foreign Intelligence Committee (forerunner of the Naval Intelligence Department or NID). He alone overcame the blind spot, which led his superiors to assume that because the TB was unsuitable for use by the Royal Navy, there was no need to consider the dangers which it posed in the hands of an enemy. He analysed possible operational needs in a war against France, assuming that a policy of blockade would be adopted. From this there followed the perfectly logical proposition that certain vessels were necessary.

> It is generally admitted that TBs constitute the chief danger to a blockading squadron, and their extensive employment in the defence of a port will result in the blockading squadron having to seek a wide offing as night approaches ... unless it is accompanied by an adequate number of torpedo vessels sufficient to protect the squadron, and at the same time, to attack the enemy's ships in port. Were this the case, the tables would be turned, as the enemy TBs would find sufficient work cut out for them in defending their own vessels.

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1. Thorneycrofts to Admiralty, 6 Nov 1884. Hopkins minute 11 Nov, 1884 and Richards minute 28 Dec, 1884; ADM 138/104.

For this purpose, he advocated vessels of 'not less than 300 tons'.[1] This approximated remarkably to the specifications of the Thorneycrofts design, was three times the size of the larger TBs, but far smaller than the seagoing auxiliaries already produced for the Royal Navy. It was also a forecast of the 'Rattlesnake' type. In the absence of such vessels meanwhile Hall considered that the Baltic, infested with over 100 Russian TBs, would be a death-trap for the Royal Navy and in the event of war would have to be abandoned to the enemy.[2] In March 1885 his theory was very nearly put to the test, when war with Russia seemed imminent. From the start, there was no question in Cooper Key's mind that the war would not be carried to the enemy. The Particular Service Squadron was assembled at Portland to enter the Baltic and attack and bombard Cronstadt. Phipps Hornby, the squadron commander, commented, 'Now the only place we can strike him is the very place where we ought not to do so.'[3]

Improvisation replaced the non-existent preparation. Hall busied himself with plans for transporting TBs to the Baltic in merchant vessels, and using them in a defensive role. 'A large number of suitable steam guard vessels will be required as well, to protect the squadron from TB attack, if there are not sufficient suitable boats available in the dockyard I would venture to suggest that enquiries be made if there are any suitable tugs or similar

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1. Hall 'Remarks on a Naval Campaign', 24 Sept. 1884; FIC 14.
2. Hall 'General Outline of Possible Naval Operations against Russia' 14 Mar 1885; FIC 64.
3. Hornby to Mrs Stopford, 1 May, 1885; Phipps Hornby Mss, Phi 120b.

craft in our mercantile ports'. In addition to the eight TBs available, the TB depot ship Hecla and the Polyphemus, eight merchant vessels and two tugs were hired and armed. Meanwhile no less than 54 TBs were hurriedly ordered for use as catchers.[1] In effect, this was a confession of the complete bankruptcy of Admiralty policy.

In fact, the TBs so hastily ordered were less than wholly successful. Not only did they take well over a year to deliver (somewhat late for the Baltic!) but the design of their bows and the use of a heavy bow torpedo tube made them very wet. An extra eight tons of ballast was necessary to make these 'undesirable apologies' seaworthy. The use of ammunition for this purpose was described by Custance as 'a splendid dodge they have got hold of for getting out of the mess, which reflects great credit on all concerned in this scandal'.[2] For seagoing purposes the TB was indeed quite useless; nevertheless it was in the short term the only possible antidote to the threat posed to the British blockade by the Russian TBs.

As the fleet waited for the impending war, the Board hastily ordered the design of a 17 knot gun and torpedo vessel.[3] A month later, in May, Barnaby was given more specific instructions. A vessel of 300 tons, greater manoeuvrability and more seaworthy than a TB, with a draught of eight feet for safety against torpedoes, was now required.

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1. Hall minute 31 Mar 1885; ADM 1/8869. Also 'Preparations for War' 31 Mar 1885; ADM 1/8870.
2. Jeffreys to Fisher, 1 April, 1886. Custance to Phipps Hornby, 21 May 1886 Phipps Hornby Mss, Phi 120b. Also A.W.A. Hood to Vezey Hamilton, 31 Oct, 1886; Vezey Hamilton Mss VHM9.
3. IND 18387 April 1885.

Even now, however, Key and Brandreth had second thoughts. Was 300 tons enough for Atlantic sailing? Again, the cruising requirements bedevilled design decisions. Northbrook suggested waiting for Phipps Hornby's report on the manoeuvres which had now replaced the Baltic expedition;[1] this report confirmed the necessity for a 300 ton anti-torpedo vessel[2] which could act in support of the blockade. Until then, no evidence had been available; equally however, no attempt had been made to obtain any, and only Hall had made the simple and rational analysis which provided virtually all the necessary information. Despite the genuine concern with the TB issue, the failure to prepare adequately for war reflected poorly on the Admiralty's capacity to assess the nature of the menace. 1

The result of the Russian crisis was the Rattlesnake, the designs for which were produced by Sir William White in August 1885. This was a 400 ton, 200 ft., 19 knot torpedo gunboat in which cruising capacity was eschewed, and the emphasis laid strongly on catching and sea-keeping qualities.[3] With her the era of 'cruising' ended and the era of 'catching', as the major role of the smaller auxiliary vessel, began. In her trials in April 1887 she was able to forge on in seas which swamped TBs. 'On the whole, her performances have been most satisfactory, and her power of maintaining a high rate of speed and thorough habitability under circumstances of wind and sea, which compel even the largest TBs to slow down, has

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1. Barnaby minute 8 May 1885, key minute nd, Brandreth minute, 18 May 1885 Northbrook minute, 22 May 1885, ADM 138/104. Northbrook minute July 1885; ADM 1/7465c.
2. See p. 132.
3. White minute, 15 Aug, 1885; ADM 138/104.

been conclusively established'. Work was started on an improved catcher, the Grasshopper..

The adoption of such a vessel finally destroyed any possibility of the Jeune Ecole's theories gaining the ascendant in Britain. There had been much confusion, and a marked reluctance to build any more ironclads than was strictly necessary; there was a widespread belief that the future lay in smaller ramming vessels; and many of the younger officers discussed and favoured the ideas of Charmes and Aube.[1] The ironclad had however never lost its place as the ultimate arbiter of sea-power, and the construction of vessels specially designed to protect it against the danger which according to some theorists threatened to replace it, was a final affirmation of its primacy. The extent of the TB menace, however, was still unclear, and the debate in 'informed circles' on this issue did very little to clarify matters.

The debate itself[2] lacked nothing in quality, but failed to resolve any of the contentious issues, mainly because the protagonists were disputing different things. The torpedoists' claims were essentially moderate and reasonable, the most extreme being that the TB might be used in an auxiliary function in a fleet action close to shore. Their main contention was however that TBs would be highly

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1. According to Admiral E.R. Fremantle, 'Ironclads and Torpedo Flotillas' Nineteenth Century XVIII (July 1885) 657-673.

2. For the debate. Fremantle, 'Are Ironclads Doomed?' Blackwood's CXLI (April 1887) 519-33, Gallway 'The Useof Torpedoes in War' RUSI XXIX (March 1885) 481-97 Fremantle 'Naval Tactics' RUSI XXX (February 1886) 367-419. Harris ditto RUSI XXX (1886) 419-501. Colomb 'Naval Reform' RUSI XXXI (July 1887) 767-785. Colomb 'Blockades under existing conditions of warfare' RUSI XXXI (June 1887) 733-765. Grenfell 'The Position of the Torpedo in Naval Warfare' RUSI (April 1887) 539-65.

dangerous at night in restricted waters, a point which few denied and which had resulted in the development of the 'catchers'.

The advocates of the status quo ignored this argument and merely attacked the excessive claims of the French school which had been thoroughly discredited by the manoeuvres of the 1880s. The pith of their attack was quite simply that the TB lacked the seaworthiness and engine-power to challenge the battleship on the high seas, while the French argument that numbers would prevail assumed that quite unrealistic sacrifices would and could be borne by TBs in order for one of their number to succeed. Their defence of the blockade strategy on the other hand rested on foundations which were less than secure. E.R. Fremantle, for instance, maintained that it was quite possible to maintain the blockade, given the proper precautions of electric lights, nets and TB catchers. His opinions, however, were not supported by any evidence, while the manoeuvres appeared to indicate that the blockade was in fact a distinctly hazardous operation. His main argument was the general weakness of the TB at sea. Nobody disputed this; whether it was relevant to the particular problem of the blockade was, however, another issue.[1]

The excesses of Charmes' Naval Reform allowed the problem of the blockade to be avoided altogether. The argument about sea-worthiness could be employed really effectively, while Colomb and Fremantle were free to philosophise on the nature of sea-power, and debate the matter on an almost metaphysical plane. Should a variety of weaponry be concentrated in one vessel, or should there be

specialisation by different types of vessel? Could the TB replace the battleship, simply because it could destroy it? Was that not like arguing that the dagger should replace Caesar? And would torpedo vessels retain any purpose following the abolition of the only vessels they could destroy? It was a fascinating excursion into the more profound problems of naval warfare; as an answer to the immediate problems it was irrelevant. The blockade remained a matter of faith, and Colomb expressed the opinion which dictated the continuation of this idée fixe of naval strategy.

> My own conclusion is that unless there are a very numerous fleet of spiders - something with very great MG or QF gunfire, and such light draught of water as not to fear torpedoes, you cannot enforce military blockade, but if you have plenty of spiders you are able to intercept and destroy emerging TBs and are able to set up such a care in the blockaded mind that he will send his ships out. In fact, if you go the right way to work about it, his torpedo service for the goose is also his sauce for the gander.[1]

By the end of the 1880s, therefore, the general conclusion was that the excesses of the Jeune Ecole should be rejected, and the traditional patterns of sea-power asserted. Just as the earlier determination to prevent the adoption of the TB had however served to distract attention from the necessity for countering its very real dangers, so French exaggerations now distracted attention from the fundamental issue of the menace which the torpedo could pose in certain limited conditions. The faith of the optimists was less than wholly convincing.

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1. Colomb to Phipps Hornby, 6 Sept 1888; Phipps Hornby Mss, Phi 120c.

(b) Service Reaction: The 1890s.

By the end of the 1880s, the situation appeared to be under control. Although the danger to the blockade had been fudged, the menace appeared to most observers to have been exaggerated. The TBs' inability to keep the seas, and the appearance of the 'catcher' seemed to have put matters into perspective. The results of the manoeuvres of 1890 therefore came as a considerable shock[1], particularly since the French threat, which took the form of large numbers of their improved TBs in fortified stations along the channel coast, was immediate and obvious.

> In time of war, any fleet sent to cruise and cover the English and Irish Channels will avoid narrow waters. The condition of torpedo warfare forces this upon us. Our neighbour on the other side of the Channel has established no fewer than twelve TB stations at convenient distances apart, from Dunkerque to Brest inclusive, within easy striking distance of the trade routes up and down channel. They are all more or less protected by artificial and by natural defences and obstacles. This fact shows that it is contemplated to make the Channel as to its passage one of anxiety, to say the least, and as to its occupation by the fleet, a hazardous task.[2]

The danger was enhanced by the proven inadequacy of the catchers[3]. As constructed they were too big to benefit from the advantage of shape which gave the TBs their high speed, yet too small to benefit from the power which large ships could exercise against the sea. When the Construction Department increased the size of the catchers

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1. See p. 143.
2. Report of Joint Naval and Military Committee on the Defence of Certain Harbours and Positions, 9 May 1891; Vezey Hamilton Mss, VHM 9.
3. See pp. 150-1, 152.

this led to no increase in speed, but merely overworked the engines. It was a basic design failure which had been noted by the Marine architect R.E. Froude when he commented on the original specifications.[1] By December 1890, Sir William White commented in exasperation: 'The construction of small swift craft such as torpedo gunboats is a practical impossibility'.[2]

The naval officer was therefore entirely in the hands of the naval architect, for the solution appeared in principle at least, quite simple. The Controller, Fisher, argued that the 1890 manoeuvres demonstrated that the English Channel would be untenable, particularly at night, unless the torpedo boat menace were neutralised either by the destruction of the points d'appui or by vigorous offensive patrolling. For the latter purpose, the Navy required a cheap tough vessel of shallow draught, with just sufficient sea-keeping qualities to maintain itself off the French coast and sufficient size to give an advantage of speed over the torpedo boat in rough weather. He rejected the idea that suitable civilian vessels could be found for conversion and suggested that purpose built ships should be ordered either from the DNC or from private industry. The DNC had failed, so the problem was put to private industry. The result was the creation by Alfred Yarrow of the torpedo boat destroyer (TBD) Havock, a vessel only slightly larger than the TB, but armed with guns rather than torpedoes.[3]

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1. Froude minute, 7 Aug, 1885; ADM 138/104.
2. White memo, December 1890; ADM 1/7028A. Also Armstrong Torpedoes and Torpedo Vessels (London: George Bell and Sons, 1896) pp 213-27.
3. A.J. Marder op cit. 167-68. Fisher memo, Feb 1891; in 'Notes for Navy Debates'; Naval Library, MOD.

This remarkable creation was a complete success and Fisher was ecstatic when the Havock was put through its paces in October 1893.

> The official trial was most successful both as regards speed and to behaviour as a seaboat. It was blowing hard with a good sea on and she behaved very well. With 151b steam pressure to spare, she averaged 26¾ knots - she is a good 27 knot boat. So our anxiety is at an end and we may safely launch forth in ordering more, feeling we shall get the speed and that we have got hold of the right type of vessel as a TBD and sufficiently seaworthy to accompany our Fleets to sea so we hope.[1]

The 'unalloyed success of the TBDs'[2] caused Richards in November 1893 to urge 'most strongly the necessity for creating a force of at least 80 TBDs in the shortest possible time and at no matter what cost - apart from such a force, he considered the English Channel untenable in view of the French TB organisation'.[3] Spencer himself was more cautious, and warned of the disasters associated with the previous mass order of 54 TBs in 1885: 'some bad defect may be discovered and that a better pattern and type may be discovered before they are all built'.[4] However, he recognised the merits of the vessels and put up only a token resistance to the claims of Richards and Fisher for a programme of no less than 82 TBDs to be built over a period of three years.[5] More would have been ordered, if not for the traditional resistance of the Treasury, and the objections of Sir William White, who argued that the design was 'not beyond criticism'.[6] The course of future policy was, however,

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1. Fisher to Spencer, 30 Oct, 1893; Spencer Mss, Spencer 11.
2. Fisher memo, n.d.; Spencer Mss, Spencer IV.
3. Minutes of Board Meeting, 22 Nov, 1893; ibid, Spencer 23.
4. Spencer to Culme Seymour, 7 Feb 1894; ibid, Spencer 7.
5. See Marder op cit pp 191-92.
6. White memo, n.d.; Spencer Mss, Spencer 22.

clearly decided. The future battle fleet was to consist of battleships and destroyers. The one was to hold the seas, maintain the blockade and defeat the enemy; the other was to eliminate the threat to the battleship from the TB. Moreover, the manoeuvres of the 1890s and particularly the extensive destroyer trials of 1894 appeared to indicate that the TBD indeed offered a realistic means of suppressing the TB.[1]

While providing lavishly for these offensive counter-measures, the Board was equally concerned to protect the harbours whose vulnerability had been exposed in 1890. Portland and Dover were exposed to attack and experiments conducted to test the effectiveness of the Solent defences showed that TBs were capable of running up the Needles passage despite gunnery and searchlight defences. Only inside Portsmouth harbour or Southampton River would the fleet be safe. 'It is idle to build costly ironclad fleets and to continue in the condition of having no harbour in which they can remain at anchor at night without the ships being exposed to destruction by the locomotive torpedo'[2] said Richards, and Spencer argued in Cabinet that 'the power of the fleet for conducting offensive movements ... would be paralysed' without secure bases.[3] Spencer's arguments paid off; the 1895 Naval Works Bill provided for the construction of breakwaters at Portland and Dover.[4] The Mediterranean however took longer. Despite continued pressure, Spencer was unable to obtain

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1. See pp. 152-3. Also pp. 154-66.
2. Richards to Spencer, 1 Feb 1896; ADM 1/7256B.
3. Spencer memo, 16 Jan 1895; CAB 37/78/6.
4. Cabinet decision 16 Jan 1895; ibid.

funding for a breakwater at Gibraltar in 1896, and it was not until 1901 that the money was provided for one at Malta.[1]

This decade therefore saw immense expenditure of effort, of material, and of money in meeting the threat of the TB. For while Bridge in his NID reports denigrated the TB at every opportunity, the Board took the threat very seriously indeed. The extent of the danger remained a matter for debate, turning on the familiar arguments arising from the manoeuvres[2] concerning the effectiveness and 'moral effect' of gunnery and torpedo fire. Interestingly the lead in the public debate was taken by the civilians Thursfield and Laird Clowes; and it was the latter who most effectively pinpointed the main difficulty of the TBs, that of finding the enemy.

Reflecting on the period of the 1880s and 1890s, Cyprian Bridge was critical of Admiralty policy: 'A new weapon comes into existence, tactical methods of employing it involving the construction of a novel class of vessel, had been devised, and yet tactics were silent as to the means of counter-acting its employment. Reliance was placed on passive defence arrangements exclusively'.[3] Bridge was railing against the enormous expenditure on harbour defence and the consequent distraction of resources which, for instance, Cooper Key

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1. Correspondence on the fortification of the Mediterranean bases; Selborne Mss Selborne 8. Richards to Spencer 12 Nov, 1894, Spencer memorandum 8 Jan, 1895, Goschen minute, 2 April, 1897, Admiralty to Treasury 6 July, 1900 ADM 116/553.
2. For the debate, see Long 'An Attempt to Estimate the Probable Influence of the Introduction of QF guns on Naval Tactics and Construction' RUSI XXXVI (January 1892) 233-59. Laird Clowes 'The Place and Uses of TBs in War' RUSI XXXVI (May 1892) 667-700. Thursfield 'British Naval Manoeuvres 1893' Brassey 1894.
3. Bridge 'Fifty Years Architectural Expression of Tactical Ideas', INA LIII (July 1911) 34-50.

had also resisted. He was in fact continuing the campaign, begun in his NID reports, to write the TB out of the reckoning. For all the shortcomings of the TB, however, his criticism must be judged unfair. The role of the TBD was certainly 'defensive' in the broad strategic sense; but the method of its employment, and in particular the obsession with the blockade and the hunt, was offensive in the extreme and not perhaps the wisest of senses. The defensive works were certainly expensive yet the alternative was to trust in luck and the counter-attack of the TBD. The Board considered, and Bridge certainly agreed, that the TBD was indeed a good answer to the TB; but they could not ignore the fact that in certain conditions of darkness, mist, fog or rain, the TB could pose a deadly danger to the fleet. They could therefore afford to take no chances. Both the practical experience of 1890 and the warnings of such writers as Eardley-Wilmot in his book The Next Naval War (1894) illustrated the consequences of failing to take every precaution.[1] There can be little doubt that the measures taken were appropriate.

Against one form of TB warfare, however, no protection could be provided. It was a long-standing theme of some Jeune Ecole writers that TBs should operate against merchant shipping,[2] and this was a theme taken up by Lord Charles Beresford in a speech to the London Chamber of Commerce in July 1893.[3] Official naval opinion was

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1. Eardley Wilmot The Next Naval War (London: Edward Stanford, 1894).
2. See pp. 120-1.
3. Times, 13 July, 1893.

sceptical, basing its reasoning on the guiding principle laid down by the Foreign Intelligence Committee in May 1885:

> TBs are omitted from this category [commerce raiders] for, though the modern first-class TB is to some extent a sea-keeping vessel, able to operate at some distance from land, and capable of overhauling and sinking merchant vessels, her role is considered to be more that of attacking warships than of harassing commerce. Moreover, her crew being too small to furnish a prize crew, our enemy's vessels must either be let pass or destroyed, in the latter case, the only mode of disposing of her crew would be to cut them adrift in their own boats to make the best of their way to land.[1]

This of course was virtually unthinkable.

This judgement became and remained an article of faith in Whitehall. By the 1890s moreover, it was more or less accepted that TBs would operate only by night, which would necessarily make the sinking of merchant vessels an indiscriminate act and therefore unthinkable, since identification would be impossible. NID considered the problem again in 1892. Bridge, the DNI, refused to consider defensive operations. It was, he argued quite correctly, a task whose demands would be endless. There were so many merchant ships that it was impossible to defend them all. Commerce would just have to put its trust in the offensive operations on which he proposed to employ the TBDs. Basically, however, he put his trust in the ethics of the period, and simply did not believe that TBs would actually sink merchant ships. 'If they do so, it will be a revival of a barbarous practice which has become obsolete among nations for centuries, if it ever prevailed amongst them. (Revival

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1. 'The Protection of Commerce by Patrolling the Ocean Highways and by Convoy' May 1885 FIC 73.

is probably incorrect. It was never done except by the Salee Rovers and other pirates)'. Nor would TBs gain any prize money by so acting. Bridge concluded with the interesting if hardly reassuring contention that even if merchant shipping were attacked, this would at least mean safety for warships.[1]

This belief that the TBs would confine themselves to the attack of warships remained firmly rooted in all naval circles for as long as the torpedo vessel constituted a threat.[2] Only Commander G.A. Ballard thought otherwise. Facing up to the possible implications of the TB, he argued with thorough good sense that there was no reason why the French would not use their TBs for attacking commerce, particularly since this was their stated intention. Furthermore, they would be unable to use any other type of vessel because of the Royal Navy's general supremacy, and warships would be either well protected or out of range of TB attack. He therefore advocated a comprehensive system of controlled routes along which ships would sail by day and anchor by night.[3]

This thorough survey, with its logical assessment of the possibilities, was directly at variance with virtually all opinion. Thursfield pointed out that the TBs could operate only in limited waters and could therefore be watched. Lieutenant Carlyon Bellairs emphasised the difficulties of finding and identifying merchant

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1. 'Report of a Committee ordered to assemble for the purpose of determining the best means of combating the possible operations against this country, suggested by the several torpedo stations recently organised by France on her north coast' July 1892. Commentary by Bridge 18 Aug, 1892; ADM 1/7133.
2. Explicitly stated by Battenberg when DNI, 24 Dec, 1904; ADM 1/8880.
3. Ballard 'The Protection of Commerce in War' RUSI XLII (April 1898) 365-507.

shipping (implicitly assuming that the TB would bother to identify his victim before firing!). Above all however, faith was placed in the sanctity of civilian and private property.[1]

Warships of course could expect no such immunity, and it is therefore rather surprising that the organisation of the defensive arrangements did not match up to the material provision. Early NID plans for the defence of the Channel anticipated TBDs being deployed at Sheerness, Portsmouth and Devonport with the catchers assigned to the fleet and TBs employed as auxiliary catchers.[2] All vessels would therefore be ready for the TB attack immediately on outbreak of hostilities which attache reports indicated to be the most likely course of events in the event of war.[3] By the turn of the century, however, there was no adequate preparatory organisation, much to the concern of the new DNI Custance. The First Naval Lord, Kerr and the ADNI Sturdee, however, showed a remarkable lack of concern. This was particularly extraordinary in the case of the latter, who had spent so much time warning of the danger. Now he merely remarked that every precaution was necessary.[4] Custance continued to agitate, in vain, for the appointment of a Captain (D) to control all the destroyer flotillas and supervise their training, but subordinating their war-time activities to the flag officers at Plymouth, Portsmouth, Portland and Sheerness. It was a curious reversal of roles which found Custance now as the agitator.[5]

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1. Bellairs 'Commerce and War', Brassey 1904. Thursfield 'The Attack and Defence of Commerce', Brassey 1906.
2. Bridge memo 18/8/92; ADM/7133 and Bridge memo October 1893; ADM/7159.
3. Jackson report, April 1899; NID 537. Gamble report, 21 Feb, 1901; ADM/7550B.
4. Custance minute, 25 April, 1901, Kerr minute, 27 April, 1901, Sturdee minute 24 April, 1901; ADM 1/7518.
5. Custance minute, 17 Jan, 1902; ADM 1/7527.

Despite the pressure from Custance and his successor Ottley, it was not until 1904 that matters were brought to a head. In that year, chaos was caused during the trial mobilisations by the organisation of Admiral A.K. Wilson, who merely indicated that the destroyers should come under whoever happened to be the local senior officer at the time of mobilisation. The new DNI, Battenberg, adopted Custance's original proposals, and all TBs, TBDs and submarines were put under a Rear-Admiral who was given responsibility for organisation and training, but not for operational command in war.[1] The major threat remained a surprise attack: 'the attack against which it is most necessary to be prepared is one by TBs or TBDs on ship at anchor, which may very possibly be delivered even before the declaration of war', a point which was repeated in successive NID assessments of war strategy until 1907.[2] Not until now, however, was there an organisation capable of meeting the threat, and this was too late, for Germany had now replaced France as the main potential enemy. Perhaps, in the event of war, the shortcomings of the TB would have outweighed the shortcomings of the organisation of the forces deployed against them. The matter was never put to the test.

After the initial technical difficulties of the 1870s the torpedo acted as a major constraint on ironclad building in the 1880s, compounding the problems caused by the remarkable development of guns and armour in that period. It was the centre-piece of the great

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1. Kerr and Battenberg minutes dated 4 May, 1904; ADM 1/7725. Admiralty to Commander in Chief Channel 21 Feb, 1905; ADM 1/7861.
2. 'Instructions on Defence Matters' Oct 1907; NID 797.

debate on the future of naval warfare, in the process of which the Admiralty, despite its hesitations and doubts, maintained a basically clear idea of its priorities and strove, however unsuccessfully, to meet them. There were indeed faults in the conception of the war which was anticipated, notably in the failure to provide for the blockade function. After the shock of 1885, however, the pattern of naval construction and policy was clear. From then on, the problem was not one of conception, but of the failure of the architects to supply the needs of the navy.

By the late 1890s the construction of safe defended bases and increasing numbers of TBDs appeared to have defeated the menace of the TB. The Admiralty could therefore feel more secure. At the same time, the evidence of the manoeuvres dispassionately considered appeared to indicate that the enormous defensive precautions taken by the Royal Navy were less than wholly necessary.[1] The contradiction of these two propositions reflects the complexities of the problems and the difficulties of resolving them, while the energy shown in the 1890s emphasises the confusion of the previous decade. The clarity of purpose of the Richards Board throws into sharp relief the muddled and indecisive thinking of its predecessor and it is difficult to refute the logic of their actions in view of Britain's peculiar naval position. When all this is said, however, the determining factor in naval policy was the availability or otherwise of suitable vessels. Until the naval architects produced the means, the end could not be willed. The naval officer was obliged to wait for the civilian expert to produce the solution to the problem he had created.

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1. See pp. 157-8, 166.

CHAPTER SEVEN - THE ROLE OF THE TORPEDO BOAT DESTROYER

The problems of the 1870s and thereafter which run consistently through this study revolve around two questions; that of establishing a suitable role and function for the new weaponry and of adapting that role and the conduct of naval warfare as technical and strategic circumstances changed. The TBD exemplifies both these questions and at the same time carries its own special significance. For this was a unique vessel which had neither evolved historically like the battleship, nor been created as an abstract engineering feat like the TB; she had been consciously created to meet a specific strategic and technical need, which had been established by the experiences of the 1870s, 1880s and 1890s. By the time she had entered service in sufficient numbers to meet her task however, the circumstances which had shaped her creation had substantially altered. The story of her subsequent development in the 1900s is that of the difficulty experienced in coming to terms with those changed circumstances and establishing a satisfactory deployment for a vessel on which the Royal Navy had firm views based on experience which was, arguably, now of dubious relevance.

The destroyers were 'intended to watch torpedo stations, and run down any torpedo boats which may emerge from them'.[1] This role was dictated by several coincidental factors. Firstly, it was an article of faith that the best way of dealing with TBs was to hunt them, a belief strongly reinforced by the influence of Cyprian Bridge's

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1. Spencer memo, 13 Dec, 1893; Spencer Mss. Spencer IV.

writing in the early 1890s. Secondly, TBDs were unable to maintain high speeds for long distances and were therefore obliged to act independently of the fleet. Thirdly, the concept of the 'offensive' use of destroyers took firm emotional roots, which were to dictate their employment for far too long.

It was widely believed that the manoeuvres of the 1890s vindicated the role of the destroyer in harassing the enemy TB bases. In fact, however, these exercises demonstrated that the TB was suppressed by its own limitations, rather than by any action taken against it.[1] Furthermore, on several occasions it was clearly shown that a system which relied on a defensive escort for the battleships was superior to a system of offensive blockade. In 1903, for instance, one of the fleets operating in the Irish Sea used its destroyers in defensive screens, which prevented TBs from attacking at no cost to the defence. Destroyers disposed offensively, on the other hand, suffered heavy losses from shore based harassing attacks.

Despite the clear vindication of his dispositions, the Blue admiral was criticised for failing to pursue 'uninterrupted offensive measures', and allowing the seas to become infested with TBs. It was argued that a system of escort required large numbers of destroyers, but this belief flew in the face of the facts. It was blockade which consumed the casualties and demanded constant reliefs and reinforcements.[2] Argostoli in 1902 had given an indication of

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1. See pp. 157-8, 166.
2. Torpedo Craft Manoeuvres, 1903. NID narrative and officers' reports; NID 714.

casualties to be expected[1], while in 1904 no less than 22 out of a total of 48 destroyers were lost in a week as they blockaded TBs on the west coast of Britain.[2]

These facts were not faced, and the changing strategic conditions after 1904 made the matter all the more important. In the limited context of the English Channel, it was possible for destroyers to operate for several days off the enemy ports while supported by Cruiser squadrons. Now however the comparative immensity of the North Sea had to be crossed and the whole German coastline watched, a task made more difficult by the stormy and choppy nature of these waters.

Nor were such problems made any easier by the loose thinking induced by the fixation with 'hunting' and 'harassing'. Captain Michael Culme Seymour for instance assumed that the German destroyers would come out and allow themselves to be destroyed. This was a common belief which stemmed from the idea that the North Sea should be cleared of enemy torpedo craft before the battleship would be allowed in. Having grasped this rather simplistic view of naval warfare Culme Seymour then willed the means to suit the ends. He assumed that the Germans would cooperate with his scheme.[3]

If this opinion were naive, then it was equalled by the extreme narrowness of the views of the Commodore (T), Lewis Bayly. He held firmly to the view that 'the primary object of our destroyers is

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1. See p. 158.
2. Torpedo Craft Manoeuvres 1904; NID 754.
3. Culme Seymour 'Paper on Destroyers' Feb 1906; Keyes Mss, 3/4.

the destruction of the enemy's torpedo craft'. When his superior, Admiral Bridgeman and the DNI Captain Grant, observed that it would often be possible for the destroyers to use their torpedoes against the enemy battleship, Bayly argued that this would detract from the main purpose of the flotillas.[1]

Such tactical obtuseness was matched by the unreality of the plans within which the destroyers were to play a major part. Sir Arthur Wilson envisaged

> no limit to their duties. The principle duties of destroyers are to use every exertion to bring the enemy's torpedo craft in action and to keep them clear of the areas in which our own ships are operating. They will be required to form the inshore lookout off any of the enemy's ports that are being watched in the Channel and the North Sea, to report any of the vessels leaving harbour and to take any opportunity that occurs of torpedoing any of the enemy's ships which they may encounter during the night. They may also be required to search for any of the enemy's cruisers that are at large in the North Sea or Channel, keeping touch with them when found, and taking every opportunity of sending information as to their position, until the necessary ships can be brought to deal with them.[2]

Those charged with fulfilling these instructions were however less than optimistic about their hopes of carrying out even the minimal tasks.

Lord Charles Beresford, for instance, carried out exercises in 1907 to test the efficiency of blockade. Although the distance

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1. Bayly to Bridgeman 21 July, 1908 and 29 Aug, 1908. Bridgeman to Bayly 18 Aug, 1908, and 31 Oct, 1908. Grant minute 11 Feb, 1909; ADM 1/7988.
2. Wilson memo on Torpedo Craft, nd; ADM 116/900B.

from base to blockade was a mere 150 miles, considerably less than that which would have to be met in war, the lessons were clear and ominous enough. Blockading destroyers were in serious danger from cruisers and could not rely on support from their own cruisers.[1] In the following year, even such a persistent optimist as Lewis Bayly suggested a minimum destroyer ratio of 5-1 in favour of the blockader.[2] It was the destroyer expert de Robeck who provided the clearest statement of the failure to match resources with policy. He calculated that a force of 24 cruisers and 72 destroyers was needed off the German coast at any one time, while only 50 were actually available at that time, and this number would drop as casualties were incurred. The Germans would then take advantage of the system of rivers and canals to concentrate and drive off the blockaders, 'which would prove very harassing both to the destroyers and the cruisers and cause a large and unnecessary expenditure of coal'. Furthermore, most of the destroyers had been built for the Channel, and were unsuitable for use in the choppier North Sea.[3]

The blockade fixation explained much of the desire for a base off the German coast. Borkum and Terschelling were considered, and there was even a proposal to sink 12 old ships on the Horn Reef to act as a shelter. The war plan of May 1908 anticipated a close watch on each German river by six destroyers and one cruiser, with

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1. Tactical Exercises 24 June - 10 July, 1907. Remarks on Performances of Destroyers; ADM 1/7926.
2. Bayly memo, n.d.; de Robeck Mss, de Robeck 3/9.
3. De Robeck memo, n.d. Copy in de Robeck Mss, de Robeck 3/13.

the cruiser retiring by night, and the battleships cruising 170 miles from the coast in the North Sea. There would also be a screen of destroyers off Terschelling, protecting the Thames approaches, a screen in the Skagerrak and a flotilla of 12 destroyers with each of the battle fleets. With stunning unreality, it was noted that 'we shall be compelled to avoid any tendency to extravagance in our use of these craft in the Heligoland Bight'.[1]

Yet the plans themselves were wasteful. Even A.K. Wilson noted that some vessels would be exposed,[2] while Richmond, probably the most intelligent observer of the scene, was frankly appalled. Available forces were quite inadequate for the plans, which scattered weak detachments in exposed positions. Officers were unable to see through the implications of their plans, W.H. May for instance changing his mind on the blockade question from one day to the next.[3] Meanwhile traditional ideas continued. Even so able an officer as G.A. Ballard, after advocating a sealing blockade of the North Sea, then talked in terms of 'scouring' it for torpedo craft.[4]

Not until Sir George Callaghan became C-in-C Home Fleet were plans for the permanent close blockade finally scrapped. In March 1911 the cruisers which had been intended to support the close

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1. War Plans 19 May, 1908; ADM 116/1043B.
2. Wilson remarks; ibid.
3. Richmond diaries, 2 May, 1909, 23 Mar 1910; Richmond Mss, RIC 1/8.
4. 'Ballard's Committee' report, 1907; ADM 116/1043B.

destroyer blockade were withdrawn, and Callaghan suggested that the entire policy should be reviewed.[1] Accordingly, the use of battleships in the blockade function was ended in 1912.[2] However, the War Plans still provided for an observation force of five destroyer flotillas off the German coast,'which controverts the lessons of the recent manoeuvres that their functions are primarily for fighting and offensive action, and not for observation, for which they are unsuited.' Furthermore, these flotillas were permitted to close towards the enemy coast during darkness. 'With what purpose?' demanded Beatty.[3] This was merely asking for trouble.

Callaghan again pressed for a conference, in October 1913, at which he urged the ending of any contact with the enemy coast.[4] His logic was eventually accepted after considerable delay. The fleet was to be kept out of the North Sea and maintain a distant commercial blockade.[5] Even now, however, Churchill pressed for a drive into the Heligoland Bight on the outbreak of war to cow and impress the Germans.[6] It was a suggestion which was resisted with some vigour by Callaghan, who had caused the adoption, not before time, of a strategy which took into account the dangers of enemy surface torpedo boats, and increasingly, of enemy submarines. Fortunately, common sense prevailed. The close blockade, long

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1. Callaghan comments on War Plans, n.d., (but probably Mar 1911); ADM 116/3096.
2. Admiralty letter M001/12 n.d.; ibid.
3. Beatty's comments on Provisional War Plans, 25 Nov, 1912; ADM 116/3412.
4. Callaghan to Admiralty, 23 Aug, 1913; ADM 137/1936. Callaghan to Admiralty 4 May, 1914; ADM 116/3096.
5. General Instructions, July 1914; ADM 116/3131.
6. Jackson (COS) to Callaghan 11 May, 1914, Churchill to Callaghan, 11 June, 1914; ADM 116/3096.

since a dubious proposition for the TBD, was finally dead.

Just as the traditional offensive role in the blockade was being gradually rendered obsolescent by changing strategic considerations, so changing tactical conditions were also forcing a complete reconsideration of the use of the TBD. The destroyer was becoming much larger and her torpedo armament, originally introduced to provide some protection against cruiser attack while engaged on the blockade, was a standing temptation to assume the role of a bigger and better TB. It was to counter precisely this kind of inclination that the destroyer corps was indoctrinated with the belief that it was its primary duty to hunt the enemy TB. This concept was however interpreted somewhat too narrowly with unfortunate effects on the planned employment of the destroyer flotillas.

There had been no suggestion that the TBDs should accompany and screen the battle-fleet at sea since the success of such tactics in the much-criticised 1903 manoeuvres, and while the enemy TBs also acted independently of their fleet, this was no problem. However, in the late 1900s it appeared that the Germans were intending to bring their destroyers to sea with them and use their torpedo threat against the British fleet.[1] This development caused serious concern in some quarters. A lecturer at the War College in 1912, for instance, envisaged a situation in which German battleships, destroyers and submarines would combine to send

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1. Memorandum on German TBs. Intelligence Report, 11 Jan, 1913; Drax Mss, Drax 1/4.

anything up to 200 torpedoes from all angles against an ambushed British fleet.[1] In the years immediately preceding the war it was perfectly reasonable to argue that the increased range of the torpedo had now put it on an equal footing with the gun. Mathematically, it was possible to claim that a spread of torpedoes fired against a line of battleships had a 2-1 chance of hitting, and this would be so at very considerable ranges.[2] This carried serious implications for the traditional formation of the line-of-battle and required counter-action.

The logical response would be for the destroyers to accompany the fleet to sea. Such a suggestion however received little support in the fleet. When Admiral May called for opinions, all his flag officers except Battenberg opposed the idea, arguing that they would only add to the confusion of battle. Richmond noted in exasperation 'a certain lack of consistency' in these arguments. Everybody anticipated the certain success of a destroyer attack, particularly in misty weather, yet none made any provision for defence against such an attack, and none suggested using the destroyer offensively against the enemy.[3] The destroyer in the Royal Navy had never been used in this way, and despite the changing circumstances, nobody hinted that its role should be revised.

Richmond was convinced that the remedy was to revolutionise the traditional task of the destroyer, by using it to attack the

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1. War College lecture notes 1912; Drax Mss, Drax 1/10.
2. 'Torpedo Fire in Fleet Action'; Naval Review, Feb 1914.
3. May report, 'The Employment of Destroyers in Fleet Actions', 17 May, 1910; ADM 1/8120. Richmond's opinion in May Mss, May 9th.

enemy. From his position as May's flag captain, he vainly attempted to combat the traditional ideas which had become so firmly entrenched in the fleet and in Whitehall. May's successor took up the issue. For instance, when the decisions on the 1912-13 and 1913-14 classes of destroyers were being taken, Callaghan suggested that the torpedo armament should be strengthened. He was overruled, preference being given to the traditional role as gun platform. The Director of Operations (DOD) at the Admiralty Rear Admiral Sturdee, maintained the traditional, hackneyed and erroneous arguments, claiming that the TBDs should stick to the 'steady performance of their true duty, arduous and less satisfying, of searching for and engaging the enemy torpedo craft and driving them off the seas'. He maintained that it was futile to attempt to practice a role which was suitable only for the enemy, and not for British vessels.[1]

The Admiral of Patrols, Rear Admiral de Robeck, was meanwhile preaching a completely different religion to his subordinates. He recognised that the torpedo could not meet the torpedo, that, if anything, the submarine would replace the destroyer as an ocean-going torpedo-vessel, and that the raison d'etre of the destroyer should be kept firmly in view. But he applied himself vigorously to the loose thinking contained in Admiralty directions, which had been supplied only when specifically requested by the destroyer flotillas. These instructions included a statement that:

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1. Callaghan to Admiralty 3 Aug, 1912, Sturdee minute 22 Oct, 1912, Churchill minute 15 Jan, 1913; ADM 1/8269.

'It is of great importance that officers of destroyer flotillas belonging to the Fleet should realise that the duty of searching for and engaging the enemy's torpedo craft and clearing them off the seas, is one for which they are primarily called upon to prepare'. De Robeck observed that these instructions ignored the fact that the TBD was simply not made for searching.[1] Once again the problem of finding the enemy had been glossed over. Yet this was vital to the actual utility of the TBD. The answer lay either in the blockade, or in defending the fleet, as had been done in 1903. Both these courses of action were, however, precluded. The blockade was by now abandoned; defence was never likely to find favour.

Yet the traditionalists were, by a curious reversal of roles, themselves advocating a defensive role for the TBD, by emphasising its anti-TB function, and refusing to consider its possibilities as a torpedo vessel. De Robeck, on the other hand, was now arguing for a greater role for the offensive weapon, emphasising the 'past history and traditions of our service'.[2] His real interest was however, in the most sensible employment of his vessels, which could no longer be dictated by tradition.

It was Sir George Callaghan who most forcefully and logically related the issue of war role with that of the tactical employment of destroyers, in a long and clear memorandum which encapsulated

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1. De Robeck lecture to destroyer captains, 31 May, 1913; de Robeck Mss, 3/16.
2. De Robeck to Admiralty 15 Aug, 1913; ADM 1/8269.

the logic of de Robeck and Richmond. He began by refuting the common assumption that the Germans would send their flotillas into the North Sea in the vague hope of finding the British fleet, and continued by refuting even more strongly the equally common assumption that the appropriate counter-plan would be to send off the destroyers in a similar aimless search for them. The Germans would, he argued, use their vessels as TBs in company with their battle fleet. This threat, he continued, could be countered by blockading the German ports, a policy which had already been abandoned, or by meeting the enemy half way in a sweep of the North Sea, a compromise unsound in principle and dangerous in practice. He pointed out that the enemy TBs could be offensive only when they were in contact with the British battlefleet, so that this was therefore the best place to defend the capital ship. 'If our destroyers are intended to be employed in the defensive role of beating the German TBs by superior gunfire (thus preventing their antagonists using their torpedoes), it seems a far better war policy to keep them in contact with our main force than to send them afield'. His conclusion was that close cooperation between destroyers and battleships should ensure safety for the latter.[1]

Whatever role the destroyer was going to pursue, its presence accompanying the fleet was essential, according to this impeccable logic. Once this basis was agreed, it was so much the easier to argue that attack was the best means of defence. This was done

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1. Callaghan memo, n.d.; ADM 116/1214.

by Callaghan and de Robeck, against stiff opposition from Sturdee. Richmond, now ADCD, did everything he could to swing the war staff in favour of Callaghan.

> To give them [the TBDs] the role of defending our own battleships from the enemy's attack is therefore a wrong principle in theory as it violates the teaching of war, besides being an impossible one in practice [he argued]. The theory of the offensive requires to be carried into our tactical thought and every vessel that can be used offensively against the most important part of the enemy's force, viz the battleships, should be so used and should be designed that it can be so used.[1]

It was not enough, and the inertia of tradition carried the day. The original TBD was a peculiar animal, which had developed from its narrow origins into a seagoing but not a seakeeping vessel. It was a compromise between those who insisted on speed, on gun power, and seagoing qualities as the necessary requirements. The result was unsatisfactory. The two duties assigned to it required quite different qualities. The torpedo-vessel, for instance, had to be fast and small; the TBD had to be manoeuvrable, protected, heavily armed and with a large fuel capacity. Advanced circles therefore thought in terms of the light cruiser taking over the role of the TBD, while submarines took over the role of torpedo vessels, 'when their speed is increased somewhat to fulfil these requirements'.[2]

Winston Churchill was perceptive enough to grasp the fundamentals of the problem of according a new role to this vessel.

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1. Richmond memo, n.d.; ADM 116/1169.
2. De Robeck notes 'Duties of TBDs' n.d.; de Robeck Mss, 10/1.

Its primary function, unique to the Royal Navy, was the elimination of the torpedo-vessels of the enemy; the secondary function was the attack on enemy battleships, which involved using 'a weapon of great and increasing power, capable of producing decisive results upon the main strength of the enemy'. Hence the interesting and tantalising contradiction that 'the primary function is achieved by use of a secondary weapon, and produces only partial and good results: the secondary function is achieved by means of the primary weapon and is capable of producing decisive results'.[1]

Yet this was a dilemma which preceding generations had escaped. In the 1870s the search had been made for a seagoing torpedo vessel, for this was intended to add to the strength of the Royal Navy. Now that such a vessel was available, the service was obsessed with the need for defence, albeit by 'offensive' methods against the enemy's torpedo vessels, a painful position for a navy which worshipped the offensive. The search for an adequate torpedo vessel in the 1870s and 1880s had led to a neglect of basic defences; now in the 1900s the preoccupation with defence which superseded the earlier neglect, resulted in a neglect of the opportunities for which Barnaby and Key had striven in the early 1880s. In the 1870s, the enthusiasm for the new invention had led to attempts to emply it to the advantage of the navy; by the 1900s the torpedo had been relegated to the position of auxiliary weapon, against which defence was the primary consideration. Attitudes hardened in the 1880s and 1890s prevented the navy from

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1. Churchill minute, 15 Jan, 1913; ADM 1/8269.

dedicating to the torpedo the effort which Richmond, Callaghan and de Robeck believed could have given a new emphasis to a powerful weapon in the Great War. It is hard to fault the arguments of this new 'offensive' school and to deny that they alone, by returning to first principles, were capable of escaping from the restrictions of the immediate past and according to the TBD a role appropriate to its power and capabilities. In finally abandoning the blockade the Service had gone some way to recognising that the factors which had dictated the origins of the TBD were changed; its proposed method of employment of the vessel with the fleet however indicated the limitations of this recognition and demonstrated the strength of an idea whose time has come and gone but which, having taken root firmly in the controversies of the 1890s, itself refused to go.

CHAPTER EIGHT - THE SUBMARINE: NEW WEAPON - OLD PROBLEMS

(a) The Submarine emerges

The new century saw the emergence of a new factor in the torpedo question. The submarine appeared at a crucial time, for it coincided with the decline of the TB as the principal agent of the torpedo. Gunnery and the TBD had sealed the fate of the TB by day even when operating only in the most limited circumstances of coast and harbour defence. Invisibility was the torpedo-vessel's greatest protection against gunfire, and this was available only by night. The submarine or submersible torpedo vessel was now able to remain invisible by day and this was the basis of the danger it posed. The surface vessel now faced the same threat of invisible attack by day that it faced by night. The TB threat was therefore revived, and the debate on the submarine followed the same themes as the debate of previous decades.

For instance, the official verdict on submarines echoed the opinions of Brassey and Northbrook on the TB.

> The submarine boat, even if the practical difficulties attending its use can be overcome, would seem as far as the immediate future is concerned, to be essentially a weapon for the Maritime Powers on the defensive, and it is natural that those nations which anticipate holding that position should endeavour to develop it ... it seems certain that the reply to this weapon must be sought for in other directions than in building submarine boats themselves, for it is clear that one submarine boat cannot fight another.[1]

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1. Goschen, 6 April 1900; Parliamentary Debates (House of Commons) 4th ser., vol. 81, p. 1402.

In essence, this was logical enough, but for how long could a new weapon be ignored by the premier naval power?

The fact was that very little was known about the submarine, information being restricted to foreign reports, which were greeted with much scepticism. The French were, however, undoubtedly active, as attaches' reports in 1899 clearly indicated. Captain H.B. Jackson reported from Paris that 'these submersible vessels have now reached a practical stage in modern warfare and will have to be reckoned with and met in a future European war'. He wrote that the submarine Gustave Zedé had approached, torpedoed and gone right under the battleship Magenta, that she was far more habitable than a TB and that target practice had shown 'the great improbability' of hitting her conning tower. Furthermore, her radius of action of 180 miles made her capable of crossing the Channel and therefore posing an 'offensive' threat.[1]

Whitehall reaction to this report was frankly incredulous. 'I do not attach much importance to these boats beyond the moral effect they are likely to produce on the blockading squadron. Time has not yet come when they may be seriously considered', was the comment of the ADT Egerton. Navigational difficulties would ensure the safety of Portland, while blockading vessels could put their faith in the uncertainties of torpedoes and the difficulty of getting into position against a moving vessel. These arguments were those of a staunch and leading torpedoist!

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1. Jackson report, 22 Jan, 1899; ADM 1/7422.

The DNO, Jeffreys, argued that the French would find it impossible to tow the boats across the Channel to attack English ports because the seas were commanded by the Royal Navy. The Controller A.K. Wilson ended the debate with an expression of his lack of interest, an opinion which met with the hearty concurrence of the DNC (White) and the DNI (Custance).[1] White had once had the misfortune to be stuck at the bottom of Tilbury dock in a submarine, an incident which had coloured his opinions of them ever since.[2] Custance disliked submarines for exactly the same reasons as he disliked TBs, and at this stage there was indeed very little difference in role and capability.[3]

Scepticism about the submarine was widespread throughout the service. When a lecturer extolled the virtues of submarine boats before the INA in April 1898, he was virtually laughed out of court. How was it possible to see through water; how often and for how long had the lecturer been under water; and how had he liked it, the audience demanded.[4] Indeed, it was the activities of civilians which brought about the adoption of the submarine. The First Lord, Goschen came under pressure in the Commons. 'If you are conducting a great business ... you must not only be first in production, you must also be first in experimenting', argued the critics.[5] Such a point found little favour within the navy,

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1. Egerton minute, 15 Mar, 1899, Jeffreys minute, 16 Mar, 1899, Wilson minute 16 Mar, 1899, White minute, n.d.; ibid.
2. Vice Admiral Sir A. Hezlet The Submarine and Sea Power (London: Peter Davies, 1967) p.9.
3. Custance to Bridge n.d.; Bridge Mss BRI 18.
4. Captain W.H. Jacques 'Submarine Torpedo Boats' INA XL (April 1898) 259-74.
5. Mr B. Harwood, 17 July 1900; Parliamentary Debates (House of Commons) 4th ser., Volume 86, p. 303.

where it was firmly believed that experiment was no business of the Royal Navy. 'It is sufficient for us to meet them [the enemy] by doing better when developed by others.'[1] Goschen was, however, convinced, and overrruled opposition. By November 1900, it was agreed that five 'Holland' submarines were to be built in the yards of Vickers and Barrow, under license from the Electric Boat Company.[2]

Naval thinking had stiffened considerably since the 1870s and 1880s when the torpedo had been adopted with considerable enthusiasm. By now the position of the torpedo was clearly subsidiary, and the TB clearly defensive. The submarine, which embodied the damming characteristics of both, could expect to find little favour. Not only this, but it was new, and the bold pioneering days of the Polyphemus were long gone. The submarine had few friends. Novelty was no recommendation.

The only role which the submarine could fulfil was that of coast defence, a role long spurned by the navy. Once it had been adopted it inevitably assumed this function, which explained both the objections to its introduction and the prejudice and suspicion with which the submarine was regarded thereafter. Wilson continued to maintain that the only reason for possessing any of these boats, was to develop measures to counter them, while successive civilian members of the Board, Goschen, Pretyman and Arnold Foster, argued on the other hand that the steady improvement

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1. Vice Admiral Sir W.H. Henderson 'Remarks on Type of Ships' n.d.; Henderson Mss, HEN 9/9.
2. For a fuller exposition, see Rear Admiral Sir William Jameson The Most Formidable Thing (London: Rupert Hart-Davies, 1965) pp 71-75.

of the submarine arm was an essential feature of any modern navy.[1]

Despite this conflict, the submarine was adopted, and in order to find a role for it coastal defence was taken over from the Royal Engineers. The anti-submarine theorists of the 'offensive' school felt their arguments to be fully justified; if a coastal defence weapon were adopted, then the role of coast defence would be assumed by the Royal Navy. The TB had been successfully resisted. Not so the submarine. Once again, technical progress dictated strategy and tactics.

At this stage, the submarine was still very much an unknown quantity, for reports from France remained unclear. In July 1901 for instance, the Gustave Zede was towed from Toulon to Ajaccio, where she torpedoed a battleship. This successful attack on a battleship made at a considerable distance from base, was a notable achievement, but the attache was not slow to observe the limitations of the boat. It was completely dependent on its tug.

> An officer states that all the cooking had to be done in the tug, that the accumulators were replenished by the Magenta (a battleship) after the boat had left Toulon and that she is considered to be dangerous to live in, her radius of action is very limited. She is too complicated, a bad manoeuverer on account of her length, and she could not be used at any distance from port.[2]

During the winter of 1901-2, more exercises were conducted. Two submarines made the return journey between Cherbourg and

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1. Wilson memo 21 Jan, 1901, Goschen minute 24 Oct, 1900, Pretyman 19 Jan, 1901, Arnold Foster 13 Mar, 1901; ADM 1/7515.
2. Attache reports, Sept 1901; ADM 1/7554.

Dunkirk, a distance of 190 miles. While this was undoubtedly a major achievement, the exercises which followed proved very little. Battleships paraded up and down outside Brest and Cherbourg, while submarines attacked them. As the attache noted, conditions were hardly akin to war.[1]

Not until November 1901 were the first British boats due to be delivered. 'We shall then begin to know something of a subject on which we at present know nothing and I do not think that the Cabinet will consider that the step has been taken a day too soon'. The First Lord, Selborne, summarised the position when they arrived.

> I regret to have to record my conviction that the submarine is a vessel to be seriously reckoned with. The true answer to the submarine is the submarine. Not that one submarine is of any use for hunting or destroying another, that work must be left to the destroyer, and we are working strenuously to devise the best means of dealing with the submarine boat when found. Submarine is an answer to submarine in order that whatever value the submarine may prove to have in war in the future, it may be an asset on our side as well as to our opponents, and that whatever damage they may be able to work upon us by its means, we may be able to retaliate upon them.[2]

This summarised the duality of purpose for which the submarines were initially purchased. It remained to be seen what could be done to investigate these two aspects of submarine policy.

Initially, both aspects were pursued in tandem. Captain R.H. Bacon, the newly-appointed Inspecting Captain of Submarines (ICS)

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1. Gamble report, 22 Feb 1902; ADM 1/7482.
2. Selborne memoranda 1 Nov, 1901 and 16 Nov, 1901; Selborne Mss, Selborne 11.

received help from neither the Constructor's nor the Engineer-in-Chief's departments, and the development of the early submarines was primarily a cooperative venture between himself, his captains, and Vickers. Such was the technical skill of those involved, that the submarines were ready for rudimentary experiments within two years.[1] Bacon's report on those exercises was favourable. Holland submarines were capable of being manoeuvred underwater and attacking a target. Within the limits of the primitive state of submarine navigation, it was possible to make attacks unseen when the sea was choppy enough to conceal the periscope.[2]

The next stage was more important, for this consisted of full-scale fleet trials in March 1904. The Home Fleet operated off Spithead which was defended by a flotilla of submarines. Admiral Wilson commanded the fleet, and spared no effort in improvising a number of anti-submarine devices, such as explosive hand charges, towing charges, indicating nets and lassoo nets with charges. Despite the impossibility of effectively testing many of these devices, and 'even with the primitive appliances that we were able to improvise, they seem to have fair prospects of being able to catch and destroy any unsupported submarine that they can get near before it dives'. Such was Wilson's rather optimistic conclusion. Bacon took the contrary view. Eleven destroyers had been claimed by his submarines, yet none had been ruled out of action. Of course, there was no means of judging what danger

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1. Jameson op cit p. 81 Scott op cit pp 64-66.
2. Bacon report 31 May 1903; ADM 1/7725. Also Bacon 16 Jan. 1904; ADM 1/7719.

the destroyers ran, and when Wilson proposed that some should be specially strengthened to withstand hits from torpedoes fitted with collision heads, to test the possibility of torpedo hits when actually fired, his proposal was rejected on grounds of cost. The umpires noted the artificial immunity of the destroyers, which led to wholly unreal manoeuvres. 'Speed on the part of the ships and constant alteration of course are the two principal methods by which to circumvent the submarine', reported the umpires. It was the same formula as that suggested for evading TB attack.

Despite Wilson, the general opinion was that the submarine was vindicated as a powerful weapon. Bacon reported that 'the submarine ... has achieved a state of completion and perfection which must render it ... a continual danger and menace to an enemy ... in any position within its radius of action ... its capabilities in the hands of well-trained and experienced officers are very great, and the fear of what it can do renders its strength still greater.[1]

This opinion was confirmed by the manoeuvres later in the year, in the Irish Sea. Destroyers blockading Milford Haven were harassed by submarines operating on the surface as TBs. In every case the torpedoed vessels learnt of the very close presence of the attacking submarine only when the warning Very Light burst over them. The submarine, according to Bacon, had dealt a 'fatal blow to the maintenance of close blockade by torpedo craft or

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1. Bacon report 24 Mar, 1904, Wilson report 22 Mar, 1904. Umpires' report 28 Mar, 1904; ADM 1/7795.

destroyers'.[1] Kerr and May, the First Naval Lord and Controller respectively, agreed.[2]

These were the achievements which prompted Commander Murray Sueter's entry for the RUSI prize essay competition in July 1904. He gained only the third prize, but the vision and foresight of his work was in marked contrast to the very ordinary efforts of his rivals. Arguing that the submarine 'strikes at the very root of our naval policy', by making the enemy coasts a danger area, he observed that the submarine would drive heavy ships from narrow waters, and that the North Sea and English Channel would be used only by the smaller vessels in the event of war. Close blockade would be replaced by a 'strategic masking blockade', probably from the east coast of Scotland. Not content with this remarkable prophecy, he then touched on the subject of merchant shipping. While agreeing that the torpedoing of helpless merchant ships would be a barbarous act, he observed that the heat of war was likely to end respect for International Law. 'The problem should excite interest, and may be taken as one instance out of the many difficulties which must arise when the full meaning of present conditions is appreciated.'[3] All this was in 1904, and the seriousness with which it was considered is reflected in the

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1. Bacon report, 6 June, 1904; ibid.
2. May minute 30 June, 1904, Kerr minute 1 July, 1904; ADM 1/7719.
3. Commander M.F. Sueter 'in the existing state of development of Warships and of Torpedo and Submarine Vessels, in what manner can the strategical objects formerly pursued by means of blockading an enemy in his own ports be best obtained'. RUSI XLVIII (August 1904) 757-875.

treatment afforded it by the RUSI judges. Sueter was Bacon's leading submarine commander, however, so it is probable that within the submarine service itself, these were the sort of opinions being discussed. In any event, the submarine could no longer be ignored.

(b) Countering the Submarine

The main reason for accepting the submarine into the Royal Navy, so far as the naval establishment was concerned, was that counter-measures could be the more easily devised. As early as July 1900 Wilson was busy proposing that Vernon should prepare outrigger torpedoes for use against submarines,[1] and from the introduction of the submarine, Vernon experimented with a variety of equipment. In 1901, for instance, trials were made with a time or range pistol on a torpedo. It was intended that the torpedo should be exploded within 100 yards of the submarine, but these trials were soon abandoned when it was realised how remote were the chances of success.[2] A towing torpedo was then tried, with the intention that this should be brought into contact with the submarine's hull. However, the problems of applying this device at high speed were insuperable, and it was abandoned in 1903.

Wilson's proposed outrigger received fuller attention, which was justified by the difficulties of developing a spar which neither snapped off when under pressure, nor recoiled too vigorously under the force of the explosion. By April 1902 an outrigger was developed, capable of being used at 15 knots, but by the following September Vernon had given more consideration to the likelihood of being able to apply this device, and it was abandoned.[3] The question of harbour defence was virtually ignored. Proposed net defences were held to be impossible to maintain in a tideway, and

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1. Wilson minute 31 July, 1900; ADM 138/246a.
2. Vernon 1901; ADM 189/21.
3. ibid, Vernon 1902 and 1903; ADM 189/22, 189/23. Egerton report 15 Sept, 1903; ADM 138/246a.

the matter was left at that.[1]

All these devices were in any case useless unless the submarine could first be detected. A limited amount of experimental work on the development of hydrophones was accordingly undertaken by Vernon. With these, it was possible to hear torpedoes as they ran the length of Horsea Lake, while a bell could be heard through 1,000 yards of intervening water. This, however, hardly advanced the problem, for there was still the problem of ascertaining the direction of the sound. As Sueter observed, knowledge of a submarine's presence, but ignorance of anything else about it, was more likely to cause panic or paralysis than preparedness.

Throughout 1902, therefore, sporadic tests were made on a variety of hydrophones. The main problem at this stage was the unreliability of the vibrometer, which activated the call-up bell. It was believed that a man could not be expected to wear ear-phones all the time, and that a call-up bell was necessary to alert him to wear them when necessary. The whole project foundered on this misapprehension, trials finally being abandoned in April 1903. The apparatus was useful only against distinctly noisy steam engines, of only limited value against launches, and completely useless against submarines with electric motors.[2]

Although a practicable towing torpedo (Captain Ogilvy's sweep) was developed in 1904, this device was therefore of little value.[3]

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1. ADM 1/7516. Vernon 1901; ADM 189/21.
2. Vernon 1902 and 1903. ADM 189/23. Sueter op cit pp 360-64. Notebook of Captain G.E. Frazer. Frazer Mss, FRR 8.
3. Vernon 1904; ADM 189/24.

Furthermore, even if the submarine were found, and the explosion made, there was very little evidence that the target was likely to be injured. Experiments in 1907 'must be regarded as reassuring to submarines, and in accordance with reported results obtained elsewhere'. Even a charge as big as 100lb had to be exploded within a submarine's length of the target to be effective.[1]

After this initial burst of activity, anti-submarine research lapsed at Vernon. This was hardly surprising. These new duties constituted only a small proportion of the total work of the establishment and only a correspondingly small proportion of its time could be spent on it. Nor was Vernon in any sense a research institution. Nobody in particular was given responsibility for anti-submarine developments, so that the matter drifted. In 1908 a committee was set up to investigate the question. Fisher, Moore, the Controller, the DNO, DNI and the ICS, S.S. Hall decided that the situation was pretty hopeless and that 'the only answer to the submarine was the submarine'.[2] The precise meaning of this rather vague expression was left unclear.

From 1910-12 an anti-submarine committee, under the aegis of Rear Admiral Sturdee, and with the prompting of the evergreen A.K. Wilson, investigated a variety of devices, all with exhaustive tests. Sweeps, guns, harpoons, torpedoes, nets, grenades, all were tried, and all were found wanting, though the use of aeroplanes at least appeared to show some 'promise'.[3]

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1. Vernon 1907; ADM 189/27.
2. S.S. Hall to Keyes 15 Dec, 1912; Keyes Mss, 4/22.
3. Report of A/S Committee, Sept 1912; ADM 138/246c. Also Wilson to Sturdee 20 Mar, 1911, Bridgeman to Sturdee 20 Sept, 1911; Sturdee Mss.

It was not surprising therefore, that Sir George Callaghan, Commander in Chief Home Fleet, and Captain Roger Keyes, the ICS, should notice a disturbing vagueness about the problems of attack and defence of submarines in the 1912 and 1913 manoeuvres. Keyes commented: 'I am convinced that there will be a rude awakening if tactics which were common during the recent manoeuvres are repeated in actual warfare'. Many officers were under the impression that a submarine was vulnerable when she rose to the surface after making her attack; but she only did so because the rules obliged her to. Many over-estimated their chances of ramming, or hitting the periscope with gunfire. In fact, the problems of destroying submarines were much greater than was widely believed.[1]

Callaghan therefore worked in close cooperation with Keyes, and experimented with destroyer screens and defensive formations. Despite all their efforts, it was found that successful submarine attacks were still possible.[2] With the lack of relevant anti-submarine devices, this approach was, however, the only one. Neither Vernon, nor the North Sea Fleet, were the ideal means of research and technical development. There was in fact no research establishment, a weakness revealed in the technical history of torpedo development, and emphasised again now. All that could be done by the serving officers was to work out means of exploiting

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1. Keyes to Callaghan 10 Aug, 1913; Keyes Mss, 4/14.
2. Callaghan to de Robeck 6 Aug, 1913. Keyes memo 21 Aug, 1913, de Robeck memo 29 Aug, 1913, Also Keyes in War College discussion 25 May, 1914; ibid Keyes to Callaghan 3 Oct, 1912, 11 Dec, 1913, 15 Jan, 1914; ibid 4/18.

the main tactical shortcomings of the submarine. This, on the whole, was done extremely well and reflects creditably on Callaghan and Keyes.

In May 1914 the A/S Committee presented an interim conclusion. It was 'continuing their endeavours to produce effective means of a direct attack on submarines, but no system capable of general application has so far been evolved; and the following proposals are therefore considered to be those on which the defensive measures against these vessels should be based'. The proposals were based on an assessment of the weaknesses of submarines, which were defined as the limitations of battery power, periscope and compass, low surface and submerged speed and the difficulty of determining the course and speed of the enemy through the periscope.

It was suggested that these weaknesses could be exploited by aircraft patrols, which would detect the submarine and guide the hunters, incessant patrols, which would oblige constant submergence, defensive mining, destroyer screens, and a good look-out.[1] Callaghan set about educating the fleet on anti-submarine measures, based on these proposals, and his work was well in hand when the war overtook him.[2] Ignorance in the fleet owed nothing to Sir George Callaghan, and it is even possible that it might have been eradicated, had he been given more time.

The assessment of anti-submarine measures prior to the war was conditioned by the fact that no effective means of direct

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1. Submarine Committee report 5 May, 1914; ibid 4/2.
2. Callaghan memo, 13 July, 1914; ibid, 4/18.

attack on an underwater submarine had been developed. In these circumstances, the conclusions of Callaghan and Keyes were sound enough. Vigorous patrolling of the Heligoland Bight eventually made it untenable for British submarines during the 1914-18 war, and high speed gave the fleet virtual immunity. Extensive mining was used with considerable success. Even more significant, aircraft became <u>the</u> answer to submarines. The emphasis on patrolling in the Great War proved to be an error, but this was because the areas covered were so immense that the criteria for successful patrolling could not be met. The area of the Heligoland Bight, on the other hand, was so small that success <u>was</u> possible for these tactics there, and submarines <u>could</u> be neutralised. The application of this essentially sound theory to the entire Western Approaches, was misplaced, but does not detract from the good sense of the original concept.

This intelligent, constructive and realistic thinking was, however, formulated on an individual basis. The progress of the search for a solution to the submarine menace reflects badly on the capacity of the Navy as a whole to respond to the new development. By comparison with the advances made in the submarine itself, the counter-measures were badly neglected. This poverty of preparation for the anti-submarine war is notable because one of the reasons adduced to justify British purchase of the invention was the requirement to develop counter-measures, and because a similar threat by the TB in the 1890s had been countered by defensive measures of unparalleled magnitude. Nor is the contrast between the 1890s and the 1900s explicable by differing assessments within

the Service of the extent of the danger, for there had been no ccmmonly accepted view of the nature and likely cause of a potential war in the 1890s when opinion had been equally divided. Moreover, Fisher had been the directing authority at the Admiralty on both occasions. It is true that the threat was not so immediate as in the 1890s and could be seen as potential rather than actual. Nevertheless, even if the submarine were to be used only in the limited role expected of the TB in the 1880s, the Navy still needed effective protection when it approached the enemy coast. Given the increasing capability demonstrated by the submarine in manoeuvres, the failure to make any systematic effort to develop counter-measures was culpable; and the lack of any physical precautions for the defence of the fleet's bases was to cause great difficulty in 1914-18. 'Works and services' always suffer when a Defence budget is under pressure, as in the 1900s when capital ships took priority over everything else. Nevertheless it is a significant shortcoming of British naval preparations that the local appreciation of the submarine menace was not seen by the Admiralty in the context of naval strategy as a whole; and that the extravagant statements of, for instance, Fisher, resulted in no concrete action either in the allocation of resources to the necessary research facilities or in the defensive measures which were within the technical competence of the Service.

(c). Using the Submarine

While the development of anti-submarine measures languished, mainly from lack of a suitable responsible body to investigate them, the submarine service itself made rapid progress. Although the early submarines were little more than coast-defence boats, efforts were made from the beginning to improve their seakeeping qualities,[1] though underwater speed remained limited by the weight of the heavy petrol engines necessary for long sea journeys. The combined efforts of Bacon, Sueter and Vickers steadily improved the physical characteristics of the original Holland model, although not until 1906 was the first genuine 'overseas' submersible ordered. This was the D1, which had a surface speed of 14 knots and an endurance of 2500 miles, made possible by the adoption of a twin-screw heavy oil engine, which nevertheless restricted her underwater speed as effectively as previous petrol engines had restricted the speed of her predecessors.[2]

This preoccupation with technical development, the initial prejudice of naval officers against this 'undeveloped' weapon, and the defensive role allotted to the submarine, led to the isolation of the submarine service from the rest of the fleet. Nor was this all. The early submarines owed much to Fisher: 'Without that interest in them and his belief in you, the submarine service could never have developed as it did.'[3] Unfortunately, this

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1. May minute 14 Dec, 1903; ADM 138/246a.
2. Report of Conference at Admiralty, 2 June, 1910; ADM 138/299A. Jameson op cit 95-6.
3. Keyes to Hall, Jan, 1913; Keyes Mss, 4/22.

was not without its disadvantages. S.S. Hall, ICS 1906-10, wrote to Keyes: 'the awful stigma attaching to a creation of Fisher and Bacon must necessarily have taken years to remove. I steadily tried by every means I could to do so, and in the last year the cooperation and sympathy of the fleet had begun to improve enormously'.[1]

The role of the emergent submarine in war remained vague. A series of accidents had aroused public anxiety,[2] so that submarines could now exercise only in the presence of a guard-ship, which warned off other ships and saved the submarines from the danger of being rammed. In 1908, therefore, the preamble to the instructions for the manoeuvres read:

> In regard to submarines, experience of these vessels has reached a stage which promises important developments in their application to offensive war. Pending, however, further actual experiments on a more limited scale, My Lords have thought it wise in these exercises not to contemplate their employment in a manner which would give full effect to their power of influencing the movements of a hostile fleet, and the regulations for the employment of submarines on this occasion have been largely governed by a desire to lessen those risks which would otherwise be almost as great in peace manoeuvres as in actual war.

Lord Charles Beresford observed, quite fairly, that such instructions would prevent the submarines being at all useful, yet still expose them to the hazards of the manoeuvres. Their Lordships gave the

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1. Hall to Keyes, 7 Dec, 1913; ibid,
2. Jameson op cit pp 90-91.

rather loose reply that it was 'necessary as a matter of policy that submarines should ostensibly at least take part in the manoeuvres'.[1] What sort of policy was pursued by such a course of action, was left unclear.

The manoeuvres were however useful, in that officers outside the submarine service had an opportunity of studying the boats in action. Admiral Bridgeman was favourably impressed. Although there had been no opportunity for testing them in actual attacks on ships or fleets, submarines had nevertheless stayed at sea for 7-8 days in unfavourable conditions, and were none the worse for their exploits. Some had travelled 400 miles from Dover to the Forth, thereby displaying a capacity for offensive action.[2] Their Lordships 'noted with great pleasure' the efficiency and performances of crews and submarines.[3]

These successes prompted an offensive role for the submarines in the 1908 War Plans.

> In view of the staying power of the latest submarines, especially if relief crews are provided, we recommend their employment off the Elbe and Jade. Once they are at their stations they would have to remain there at night, as their speed is not enough to admit of their returning, and as they would be in the way of our destroyers at night, their only alternative is to anchor, and heave themselves down out of harm's way till daylight.[4]

Here then was a role with a future for the submarine. The blockade was to be resurrected.

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1. Admiralty to Beresford, 6 Sept 1908, Beresford to Admiralty 10 June, 1908, Admiralty to Beresford n.d.; ADM 116/1091.
2. Bridgeman report, 1 Aug, 1908; ibid.
3. Admiralty to Bridgeman, 1 Aug, 1908; ibid.
4. War Plans Document, 19 May, 1908; ADM 116/1043B.

Whether the submarines could have fulfilled this role in 1908 is another matter. Hall was still struggling to escape from the restrictions of the safety rules, which obliged submarines to rise to the surface when within 1,000 yards of any vessel to avoid the risk of ramming. Even when the guard ships were dispensed with in 1910, vessels were still forbidden to manoeuvre realistically.[1] No estimation could therefore be made of the possibilities of attack and defence. It was quite clear, however that the navigational capabilities of the submarine were improving all the time. In August 1910 three submarines left Dundee, navigated themselves successfully to a target vessel 300 miles away, and regained harbour. Hall merely added that in 1908 the D1 had made the return journey from Portsmouth to Milford Haven, a voyage of 30 days and 800 miles. He lacked no faith in his brood.[2]

It was however Roger Keyes who shaped the submarine service of the Great War. Keyes became ICS in November 1910, and brought a new vigour and dynamism to affairs. His most significant single act was to break the monopoly of Vickers. Lord Tweedmouth had earlier voiced his preference for maintaining a free hand in submarine supplies[3] but the Admiralty were satisfied with arrangements as they stood. Secrecy was ensured, for there was no danger of the designs leaking out and being snapped up by foreign powers. Excessive prices were avoided by a comparison with Chatham dockyard

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1. Hall to W.H. May 25 Feb, 1910; ADM 1/8119.
2. Report of Submarine Committee, 12 Aug, 1910. Hall comments 5 Aug, 1910; ADM 1/8128.
3. Tweedmouth memo, 8 May, 1907; Tweedmouth Mss.

prices, the designs were adequate, supplies were not short, and Vickers' considerable expertise was at the disposal of the Admiralty.[1] Keyes was, however, by no means content. The supply of submarines was far from adequate, and Keyes was incensed by Vickers' speedy completion of foreign orders, while British orders were delayed. He urged penalty clauses for late delivery, believing that this was the only way to galvanise Vickers' Managing Director Sir Trevor Dawson, of whom he was highly suspicious, into activity.[2]

Submarines had steadily increased in size to match the aspirations of the submariners. In June 1910, however, this trend was stopped. Hall had suggested the necessity for a submarine large enough to accommodate a beam tube, and had been confronted with the information that this would require a boat of no less than 1,500 tons. A conference of the ICS, DNC, DNO, DCS, Controller and Commander in Chief Portsmouth decided to restrict themselves to improving the D class submarines in the shape of the 'Es'.[3] Keyes overthrew this decision. Broadside tubes were considered essential, 'particularly when attacking vessels in column or line abreast formation and approaching to attack the destroyer screens'.[4] Broadside tubes, and the concern with accompanying the fleet therefore dictated increased size, which in turn meant a new departure from the traditional design of the 'D' and 'E' classes.

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1. Anon memo n.d. 19 Mar, 1907; Keyes Mss, 4/2.
2. Keyes memo n.d.; ibid 4/4. Keyes minute 20 July, 1911; ibid 4/21 Hall to Keyes 3 Jan, 1912; ibid 4/22.
3. Hall minute 12 Nov, 1909. Conference decision 2 June, 1910; ADM 138/299A.
4. Keyes memo 22 Dec, 1913; Keyes Mss, 4/4.

Keyes was therefore resolved to break the Vickers monopoly and adopt new designs. The familiar reasoning of competition was applied, and with good reason. In both his aims, he was obliged to seek foreign help. Firstly, it appeared that the foreign designs of Fiat and Schneider were superior; secondly, he was unable to order Vickers designed submarines from British yards until two years after giving notice of the termination of the monopoly contract.[1] Foreign designs were therefore built under license.

This was a major departure in policy, and vigorous opposition was aroused. 'It would not have got through if I had not been very pertinacious, for you can imagine the obstruction'.[2] However, the First Lord, Winston Churchill, was convinced, and with his support, the naval establishment was carried. Vickers caused more trouble, threatening to go 'as far as the law allows' to maintain the contract. It has been suggested that Vickers did not resist Admiralty policy, but it is quite clear that in fact only use of the most direct language from the Civil Lord [Sir Francis Hopwood] overcame Sir Trevor Dawson's objections.[3]

In the event, the policy was a complete failure. Competition was not introduced. Armstrong's and Scott's (of Greenock) contracted to build six and two submarines respectively on license from Fiat and Schneider respectively. The cost of these boats

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1. Keyes memo 12 Sept, 1911; ibid, 4/2. Also Keyes to Hall 19 Oct, 1912 ibid 4/22.
2. Keyes to Hall 19 Oct, 1912; ibid.
3. Hopwood minutes, 27 Jan, 1912, 4 July, 1912; ADM 138/246c.

exceeded that of the Vickers models, while the Schneider design was heavily criticised by the experts on technical grounds, and the Fiat design turned out to be only marginally superior to that of the British 'E' class. Furthermore, although the Schneider model was a complete failure, the terms of the contract obliged the Admiralty to order two more for 1913-14.[1] Keyes had in fact, merely replaced a monopoly of one by a cartel of three. The main positive result of this activity was, however, the introduction of other yards to the problems of submarine building. Their experience stood them in good stead under the stress of war production. Furthermore, adequate production was possible only by increasing the number of yards involved, and for this Keyes was responsible. Without him, the rapid war-time expansion of the submarine service would have been impossible.

In the meantime, Keyes pursued the search for a submarine large enough to accompany the fleet. 'In submitting their proposals for an 'overseas' type, the submarine committee [meeting on 29.2.12] had in view a double hulled ship-shaped vessel of sufficient speed to accompany a battle fleet, and capable of keeping the sea for extended operations in all conditions of weather.' 20 knots was the speed hoped for, and Vickers attempted to rise to the challenge. Their overseas type, the Nautilus, could however manage only 17 knots, and Scott's Swordfish only 18 knots. Problems were encountered in the form of the engines. Only steam

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1. Development of British Submarines 6 April, 1914. Admiralty Memorandum; ADM 1/8374.

could generate the required speed, and this was used on the Swordfish. The Third Sea Lord favoured steam, while the DNC Tennyson d'Eyncourt hoped for a speed of 24 knots by using a steam engine. The problem with steam was that the priceless asset of invisibility was lost, and the time taken to submerge was so much the greater. The committee, however, pressed ahead with experiments, while the improved Admiralty E class became the standard naval model. In the event, this standby proved to be a thoroughly good boat.[1]

Keyes had therefore injected considerable life into the submarine construction programme, and had done so with a clear view of his objectives before him. He was intending to make the submarine service a major element of the Royal Navy, by equipping it with vessels suitable for blockade and fleet action.[2] At the same time, he concentrated on improving their battle efficiency. He wrote to Hall: 'I have often heard you say that the only thing that matters is the personnel element - I most fully agree - but [while you] were really in touch with your personnel, didn't you rather neglect the seagoing military side ... I know when I first joined I very seldom didn't see the subs on the surface.[3] He stepped up the target practice against battleships, though he was unable to make them any more realistic (and therefore dangerous). Battleships still maintained a steady course while acting as targets. At first he was optimistic, hoping to use B and C class

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1. Conference minutes; ibid. A criticism of the steam policy by Fisher. 'The Oil Engine and the Submarine' 7 June, 1913; Jellicoe Mss, Add Mss 48993.
2. Keyes to Hall n.d.; Keyes Mss, 4/22.
3. Keyes to Hall, Jan 1913; ibid.

boats for blockade operations, while D class boats used their 13-14 knot surface speed for fleet action.[1] It was however soon obvious that faster boats were necessary, and this dictated the search for new designs.

Within a decade of their first appearance, submarines had therefore advanced far beyond the role of coast defence advocated by Bacon. Operations Division, under Ballard, regarded submarines as 'a very important branch of naval operations with great possibilities in the future'. Ballard anticipated the development of a '25 knot diving destroyer, formidable alike by day and night', which would take part in fleet actions.[2] It was at this time, too that de Robeck was educating the destroyer service in the belief that 'each year sees the destroyer and the submarine approach one another both in character of design and in the nature of their duties'.[3] Among these officers, therefore, the submarine was offering capabilities for the torpedo undreamt of since the 1870s.

The manoeuvres of 1912 and 1913 offered much evidence to support the increasing optimism of the submarines. In the former year, D3, D4 and D6 sailed in company from the Red fleet base at Harwich, penetrated the Blue cruiser screen across the North Sea, and headed for Scotland. D4 entered the Forth, torpedoed an unsuspecting cruiser and was then ordered out of action when rising

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1. Keyes report, 3 June, 1911; ibid 4/13.
2. Ballard 'Observation Force in the North Sea' 16 Sept, 1912; ADM 116/866B.
3. de Robeck to Admiralty, 17 June, 1912; ADM 1/8273.

to make her claim. She had covered 1,500 miles and was deemed out of action only by a senior officer actually disobeying the rules. D3 and D6 meanwhile continued until off Aberdeen, where they intercepted the battle-cruisers Lion and Indefatigable. There followed a succession of claims and counter-claims, at the end of which the two submarines were ordered out of action by the senior officer.[1]

Several points are worth emphasising. Firstly, the submarines had put in an impressive navigational performance. Secondly, their use had been based on the loosest thinking, for they had been sent into the North Sea in the vague hope of finding the enemy. There appears to have been no attempt to calculate how best to achieve this, and it was only by the purest chance that the junction had been made. Thirdly, when the junction was made, there was the customary dispute. Just as battleship officers had refused to acknowledge any success by TBs against them, so now the same problem met the submarines. When they surfaced to make their claim they were ordered out of action, either through ignorance of the procedures, or through a determination not to be defeated by a junior. The umpire-in-chief, May, noted: 'There is a growing feeling in the Service now that for a junior to approach his senior on the opposite side is a risk greater than the occasion warrants.'[2] Evidently the hopes of the submariners were not widely shared in the fleet at large.

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1. May report on 1912 manoeuvres, 31 July, 1912; May Mss, May 10.
2. Comment in note to ibid.

The 1913 manoeuvres confirmed the promise of 1912.[1] The Blue Fleet defended the North-East coast of England with the aid of C class submarines, while the Red Fleet operating from Dover and Harwich and supported by 11 D and E class overseas submarines, attempted to raid that coast. The submarines proved to be the 'most potent factor in the manoeuvres'.[2]

Much attention was given to the activities of the defending submarines, mainly because the defence against invasion was the major strategic consideration at the time, and submarines were the Admiralty's main arguments against this fear. Conclusions on this subject were mixed, for although the defence was successful, it was clear that positioning the submarines correctly was a problem. Events were obscured by the behaviour of some of the vessels attacked by the submarines. Keyes referred to their refusal to be put out of action as 'very rotten and unsporting'.[3] That, for Keyes, was strong language.

More significant, however, but overlooked by many, were the activities of the Red submarines, which roamed as far as the Moray Firth and attacked ships from St. Abb's Head to the Downs. Four battleships and eight cruisers were attacked and deemed either injured or sunk. Furthermore, two of the battleships had been sunk while steaming at speed in pursuit of a raiding party. They had been lured into a submarine trap laid by Jellicoe. One officer commented, with much wisdom, 'It is possible to imagine

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1. Narrative of 1913 manoeuvres by May; ADM 116/3381.
2. Lieutenant H.A. Williamson comment, n.d.; Drax Mss, 1/12.
3. Keyes to Leveson, 7 Aug, 1913; Keyes Mss, 3/16.

things coming to such a pass that on two squadrons meeting, the stronger will hardly dare to pursue the weaker'.[1]

How far the manoeuvres were a good indication of possible submarine successes is difficult to tell, and a vigorous argument developed following much the same lines as that surrounding the TB. In the case of the submarine matters were made more complicated by the fact that torpedoes were never actually fired, a weakness which Keyes was eager to rectify. 'In no other way is it possible to decide whether the submarines are really formidable or merely a menace'. Keyes himself anticipated considerable successes.[2] Others were less sure. Rear-Admiral Sturdee, for instance, commented 'while giving all credit for the excellent management of the submarines by torpedo officers, it is believed that their menace is not so serious as the manoeuvres will indicate'.[3] It was the sort of comment his superiors had once made on his efforts as a TB commander.

The attack on the submarine was led by Custance, who had assumed the mantle of Bridge, and adopted many of his arguments, with a clarity, logic and vigour which left nothing to be desired. Using the TB as his example, he drew the contrast between the heady claims made for that boat, and its disappointing performance during the Russo-Japanese war. Much the same would happen with the submarine, he observed. He was tireless in his use of statistics

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1. Williamson comment, n.d.; Drax Mss, 1/12.
2. Keyes report 10 Aug, 1913; Keyes Mss, 4/14.
3. Sturdee report, n.d.; ADM 116/3381.

to prove that the chances of torpedoes affecting the course of a battle were infinitesimal, and emphasised the role of nervous tension in the event of war.[1]

The higher echelons were not so optimistic. The First Lord, Churchill, observed that submarines ran much the same risks in manoeuvres as in war, and indeed, in 1913 attempts were actually made, contrary to orders, to ram submarines. Churchill intended that torpedoes should be used in the 1914 manoeuvres: 'My own opinion is that if the submarines had fired in these manoeuvres, they would have made good their claim to an even larger toll of ships than they are credited with'.[2] Callaghan's respect for the submarine has been noted. In the light of his caution in 1914-18, however, it is Jellicoe's testimony which is of the greatest interest. He had laid the successful submarine trap, and needed no convincing of the value of this new factor in naval warfare. Both sides could use it and it went far 'to deny the use of German ports to German ships and similarly British ports to British ships, except at great risk to the surface vessel ... [submarines] can undoubtedly carry out a blockade off an enemy's coast in the old sense of the word'.[3]

Among the senior naval officers there was therefore great respect for the submarine, which was undoubtedly responsible for ending much of the unreality in the War Plans. Those of 1908, for instance, had anticipated forcing the Baltic,[4] an operation

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1. Custance report 30 Aug, 1913; ibid Also 'The Whitehead Torpedo in War' 11 June, 1914. Lecture to War College; Keyes Mss.
2. Churchill to Asquith 30 Aug, 1913; ADM 116/3381.
3. Jellicoe report 6 Aug, 1913; ibid.
4. Slade (DNI) paper for Fisher on 1908 War Plans; Slade Mss.

which would have given the German submarines wonderful cpportunities. Fisher wrote to Jellicoe: 'hardly anyone but yourself, and this I pointed out to Bridgeman, clearly realises the immense alterations in both strategy and tactics which the development of the submarine now causes. I am quite sure A.K. Wilson doesn't realise it from our conversation at Kilverstone'.[1] Yet, if anything, it was Fisher who wilfully refused to understand the implications for his Baltic obsession of his own logic. The withdrawal of the close blockade line in 1912 was a welcome change, for the battleships were now to be positioned outside what was believed to be the radius of submarine activity.[2]

In the years immediately preceding the war, therefore, Keyes, Jellicoe, Callaghan and Churchill had no doubts about the future of the submarine. Jellicoe, for instance, enlarged on this in a report distinguished by its clear insights into the employment of submarines. 'It is of as little use to send them vaguely into the North Sea in anticipation of their meeting hostile ships as it is to send TBDs on such an expedition.' Their position was undoubtedly off a port or in waters through which ships were likely to pass. Hence the blockade role, and hence his recipe for meeting the enemy submarine danger. The danger lay off the ports; the response lay in making this position dangerous for them. From this sound premise followed the obsession with patrolling. In the right context, it was a sound enough policy. On the future of submarines, Jellicoe's opinions reflected those of the submariners. 'It should never be forgotten that a submarine on

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1. Fisher to Jellicoe 10 Jan, 1911; Jellicoe Mss, Add Mss 49006.
2. Provisional War Plans, 1912; 25 Nov, 1912; ADM 116/3412.

the surface by night is far less visible and more invulnerable than a TBD and except in the very important factor of speed, she is superior to the TBD. Once high surface speed is obtained, she will supersede the TBD.'[1]

The search for a high surface speed explained the adoption of steam propulsion and the consequent adoption of large submarines to carry the large engines necessary. 'The fast submarine destroyer of which Admiral Jellicoe dreams (and which <u>will</u> come) is not evolved yet', Keyes observed, but he was working on the matter.[2] The War Staff put this aim in perspective. Submarines were

> suitable only for special conditions, and although there seems to be good reason for anticipating that before long they will be practically supreme within their own sphere, that sphere is limited, and they cannot be regarded as fair substitutes for battleships or cruisers in a general review of our position. Those of the larger types may, on the other hand, be legitimately regarded as valuable prospective substitutes for a large proportion of our destroyer force of the future.[3]

It was this idea which pre-occupied de Robeck, and which prompted Callaghan to begin experiments with the E class submarines.

In 1913 the War Staff saw three possible roles for the submarine. Firstly, there was the close blockade. As Richmond observed elsewhere, the submarine could operate where no other vessel could go. At this stage however, such an operation was

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1. Jellicoe 'The Value of the Submarine' 6 Aug, 1913; ADM 116/3381.
2. Keyes to Hall 19 Oct, 1912; Keyes Mss, 4/22.
3. War Staff Paper 'War Duties of Submarines' 18 July, 1913; ADM 1/8733.

'problematical' and 'would require practical experience in peace manoeuvres to prove its value'. Callaghan too had his doubts, mainly on the question of engine reliability. Secondly, there was the role of scouts for the fleet. Large, fast submarines could replace cruisers and be a menace to the fleet which they were seeking. Thirdly, there was coastal patrol. Beatty, Richmond and Callaghan all voiced their opposition to this function, for submarines could not be everywhere without being weak everywhere. However, large numbers of submarines were fit only for this and so it was to these duties that they were assigned.[1]

Admiralty policy was embodied in the decision of the Admiralty Conference of 1913, which reveals an interesting revolution of the strategic and tactical wheel. The dangers of the close blockade by capital ships in face of underwater weaponry had long been recognised, and the fleet had been instructed to withdraw from the German coast at night beyond the range of hostile TBDs. The debate continued on the question of a close observation force of cruisers and destroyers, as the Royal Navy faced the unpalatable fact that the traditional strategy simply could not be maintained. This fact was recognised in eventual replacement of the close blockade by the strategic blockade and the abandonment of plans for the deployment of destroyers in the North Sea and Heligoland Bight[2]. Just as this development was

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1. Callaghan 'Remarks on North Sea Strategy, 1913' 18 July, 1913; ADM 116/3130. Beatty report n.d. ADM 116/3381; Richmond 'Remarks on North Sea Strategy' Aug 1913; Richmond Mss RIC 14/3.
2. See pp. 205-7.

taking place however, the submarine appeared to offer a hope of reasserting the traditional close blockade strategy which it and its predecessor the TB had in effect finally destroyed; for while possessing the deadliness of the TB, it was not as vulnerable and was indeed far safer than any surface vessel wherever it went. If threatened by a superior enemy, it could easily take refuge in submersion. Similarly, the search for a seagoing submarine now appeared to be leading inevitably to the realisation of the dream of a sea-going torpedo-vessel. This embodiment of a peculiarly British naval need had obsessed the navy in the days of Northbrook, Brassey and Cooper Key. The failure to develop such a vessel, and the concentration on the TB as the main agent of the torpedo, had led to its relegation to a secondary role. Now, the submarine appeared to offer the sort of vessel which naval architects had striven to create thirty years previously. Tennyson d'Eyncourt even resurrected the idea of a Polyphemus. The fast submarine could act in the same capacity as this vessel, if she failed as a submarine. The TB had been suitable only for limited defensive roles, and the submarine had been spurned initially because of similar limitations. The submarine, however, had potential, was easily protected by submergence, and was as deadly in all conditions as the TB was at night. Far from overthrowing traditional ideas, therefore, the submarine now appeared to be an excellent prospect for fleet action and the blockade.[1]

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1. Minutes of Conference 9 Dec, 1913; ADM 1/8374. For a fuller account, Keyes Mss, 4/7.

The decision-makers in no way reflected general service opinion, which continued to be sceptical of the submarine. The manoeuvres had shown how senior officers refused to consider the submarine seriously, how they refused to allow themselves to be put out of action, and how they made no effort at all to face up to the implications of the threat. The submarine was regarded as merely a slow and blind TB, and was expected to suffer the same fate as that vessel. Lord Charles Beresford embodied all the criticisms in a particularly myopic speech in July 1914, asserting that the submarine was flimsy, and blind underwater, with only a limited endurance. He suggested that small vessels should circle around and harpoon the submarine when it appeared.[1] This astonishing suggestion reflects the ease with which officers conducting the manoeuvres expected the submarine to be countered. Callaghan's policy of education obviously had a good deal still to do, and the task was too great in the limited period available.

Matters were not helped by the rash claims of those outside the submarine service, notably Sir Percy Scott. By claiming that the submarine would replace the battleship, Scott distracted attention from the actual merits of the boats and turned the debate into one of 'battleship v submarine'. Scott was not one for pulling his punches and in this case his more violent blows were misdirected. The submarine and battleship performed two separate functions. Confusing the two did nothing but damage to the submarine service, just as Beresford's confusion of the TB with

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1. Beresford INA LVI (July 1914), pp. 268-70.

the submarine did nothing to help the cause of those who sought to counter Scott's rash claims.[1]

The contrast between the wilder statements of outsiders, and the cool yet optimistic, realism of the torpedo service, is instructive.

> Such optimism is not shared by those who have worked in and with submarines during the last three years [wrote Keyes]. They are not inclined to exaggerate their powers, and are quite alive to their limitations, and to the great risks they will run of being caught on the surface at night or in a half light, or in heavy weather, and rammed or destroyed by gunfire before they can dive. Casualties in this connection are bound to be heavy in time of war, particularly among those carrying out the blockade of an enemy's ports. Submarines on this service will also be very liable to the risks ... [of stalking by enemy submarines]. Submarine officers [merely] claim that, given opportunity and a favourable position, they are able to deliver a very high percentage of successful attacks, with little more risk than is run in our daily peace exercises, but they fully realise that such opportunities are likely to be few, and, until we have a great many more submarines in commission, the submarine menace to an enemy would be more moral than real, particularly on the high seas or at a distance from a base. The moral effect should certainly be great, for one can never feel secure from attack, but the field of operations is large, casualties and breakdowns are certain to be numerous, and numbers are essential, if offensive operations are to be maintained.[2]

Keyes' predecessors, Lees and Hall, had always recognised these limits, while Bacon had been quick to pour scorn on civilian fantasies.[3] In the period from 1900 the submarine service, despite

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1. For Scott's intervention, Padfield op cit 223-27. For a less partisan analysis, Jameson op cit pp 114-16. More rational discussions were being pursued contemporaneously by writers in the Naval Review August and November 1913, and August 1914.
2. Keyes memo 16 May, 1914; Keyes Mss, 4/2.
3. Hall and Lees comments in INA XLIX (March 1907) 65 Bacon comments in RUSI XLVIII (June 1904) 1299-1306.

its poor image as successor to the TB, had striven to assume instead the role which had been anticipated for the torpedo vessel in the 1870s. With any novel and revolutionary weapon there are bound to be extremes of view both prophetic and sceptical. That the submarine caused such opinions to be voiced, particularly in the light of the previous debate on the TB and the role which the torpedo had assumed then, is hardly surprising. That the service at large remained in ignorance about the submarine is equally unsurprising. What <u>is</u> worth emphasising, however, is the clarity of thought and purpose which marked official action and policy, the soundness and balance of official judgements at a senior level, and the logic with which tradition asserted itself in defining the role of the submarine. Keyes, Callaghan and Jellicoe, in particular, emerge with credit from a confusing and challenging problem.

CHAPTER NINE - THE SUBMARINE MINE - A NEGLECTED WEAPON

This study has so far concentrated, to the virtual exclusion of all other underwater weapons, on the locomotive torpedo and the consequences of its steadily developing capability; it was a significant element in naval warfare with profound tactical and strategic implications and for this reason attracted much attention in the 1880s and 1890s. 'Torpedo' was, however, a generic term used to cover virtually any underwater explosive device.[1] The Whitehead was merely one type which happened, by virtue of the powers conferred on it by its 'locomotive' capability, to be of immeasurably greater significance. The torpedo personnel of the Royal Navy in fact devoted a far greater proportion of their time to various types of passive 'mine' torpedoes but because of the latter's limited capabilities and role it remained very much a fringe activity and its emergence as a major factor in naval warfare comparable to the locomotive torpedo was delayed by technical problems which hindered its development and, much more significantly, by a reluctance to consider its use in the manner which in the event proved so effective in war.

This weapon had played a considerable part in the American Civil War, was reputed to have saved Venice from Austrian attack in 1866, and undoubtedly did save the German coast from French depradations in 1870-1.[2] Its importance for the Royal Navy was

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1. CF 'The Torpedo Committee'.
2. See particularly, Major R.H. Stodherd R.E. 'Defensive Submarine Mining' RUSI XV (June 1871), 705-28. Also Stodherd and Colonel Chesney 'Report on Franco-Prussian War' 4 July, 1872; ADM 1/6241.

two-fold. Firstly, the British fleet was expected to operate off the enemy coasts during wartime, and would probably require a temporary base particularly when engaged in coaling. It was hoped that improvised mine defences would act as protection against short-range artillery and ram attack on such a base. Secondly, the attack against enemy anchorages was expected to be a major element of naval warfare, and this would require the removal of the enemy's defensive mines.[1]

The laying and removal of defensive mines therefore constituted a major element of 'torpedo' exercises until the abolition of the weapon, and all major warships carried stores suitable for such activity. These stores were the responsibility of the lieutenant (T), who was responsible for their maintenance and for the efficiency of the seamen who would rig and lay the mines. The intended uses of these weapons dictated their nature. The ground observation mine was laid on the sea-bed and exploded by an electric cable, controlled by an observer on shore who was expected to judge when a ship passed over the mine and detonate the mine accordingly; the electro-contact mine was activated by being put on circuit from a shore cable, and when in this state it exploded automatically on actual contact. Both mines could be activated or neutralised at will and were therefore easy to remove. The electro-mechanical automatic contact mine on the other hand was deadly once laid, and this factor explained its limited use.[2]

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1. CF 1885 manoeuvres. Also Vernon 1892; ADM 189/12.
2. Captain J.S. Cowie Mines Minelayers and Minelayers (London: Oxford University Press, 1949) 25-6.

Mining or 'torpedo' exercises were complex affairs. Minefields had to be carefully planned and laid with the utmost skill because of the sensitive electrical components. If anything, mine-clearing was even worse. This topic had been extensively discussed by the torpedo committee and was of major importance to a fleet which was likely to do the attacking. Three methods were employed. Countermining involved laying a line of explosives in the water to detonate the mines, an extremely complex business, particularly in darkness or under fire. Far more dangerous were the processes of sweeping and creeping. The former involved grappling the mine cables and dragging the mines out of position; the latter involved dragging an explosive grapnel along the sea bed and detonating it against the mines. It is difficult to conceive a more hazardous operation, since this would have to be done in full view of the defences.[1]

It is doubtful if proficiency at these tasks was ever achieved. Some of the material was ludicrously inadequate. In the early 1880s the navy used WO mines and mines extemporised from 36 gallon casks. The army weapons were too bulky and delicate, while the extemporised devices seldom worked.[2] Special naval service mines were accordingly introduced, but one of them, the service EM mine, proved so unreliable and dangerous to the users that it was withdrawn in 1894.[3] Another, the E.C. mine, failed at first to detonate when bumped by ships. The designers (Vernon) had failed to anticipate

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1. ibid, 27. Also Torpedo Committee proceedings and Vernon 1881; ADM 189/1.
2. Vernon 1881; ADM 189/1.
3. Vernon 1894; ADM 189/14.

that ships seldom actually hit mines, which are swept aside on the bow wave and which therefore must always be extremely sensitive.[1]

Errors were chronic. In the 1883 Berehaven exercises, the mines were found to be faulty because of failures in storage and maintenance. In both 1883 and 1884, Captain A.K. Wilson emphasised the need for more practice. He demanded (in vain) the same priority for mining as for sail drill.[2] Standards remained patchy. The Mediterranean squadron performed well in 1886 and 1887, but operations in the West Indies were 'not at all good'.[3] Furthermore, the full-scale annual mine-laying operations at Argostoli in 1887 were a complete disaster. There was no practice beforehand, and two whole days elapsed before a very faulty minefield was laid. Certain torpedo lieutenants, disturbingly, showed a complete professional incompetence.[4]

From 1889 mining practice in the Mediterranean was increased. Six whole days were spent at Corfu, and although this was little enough it was a considerable improvement on previous periods of practice. However, mine-clearing was still not practiced, a curious omission in view of the navy's preference for offensive measures. 'It seems that there is a tacit disinclination to exercise of this kind ... if we do not practice this, it is not difficult to imagine the hopeless confusion of all the boats, jumbled up together in the darkness endeavouring to sweep for the

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1. Wilson report 2 Aug, 1883. Enclosure to Vernon 1883; ADM 189/3.
2. ibid and Wilson report 27 June, 1884. Enclosure to Vernon 1884; ADM 189/4.
3. Vernon 1886 and 1887; ADM 189/6, 189/7.
4. Long report 30 June, 1887. Enclosure to Vernon 1887; ADM 189/7. Also Slade report 6 Oct, 1886; ADM 1/6812.

enemy's mines and creep for electro cables, in a real attack.' Despite this emphasis on laying, there was still a 31% failure rate among the EC mines. Vernon blamed the shortage of practice and trained seamen of the 'seaman gunner torpedo' rating.[1] As late as 1899 the complaint was still being voiced that 'more practice and greater care' was necessary.[2] Moreover, the great weakness of this form of defence lay in the time consumed by even an efficient team in laying the mines effectively. 24 hours was considered a fair time for the establishment of a mine defence system, yet a whole day can be a very long time in naval warfare.[3]

Nor was mining a generally popular activity in the fleet.[4] The immense labours involved never seemed to justify the results, which were anything but spectacular. Furthermore, in its concern with efficient laying the torpedo service appeared to be obsessed with defensive mining. This in turn exposed it to the charge of defensiveness. Cyprian Bridge once remarked: 'these d-d mines will be the ruin of the British Empire'. It appeared that in the 1892 manoeuvres the torpedoist Durnford was concerned only with hiding behind an extensive mine defence which was only maintainable with the support of elaborate supplementary arrangements.[5] The fear that the torpedoists wished to take over the defence of the home ports was a constant preoccupation with many officers. The TB had been shunned for precisely this reason, but the mine could find no other role. It was a function gladly left to the Royal Engineers.

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1. Vernon 1890; ADM 189/10.
2. Vernon 1899; ADM 189/19.
3. CF 1885 manoeuvres.
4. See p. 259.
5. Bridge to Custance 3 Oct, 1892; Bridge Mss, BRI 18.

Naval officers displayed a half-fearful, half contemptuous dislike of the mine at all times, and this attitude coloured their opinion of mine defences which were no responsibility of the navy. It had been agreed in April 1887 that the W.O. would take charge of the defence of naval harbours, and that schemes drawn up by the military would be subject to naval scrutiny. The first clash came in 1890, when the Sheerness naval authorities claimed that the suggested minefields would obstruct shipping channels. The Admiralty supported the Sheerness authorities. On the other hand, the navy vigorously refused to take responsibility for regulating harbour traffic, fearing that this would involve the service in harbour defence. This hardly helped matters, since naval opinion was almost entirely negative: 'Any arrangements which will impede free access to protected positions in the outer portions of the harbours of the Empire are open to objection, and moreover, unnecessary except in rare and special cases.'[1]

Despite this prejudice, a committee under Sir Frederick Richards recognised the necessity of mine defences, and recommended that the administrative arrangements should remain as before.[2] The army for its part, recognised that the navy's advice was vital, for sailors naturally appreciated better than soldiers the particular requirements of naval mine defences.[3] The system therefore continued, although by the turn of the century changing

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1. Precis of W.O. - Admiralty correspondence 24 April, 1878 to 16 May, 1890; ADM 1/7717.
2. Report of Joint Naval and Military Committee on Defence 7 Dec, 1893; W.O. 32/6295.
3. Buller minute 12 Feb, 1896; ibid.

circumstances obviously necessitated a revision.

Long range naval gunnery had by now apparently obviated the necessity for ships to come close inshore in order to bombard land fortifications. Consequently, unless the minefield were extended over 10,000 yards out to sea, the battleship need never come into contact with mine defences. Defensive mining in the old sense of the term was obsolete. Not only this, but the submarine obviously carried implications for coastal defence. Naval officers were cautious about this new weapon, but expected it to supersede the mine at some stage. While the TB was effective only by night, the submarine had an extensive radius of action by day compared with the mine. These developments were reflected in the conclusions of a joint Admiralty/W.O. conference of June 1903. The mine was condemned because of its limitations and the possible obstruction it could cause to commerce. The submarine, on the other hand, was considered an effective deterrent. While the introduction of the submarine was therefore desirable, its use carried implications for mining. The two weapons were incompatible.[1]

The future of mining now became inextricably tangled with that of the submarine. Bacon was sent to inspect the fortifications of Portsmouth, Devonport and Sheerness, and their suitability for the replacement of mines by submarines. While the Admiralty had virtually already decided to take over Spithead, Bacon's report recommended that the defences of all the ports should be transferred to submarines. Naturally, this bold proposal aroused opposition.

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1. Report of Conference 9 June, 1903; ADM 1/7717.

The Junior Naval Lord Durnford doubted whether submarines could do all that was hoped, while the Third Naval Lord Drury objected to taking over fixed defences.

It is interesting that this traditional objection to a defensive role carried no weight now. May and Kerr were convinced of the value of submarines, and it was the determination to organise the submarine service properly which carried the day. A Board Meeting in January 1904 ended the debate. The mine was condemned; the submarine was adopted. At this stage the erstwhile proponent of the submarine, Arnold-Foster, was Secretary of State for War, so that there was unanimity between the two services. Almost immediately however both War Office and Admiralty began to have doubts precipitated by the devastating effects of mines in the Russo-Japanese war. Kerr noted:

> In view of the experience we have obtained from the war in the Far East and in view of the late manoeuvres with submarine boats, the experiments now in progress and the further trials of submarine boats to be carried out in the torpedo craft manoeuvres in August, I think it is expedient to consider the question afresh, and see how far we should adhere to our former view. I admit being somewhat shaken.[1]

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1. Bacon report 13 Dec, 1903, Durnford minute 24 Dec, 1903, Drury minute 29 Dec, 1903, May minute 5 Jan, 1904, Kerr minute 6 Jan, 1904 Board decision 13 Jan, 1904, Arnold Foster to Admiralty 7 Jan, 1904, W.O. to Admiralty 26 Feb, 1904, Kerr minute 6 June, 1904; ibid. These doubts had no effect on the ultimate decision, and Kerr's successor as First Sea Lord, Fisher, used the Russo-Japanese War in support of his policy of abolishing the coastal defensive mine in favour of the mine used tactically at sea. See pp. 260,261,263 . There is an excellent discussion of this and of the effect of the Russo-Japanese war on Admiralty thinking on mines in Philip Towle's unpublished PhD thesis 'The Influence of the Russo-Japanese War on British Military and Naval Thought 1904-14' (London, War Studies 1973) 262-71.

Outright opposition to the abolition of defensive mining, however, came only from the DMO, Grierson, who was keen to maintain this army activity.[1] Events were now out of his control. Arnold-Foster preferred submarines,[2] the Treasury preferred the economies they would mean,[3] and the coastal defence corps of the army was not loath to abolish mining, particularly as it was suffering from an acute manpower shortage.[4] By November 1904 Fisher was in control at the Admiralty and determined to abolish the despised mine and boost the submarine service.[5] By December 1904 the CID took the final decision on the mine defence of military ports, and by March 1905 the same decision was taken for commercial ports.[6] A traditional dislike of the defensive mine, and the determination to support the new submarine service had been responsible for the Navy assuming a role in coast defence which successive administrations had hitherto resisted.

The mine was by and large a defensive coastal weapon, about which it was virtually impossible to arouse any enthusiasm in the service at large. The Torpedo Committee had however foreseen the offensive possibilities inherent in the mine if it could be used to blockade enemy harbours.[7] To do this effectively it was first

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1. Grierson memo for CID; CAB 38/6/11.
2. See p. 218.
3. Treasury memo for CID; CAB 38/6/106.
4. Report of Wolfe-Murray, 16 Feb, 1906; W.O. 32/6364.
5. Fisher minute 29 Dec, 1904; ADM 1/8879.
6. Cabinet decisions 2 Dec, 1904; CAB 38/6/117 and 1 Mar, 1905; CAB 38/8/19.
7. Final report of Torpedo Committee 28 July, 1876; ADM 116/163.

necessary to develop a mine which would maintain a constant depth underwater, and be unaffected by rising and falling tides. Until this was done the 'blockade' mine was little more than a dream.

A torpedo officer, Lieutenant Ottley,[1] was responsible for the invention of a depth-regulating mechanism in 1884, and Vernon developed it into a practical and serviceable device. The cost of such a fitting was deemed prohibitive, however, and work on a cheaper system was precluded by another Admiralty decision: 'After careful consideration of the subject, it has been decided not to adopt blockade mines as a form of naval warfare, and that experiments may be discontinued.'[2] Fisher, as Controller, claimed in retrospect that this decision was due to a belief that the enemy should be tempted to come out, rather than be hemmed in, though such an assertion contradicts the common view of the blockade at that time.[3]

Official policy was again reversed in 1901, when Vernon was ordered to prepare a deep-water blockade mine 'as expeditiously as possible'. With the help of a draughtsman from Woolwich, a mine was produced by December of that year. Tests, however, were not encouraging. The sinker, fuse and the drop all gave problems, while some mines fired prematurely. By 1903, Vernon was still reporting that 'a perfect blockade mine has not yet been evolved'.[4]

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1. Admiral Sir Charles Ottley (1858-1932), DNI 1905-7, Secretary CID 1905-12.
2. Vernon 1884; ADM 189/4. Admiralty to Vernon 1 Feb 1895. Enclosure to Vernon 1895; ADM 189/15.
3. Fisher 'Submarine Automatic Mines' Kemp op cit II, 93-103.
4. Admiralty to Vernon 19 Mar, 1901, Vernon 1901; ADM 189/21. Vernon 1903; ADM 189/23.

Fisher himself anticipated great things from the use of blockade mines. He suggested that they should be used to cover the path of a retreating fleet, and 'it would be a very rash Admiral in command of the pursuing fleet who would disregard their possible and predictable use in this manner by the enemy'. He noted that the Russians were building two specialist minelayers but could not have foreseen just how soon these would be used.[1] For, while the torpedo was shown by the events of the War in the Far East to have been over-estimated, the mine emerged as a weapon of devastating power. Admiral Togo laid four rows of mines some two miles from Port Arthur, and lured the Russian flagship, the Petropavlovsk, to spectacular destruction upon them. The Russians retaliated by laying mines across the patrol route of the Japanese blockade patrol, and the battleships Matsuse and Yashima shared the fate of the Russian ship. All these mines had been laid ten miles from land, well outside territorial waters, constituting a marked escalation of mining policy. Thereafter mines were laid freely and quite indiscriminately and both fleets observed a paralysing caution.[2]

Such a use of mines was at first not believed in Britain.[3] Fisher, on the other hand, never doubted the value of the weapon. It was cheap, easy and secret, and with it Togo had inflicted a Nelsonic defeat on his opponents. The waters of the continental

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1. Fisher 'Automatic Dropping Mines' 6 Dec, 1902, Fisher Papers, NRS II 105.
2. The conduct of Russo-Japanese War is admirably spelt out in Corbett and Slade's unpublished War Staff History of the Russo-Japanese War.
3. Colonel F.W. Cotter 'Coast Defence from an Imperial Standpoint' RUSI XLVIII (February 1904) 510-32.

shelf were particularly suitable for the mine, and Fisher envisaged a form of mining trench warfare and large-scale fleet ambushes, pointing to the experiments made by the Italians in their 1901 manoeuvres.[1]

Admiralty mining policy developed along two separate but linked themes. The first was the necessity to achieve the abolition of the automatic contact mine, which inevitably posed major problems for the power with the largest fleet and merchant marine. The second was the development of a suitable mining capacity in order to employ the weapon to Britain's advantage.

Accordingly Britain pressed strongly for the abolition of the mine at the International Disarmament Conference at the Hague, arguing for the safety and freedom of commerce on the high seas. Not surprisingly, the plea was rejected by the other countries, who insisted that their navies would not abuse their powers to the detriment of neutrals and civilian shipping, but objected to laying down firm laws which might then be broken under the stress of circumstances. Even the agreements limiting the use of mines, were provided with escape clauses. For instance, mines were to become harmless after a certain time 'within the pressure of possibility', a clause which gave the mine user virtually carte blanche.[2]

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1. Fisher 'Submarine Automatic Mines' Kemp op cit II, 93-103.
2. 'The Use of Submarine Mines as affected by the VII Hague Convention' RUSI XLIX (November 1914), 455-68, is a good critique of the Convention.

Faced with this blank refusal to outlaw the mine, Britain was forced to use it herself. There was a strong prejudice against this based on the levelling nature of the weapon, but foreign developments left no choice. The Russians had laid 5000 mines off Port Arthur while the British were incapable of laying any. In November 1905 a meeting was convened at the Admiralty to discuss the position. Captain Briggs of Vernon reported that 300 EM mines were ready for use as extemporised blockade mines, and four gunboats were fitted to carry them. In the meantime 1000 RE mines were being converted, and another 2093 were available for conversion. Larger minelayers could be supplied either by Channel steamers which could be hired when necessary, or obsolete cruisers which could be converted. It was decided to convert the cruisers and all the mines.[1]

Fisher emphasised 'the utmost importance that the full supply of these mines should be obtained as soon as possible', but these emphatic phrases contradict the tone of the discussion which was on economy. Furthermore, the scale of action envisaged remained small, as the report of a committee on mining policy indicated. It was decided that mines should not be laid off the exits to enemy harbours, where such activity could be seen. Instead mines should be laid in pre-arranged and definite lines at some distance from the shore, but in waters through which the enemy would have to pass. In these circumstances all the advantages of the mine as a weapon could be employed. It was proposed to lay a line of

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1. Memorandum accompanying the Reports of the Navy Estimates Committee 16 Nov, 1905; Cawdor Mss.

1000. from the Jade flats to the Norder Reef, thereby catching German ships as they left the Elbe, Weser and Jade. Another 3000 mines would be needed in the event of Netherlands and Scandinavian ports being used by the enemy, while in the unlikely event of war with France the major ports of that country would have to be mined. In addition a 'liberal allowance' of 2000 mines was necessary for seagoing use, to be laid in front of the line of advance of hostile squadrons, and for blockading channels. A total of 10,000 was recommended. By the standards of contemporary strength, this was considerable; by wartime standards it was totally inadequate.[1]

As these plans indicated,the preoccupation was entirely tactical, following the pattern of the Russo-Japanese war. Minelayers took part in the 1908 manoeuvres to provide information 'in regard to proposals which have been made to drop mines in the path of an advancing fleet in the open sea'. In the event these vessels were not used so very little was discovered,[2] and not until 1914 did the researches of the Naval Historical Branch reveal that the Japanese had in fact used destroyers to drop mines in the path of Russian ships.[3] This information was available only to very few officers even then, so in the meantime conjecture was the only basis for expectations of a future war. It is interesting to observe however that there was a perfectly good historical

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1. Supply of Automatic Submarine Mines to the Fleet. Report to Fisher, n.d.; op cit II, 84-92.
2. Instructions for Torpedo Boat and Submarine Manoeuvres, 6 June, 1908, ADM 116/1091.
3. Corbett and Slade op cit 304-5.

precedent for the Grand Fleet's obsessive fear of a mine ambush which in the event did not occur.[1]

Only the DOD, Ballard, however, grasped the potential of mining as a strategic weapon. In September 1912 he noted that although there were some 9000 mines in stock, no definite function had been assigned to them. Close blockade by an observation force of cruisers and destroyers was still anticipated and this naturally precluded their use off the enemy coast. He observed that mines could be used to close effectively two-thirds of the area to be observed, could be a useful auxiliary in a commercial blockade and could hinder raiders and submarines.[2] From this inception, he developed his plans for a mining policy in a paper which he submitted in February 1913.

In its scope and conception Ballard's plan was unique in pre-war thinking. He neither confined himself to narrow technical details, nor did he produce a series of vague and optimistic generalities. He began by observing that other countries had rejected Britain's humanitarian suggestions for the abolition of mining, and that therefore they could have no complaints when they found mines being used against them. He proposed a limited actual use and an extensive pretended use. A formal notification of British intentions would both limit casualties and effectively check shipping movements. This concept of a mining commercial

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1. Also, Admiralty to Callaghan 20 May, 1914, 30 Jan, 1914; Drax Mss, 1/4.
2. Ballard, 'Remarks on War Orders' 16 Sept, 1912; ADM 116/866B.

as well as military blockade was quite revolutionary. He suggested a line of mines across the Dover Straits and from the Goodwins across the North Sea to the Danish coast. Only 2400 mines would be needed, and even the small minelaying force available would be able to do the job. His proposal was quietly shelved by his superiors.[1]

Mining was held to be un-English, and in the confused state of strategic thinking was difficult to place. Until 1912, the blockade precluded mining; after 1912 its extensive 'promiscuous and haphazard use' was equally objectionable to a fleet which required freedom of the seas.[2] Despite Fisher's effusive comments therefore, Britain had no effective offensive minelaying organisation, very little offensive minelaying capability and no mining policy.

The matériel of naval mining warfare left much to be desired. The seven old cruisers converted to a minelaying role were unable to carry out their first exercise until 1910.[3] Until then the detonating pistol caused considerable trouble, while the use of old EC, EM and War Office mines led to breakdowns, faults and confusion. In the first minelaying trials, depth-keeping failures totalled 13% of all mines laid. Difficulties were legion. Although depth-keeping improved to a mere 2.2% failure rate by 1913, problems still arose from the failure to anchor properly on hard

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1. Ballard, 'Plans for the offensive use of mines in war' 6 Dec, 1913; ADM 116/3412.
2. Churchill 'Notes on Mining' Oct 1914; Keyes Mss, 4/27. Marder From the Dreadnought to Scapa Flow (5 vols.; London: Oxford University Press, 1965), II, 79-80.
3. Vernon 1910; ADM 189/30.

sea-bottoms, particularly in a tideway.[1] Nor did Vernon improve its weaponry by a refusal to adopt improved devices. The German Carbonit mine, for instance, was found to be superior, but did not fit the service launchings. Rather than alter the service fittings to suit the better mine, the weapon was rejected.[2]

Faults therefore continued. In mining exercises in November 1912, mines were faulty with bad depth-keeping, failure to fire and defective watertightness. The splashes of the dropping mines were visible 9½ miles away by night.[3] Not only did these tests reveal failures quite clearly for those with eyes to see, but they were quite inadequate in scale and scope. 365 mines per year was the maximum laid in practice exercises,[4] and this was simply not enough. Furthermore, 'had exercises been carried out by the minelaying squadron under war conditions, and the mines left down for a few months even in waters differing somewhat in character from the North Sea, I think it but fair to assume that the failures experienced during the war would have become apparent and have been remedied.[5]

Much of the blame for this lies not only with the low priority given to mining in the Navy generally and with the generally unrealistic expectations of the nature and scope of war, but with

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1. Vernon 1913; ADM 189/33.
2. ibid.
3. Captain Bonham to Drax 11 Nov, 1912; Drax Mss, 1/11.
4. Vernon 1912; ADM 189/32.
5. Rear Admiral R.S. Phipps Hornby. Interim Report of Armaments Personnel Committee 23 Sept, 1916; Phipps Hornby Mss, Phi 205.

the low priority given to mining in Vernon itself. The stop-go policy of the 1890s and the abandonment of defensive mining in 1904 offered a discouraging background which was not helped by the inadequate facilities. Vernon had begun as an instructional school, and had developed experimental work as a by-product in the spare time of teachers and taught. The same sort of arrangements persisted now, except that the range of tasks was far greater than before. Organisation failed to keep pace with the increased scope of the underwater weapons questions. It is hardly surprising that Vernon failed to deliver the goods.

Meanwhile the same Heath Robinson arrangements were used for the minesweeping service. Again, it was the Russo-Japanese war which stirred the Admiralty into examining the problem of minesweeping material.[1] Experiments conducted by the Atlantic and Mediterranean fleets suggested that the high-speed explosive sweep was the best solution, and it was adopted in September 1906. 'It is believed that after practice with the rapid explosive sweep, the old method of clearing a minefield will cease.'[2] However, further extensive experiments indicated otherwise. It was a difficult, complex and delicate device, and the electric firing gun was particularly likely to go wrong, especially in rough weather or at higher speeds. A simplified and stronger version appeared to offer little improvement, and in August 1908

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1. May minute, 2 June, 1904. Battenberg minute 23 Sept, 1904, Kerr minute 7 Oct 1904; ADM 1/7833.
2. Vernon 1906; ADM 189/26.

a Submarine Mining Committee under Admiral Callaghan recommended its replacement by the fixed wire sweep system.[1]

Efforts were at last begun to organise a minesweeping service. The suggestion had come originally from Lord Charles Beresford, who had fitted two Grimsby trawlers with sweeping equipment.[2] Experiments conducted in the early part of the year by Sturdee confirmed his opinions.[3] Trawlers were good, handy, sea-keeping vessels with experienced crews, eminently suited to the handling of simple and reliable equipment such as the fixed wire sweep. They would be extremely useful for keeping harbour entrances clear in wartime, although their slow speed rendered them useless for fleet operations.

Accordingly, trawler-owners were approached to see if they were willing for their vessels to be used in war. The reaction was almost wholly favourable, so that by 1909 it was possible to envisage the likely shape of the projected mining service. It was also possible to appoint Captain Greatorex to the newly appointed post of Inspecting Captain of Minesweeping, thereby removing the responsibility from Vernon, as Callaghan had recommended; Vernon was as unsuitable for this purpose as it was to develop the submarine service.[4]

Greatorex showed considerable energy. The terms on which

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1. Interim Report of Submarine Mining Committee 8 Aug, 1908; ADM 1/7994.
2. Beresford to Admiralty 14 Feb, 1908, 26 Feb, 1908; ADM 1/7981.
3. Beresford to Sturdee 24 Feb, 1908; Sturdee Mss.
4. Fisher minute on Report of Submarine Mining Committee, 8 Aug, 1908 ADM 1/7994 Greatorex report 1909. Enclosure to Vernon 1909; ADM 189/29.

the Admiralty were to hire the vessels were not finally agreed until March 1912,[1] which delayed the organisation of mobilisation arrangements. Training was nevertheless begun immediately. Short courses were held on Vernon for retired commanders and lieutenants, who were intended to be the future captains of these trawlers. By 1911 50 complete trawler crews had enrolled and were in training, and by 1912 Greatorex expected to rely on up to 70 efficiently trained crews. By 1913 the number was 95. Great progress was therefore made on the question of coastal minesweepers.[2]

The defence of the fleet was more complex, for the requirements were different, and energy alone was not sufficient. It was originally hoped to use the old torpedo gunboats for fleet purposes, for they possessed the speed which the trawlers lacked. Superficially this was possible, for trials indicated that it was possible to use the sweepers at speeds of over 14 knots. In practice, however, 10 knots was more realistic and when mines were found, this speed declined to six knots. Above all far more sweepers were needed. The ten available were sufficient to cover only two battleship squadrons, a disturbing factor in view of reports that the Germans were fitting cruisers with mines which they intended to drop in front of British warships. More sweepers were therefore necessary, and the question was raised as to whether they should be new vessels, purpose built for the job. The almost unanimous decision was taken that the old River class destroyers

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1. Correspondence between the Admiralty and the trawler owners in ADM 116/1023.
2. Reports of ICMS 1911 and 1913. Enclosures to Vernon 1911 and 1913; ADM 189/31 189/33.

should be converted for the purpose. It was strongly held that it was useless to include in the fleet ships which could not fight. The converted destroyers would therefore play a dual role.

It is clear that there was a considerable underestimation of the need for fleet sweeping vessels. The DNM, King-Hall led the opposition to specialist sweeping vessels with a particularly specious argument. He argued that the claims for sweepers were based on the precedent of the Russo-Japanese war, where both sides had used mines. The Japanese had done so to keep the Russians inside Port Arthur, the Russians because they were afraid to do anything else. 'Unless such conditions are repeated, with the locality changed to Wilhelmshaven or the Forth, the corresponding loss of ships by mines is not likely to be repeated.' In view of the reports received of the ambush mining proposed by the Germans, and in view of the expected German readiness to mine, which was clearly anticipated by observant junior officers, this comment is quite puzzling.[1]

There was obviously no question of the North Sea being as mine-ridden as the waters of Port Arthur. It took Richmond to assess the actual facts. He argued that it was a reasonable assumption that mines would be laid off any North Sea or Channel port which was a suspected destination of any naval force. For this reason sensible sweeping precautions were essential all the time. Nor was it wise to anticipate that German mines would be as bad as the British devices. (A prophetic statement!) The

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1. Drax notes 1914; Drax Mss, 1/4.

fact was that King-Hall underestimated the extent of the danger. The responsibility for this judgement, however, rests firmly on the shoulders of A.K. Wilson, who led the opposition to fleet sweepers. If his judgement was awry on submarines, it was even more so on mines.[1] The result was that the fleet had no sweepers capable of keeping the seas at a reasonable speed, while the low priority given to the danger led to a poor quality of sweeping as late as 1914. Exercises were sporadic and inefficiently completed.[2] The process was always painfully slow; 2½ hours was expected to be the minimum time necessary to eliminate five lines of mines, hardly a major obstacle.[3]

Like minelaying, minesweeping remained a despised and underestimated branch of the Service. Technical development was beyond the capacity of Vernon, and the organisation of separate minelaying and minesweeping services, though welcome, came too late to be effective, particularly as both bodies were starved of men and equipment. Under these circumstances all the energy of Greatorex was of no avail. Mining received no place in the War Plans, and the mine danger was underestimated. If those such as Jellicoe were wary of the threat, they were not prepared to give it enough emphasis. The result was a completely inadequate

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1. Greatorex reports 1909 and 1910. Enclosures to Vernon 1909 and 1910; ADM 189/29, 189/30 Greatorex report 28 Aug, 1909, King Hall minute 17 May, 1910, Jellicoe minute 31 May, 1910, Wilson minute 9 June, 1910, King Hall minute 5 Jan, 1911, Richmond, 19 Oct, 1910; ADM 1/8042.
2. ICMS report on Fleet sweeping exercises. June 1912 Enclosure to Vernon 1912; ADM 189/32.
3. Reports on Grand Fleet minesweeping exercises, 4 Oct, 1913, 26 Jan, 1914 May 1914; Drax Mss, 1/11.

provision for both the laying and sweeping of mines. The omission was culpable and quite unnecessary, stemming from a dislike and contempt of mines in the 1880s and 1890s which was carried over into the 1900s with no attempt to evaluate the problem in the light of changing circumstances. Quite simply, the Admiralty got it wrong. Technically, administratively, tactically and strategically the policy was one of 'muddle-through'. It failed.

CHAPTER TEN - THE TORPEDO SERVICE

The history of the Torpedo Branch of the Royal Navy reflects and epitomises the difficulties and shortcomings of the way in which the Service responded to the introduction of the torpedo and shows both the system and the naval officer both at worst and at best. There were two requirements: firstly to train a corps of men skilled in the weapon's use, and secondly to develop an organisation and expertise adequate to develop the weapon to the best advantage of the Service. Inevitably the former took priority, the latter being an ad hoc arrangement for which no specific provision was ever made. The torpedo instruction school developed as an offshoot of gunnery instruction and, growing into a branch in its own right, never overcame the handicap of inadequate facilities, the prejudice of the gunners and seamen and the problems arising from its duality of function. A system which just worked in the nineteenth century was by the 1900s patently unable to cope.

Instruction in underwater weaponry was intially conducted in the gunnery school HMS Excellent where Commander Harvey, the inventor of the torpedo of that name, was given a special post in 1868. When Harvey's torpedo was discarded, however, the emphasis changed to the submarine mines which, with the lessons of the American Civil War fresh in the memory, were expected to form the main element of underwater warfare. Harvey was succeeded in June 1869 by Lieutenant J.A. Fisher, who had achieved prominence the previous year by the publication of 'A Short Treatise on

Electricity and the Management of Torpedoes', a comprehensive survey of the technicalities of underwater warfare.[1] The scope of underwater warfare was increasing at such a rate, however, particularly following the adoption of the Whitehead torpedo, that a separate torpedo instruction establishment was suggested by the DNO Hood. Accordingly, three years after his initial appointment to Excellent, Fisher was re-appointed to the command of the hulk HMS Vernon.[2]

Vernon's early years were not easy. Fisher was theoretically still under the aegis of Excellent, so a major pre-occupation was to gain the recognition of the new weaponry in its own right. This struggle for survival in the early years was the genesis of the departmental narrowmindedness of later years. For the moment 'The Cause' was everything: 'If you are a gunnery man, you must believe and teach that the world must be saved by gunnery, and will only be saved by gunnery. If you are a torpedo man, you must believe and teach the same thing about torpedoes. But be in earnest. The man who doubts, or is half-hearted, never does anything.'[3] Such an attitude was necessary at the time, but the eventual results were anything but good.

Facilities were inadequate from the start. In 1872, for instance, Prussia had a torpedo establishment of 500 men, and the French devoted a whole school to underwater warfare. The Royal

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1. For the initial appointment, Hough op cit pp 52-3. Hough's treatment of Fisher's treatise tends to obscure its very technical nature.
2. Hood minute 19 July, 1872; ADM 1/6255.
3. Hough op cit pp 55-6.

Navy, on the other hand, made do with one commander, one lieutenant, one gunner and nine artificers and seamen.[1] Fisher's energetic work undoubtedly made converts, among them the Second Naval Lord, Vice-Admiral Sir Walter Tarleton, who was sufficiently impressed to ensure Fisher's early promotion to Captain in October 1874.[2] Prejudice was strong, however, mainly because of the nature of the work done in Vernon. Emphasis was placed strongly on the defensive submarine mine, and this led to the suspicion that the torpedoists were threatening to take over the coastal defensive role of the Royal Engineers. There was also a deeper psychological block against Vernon in the minds of many senior officers, reflected in an extraordinary letter from Fisher to Phipps Hornby, in which the former proclaimed his enthusiasm for sails and paint.[3]

Fisher complained of the need for a senior captain to push Vernon's interests. Profound indifference consistently hampered his own efforts. In the entire navy only Fisher and Captain Morgan Singer, who had been sent to Fiume in 1871 to learn all about the Whitehead torpedo, knew how to use this weapon. Furthermore, even Fisher was 'not at all sure I would set it correctly the first time'. This was at a time when over 100 were already in service, four years after its purchase.[4] The Admiralty's optimistic hopes of improvements to the Whitehead torpedo were

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1. Fisher 'Naval Torpedo Warfare' 14 Nov, 1872. In letter of Dec 1872 to Phipps Hornby. Phipps Hornby Mss, Phi 121a.
2. Hough op cit p. 57.
3. Fisher to Phipps Hornby, 15 Dec, 1875; Phipps Hornby Mss, Phi 121b.
4. Fisher to Phipps Hornby, 9 Dec, 1875; ibid.

evidently far from realised and would not be realised unless attitudes changed. For despite its function as the navy's only instructional school for underwater weapons, Vernon was consistently neglected by Whitehall. Whitehead's insistence on secrecy, for instance, led to a refusal to issue Vernon with a locomotive torpedo until February 1876; requests for directions on net protection, another responsibility of Vernon, met with the reply that this information was 'confidential'.[1] Small wonder that Fisher felt frustrated.

Vernon received its first independent commission in 1876, under Captain William Arthur, who had headed the committee which had recommended the introduction of the Whitehead torpedo and therefore laid claim to be the senior, most experienced torpedo officer in the service. His second-in-command was Commander A.K. Wilson, who had been on the same committee and whose professional activity earned considerable praise from Fisher for his 'good temper, great powers of hard work, has a special liking for torpedo matters and has taken every available opportunity of increasing his acquaintance with the subject'.[2] The other committee member, Captain Singer, commanded the Vesuvius, which was now attached to Vernon for experimental and instructional work. The first two lieutenant instructors were E.P. Gallway, and C.G. Robinson; both were to become distinguished torpedo experts.

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1. Fisher to Phipps Hornby, 11 Jan, 1876; ibid,
2. Fisher to Phipps Hornby, 9 Dec, 1875; ibid,

This was the organisation responsible for training the rapidly expanding torpedo service. The over-riding consideration throughout the 1880s was to train officers, warrant officers and seamen to handle the 'torpedo' aspects of naval warfare. The main weapon was the submarine mine, exployed in the defence of temporarily anchored fleets. The efficient use of British mines and the equally efficient removal of the enemy's obstructions involved an extensive knowledge of mechanics, electricity and chemistry, and it was from these origins that the emphasis on the latter two factors became a dominating factor in the education of naval torpedoists. The Whitehead torpedo was by comparison a small element in naval 'torpedo practice'. Vernon therefore organised special short torpedo courses every July for gunnery lieutenants, one month courses for sub-lieutenants and courses from April to June for half-pay officers. Officers specialising in the torpedo took long winter courses, culminating in the award of the specialist grade of lieutenant (T).[1]

There was constant difficulty recruiting sufficient warrant officers and petty officers. Courses for Seamen Gunners on Vernon and on board ship were poorly attended, because qualification led to no extra pay, while the qualified Seaman Gunner rate on the other hand merited an extra 4d per day. Not only this, but torpedo service involved certain weighty disadvantages. Torpedo exercise resulted in the sacrifice of a comfortable watch below, while clothes were damaged with no compensation, in the strenuous and

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1. Armstrong op cit 140-50.

uncomfortable torpedo work above.[1] Not surprisingly, there were few volunteers. Not until November 16, 1883, was extra pay authorised for those successfully completing the course[2] for the Seaman Gunner Torpedo (S.G.T.) rating. Whereas only 352 qualified in 1883, 638 qualified in 1884. In that year too, employment opportunities for these men increased when ships with torpedo stores were allowed a torpedo rating to look after them.[3]

This explosion of numbers necessitated an increase in the number of Instructors from 60 to 100. Such a provision was not easy to meet, for there were few promotion prospects for the Torpedo Instructor. While the Gunnery Instructor could be promoted to Gunner, the Torpedo Instructor had to serve a period of 12 months as a Gunnery Instructor, after being a Torpedo Instructor, before he too could be promoted to Gunner. Nor was it easy to obtain Torpedo Warrant Officers. The Gunnery Branch drew its Warrant Officers from its Gunners, but these were not allowed to train in Vernon to become Torpedo Warrant Officers. Only when these injustices were rectified were there sufficient volunteers for Instructor and Warrant Officer (T).[4]

The expansion of the service following the Naval Defence Act (1889)[5], and the particular disproportionate increase of the torpedo service, relative to the rest of the navy, led to a chronic shortage of S.G.T.s. Numbers were maintained only by compulsory

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1. Vernon 1881; ADM 189/1.
2. Vernon 1883; ADM 189/3.
3. Vernon 1884; ADM 189/4.
4. Vernon 1885; ADM 189/5.
5. For the Naval Defence Act see Marder op cit p. 143.

torpedo training for all suitable and otherwise untrained A.B.s. Shortages in the Mediterranean even of S.G.T.s from this source were rectified by including a certain amount of torpedo instruction in the qualification for Acting Seaman Gunner, who would then take over the duties of the absent S.G.T.[1]

Even more seriously there was a decline in the number of applicants for training as Lieutenant (T). From 11 in 1885, and 14 in 1887, the number fell to eight in 1888, seven in 1889, five in 1890, four in 1891 and six in 1892. Since five were selected annually, very little actual selection was possible and those attracted were no longer of the highest quality. By 1892 there was a shortage of twenty qualified lieutenants in the torpedo service. By 1900, 16 places were given annually for torpedo training, and four were unfilled. Gunners (T) were given ship appointments to fill gaps vacant through lack of Lieutenants (T). There was thus a chronic shortage of officers, warrant officers and seamen for the torpedo service.[2]

The reasons for this apparent unpopularity are diffuse. There was undoubtedly a strong reaction within the service against new fangled inventions, particularly those which detracted from sail and paint and threatened to preoccupy the navy with defence. The torpedo and mine committed both these mortal sins. The defensive/offensive role argument probably lies at the root of the problem, for this is a continuing theme from Key, through

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1. Report of Committee on Gunnery and Torpedo Training 2 Mar, 1891. Printed Pamphlet, Naval Library.
2. Vernon 1892; ADM 189/12.

Bridge to Custance, and continued from the TB to the submarine and destroyer in both manoeuvres and ship-construction policy. One officer made the revealing comment that TBs would never overcome the prejudice against them till guns were mounted.[1] Indeed, Lieutenants Ottley and Richmond specialised in torpedo because Excellent would not take them.[2] There was also the belief among the seamen that the many well-paid civilian jobs in the Ordnance Store Department were open only to former ratings qualified in gunnery.[3]

Nevertheless, prowess in torpedo work was no bar to promotion. Fisher himself, Wilson, May, Eardley-Wilmott, Sturdee, Bayly, Jackson, Duff, de Robeck and Bacon are all distinguished names. Many of these attracted favourable attention for their exploits afloat, Sturdee for instance receiving great praise in 1890 despite the criticism of his actions. TB officers were able to display dash, initiative and seamanship, qualities which many feared the advent of steam and the demise of the sail had eliminated. Lieutenant Gallway even claimed that the danger of serving in a TB was an added attraction.[4] On the other hand, there was always the accusation of indiscipline, since smart uniforms gave way to waterproofs and sweaters.[5] It is interesting to note also that numbers rose when the Jeune Ecole was in the ascendant, and fell when these theories were discredited. The TB remained, however,

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1. Commander W. Dawson in RUSI XXI (May 1877), 633.
2. Richmond diary 5 Jan 1893; Richmond Mss, RIC 1/3.
3. Vernon 1892; ADM 189/12.
4. Gallway to Phipps Hornby 30 Nov, 1887; Phipps Hornby Mss, Phi 120b.
5. Armstrong op cit p. 205.

the glamorous part of the torpedo service. Mining was anything but glamorous, and the preoccupation with this heightened suspicions about the torpedoists' intentions. Nor was it helpful that the most vocal defender of the torpedoists' cause was John Durnford, who invariably commanded a shore establishment and whose lugubrious expression endeared him to nobody. Even the ardent torpedoist Fisher despised him.[1]

The seamen trainees received an essentially technical and practical course of instruction in the application of underwater weapons. Mining was the major subject of the teaching and a brief introduction to physics, mathematics, batteries and electricity preceded a large element of practical work in setting up and defusing mines. The Whitehead instruction involved a 40 day course of mainly practical maintenance and running work. Officer training was remarkably similar, but the level was much higher.[2] A period at Greenwich preceded Vernon, and while there, the trainees crammed mathematics at an alarmingly high level.[3] Richmond, who experienced this at first hand and gained a first in this examination, criticised the content of the Greenwich course vigorously. Nobody gained from this, for some officers worked hard to get a first-class, some worked hard merely to pass, while the majority merely jogged along quietly to survive the course. Naval officers, Richmond argued, were neither suitable, nor should they be suitable, for this sort of activity, which he described as 'trying to make a racer out of

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1. Even in the manoeuvres, Durnford commanded from the shore. Photo in scrap-book in Library of HMS Vernon. Fisher commented 'the biggest pessimist the world ever saw .... He always gave me a stomach ache whenever I saw him, even if a mile off'.
2. Syllabus and accompanying notes; Tudor Hamilton Mss, HTN 110.
3. Examination papers in Sturdee Mss.

a cart-horse.'[1] At Vernon, there was instruction from petty officers and artificers in the technical aspects of underwater weapons work. Torpedoes were run from Vesuvius, Lightning and 'that vile little craft No. 69'.[2] As one critic observed, the instruction came mainly from petty officers, so that officers received an education suitable for petty officers.[3] There was a total absence of any study of history, law, or the tactical and strategic application of these weapons. It was an education for factory workers, not naval officers.

Nor were the facilities for giving this instruction ever adequate. After the great increase in SGTs following the 1883 measure more acccmmodation was needed. The question was whether two schools should be founded, or whether the one school should be expanded. If the latter, should it be on shore or in an additional ship? It was decided that temporary accommodation on the hulks Donegal and Defiance would allow the issue of buildings on land to be shelved.[4] Not until 1903 was there any addition to the establishment, when pressure of numbers forced the use of another hulk, the Marlborough.[5]

The quality of torpedo work throughout the service was affected not so much by the activities of the shore-based school, but by the quantity and quality of instruction and exercise on board ship. Even after 1883 these received a low priority, even

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1. Richmond to Henderson 7 June, 1902; Richmond Mss, RIC 14/2. Also H.G. Thursfield comments 21 May, 1903; Thursfield Mss, Thur 1.
2. Richmond diary, autumn 1895; Richmond Mss, RIC 1/2.
3. K.G.B. Dewar The Navy from Within (London, Victor Gollancz Ltd. 1939) p. 46.
4. Final Report of Committee 1 July 1884; ADM 116/236.
5. Vernon 1903; ADM 189/23.

in conscientious ships. 'Even in the Empress, where old Bacon was as sound a man at the job as one could find, the RNR man who came for training, instead of spending the short time at purely gunnery or torpedo work, spent it as an ordinary hand in their part of the ship.'[1] Instruction was unpopular among teachers and taught. 'I am still doing the Naval Instructor job and dammably sick of it ... Teaching people who will not try to remember is most killing ... none seem to take an interest in them as they should ... neither know nor care'.[2] Attempts were made to utilise the winter by organising elementary technical courses in the canteen room at Malta, while the fleet spent several weeks at Corfu doing practical exercises. This partly compensated for the lack of attention given to torpedo work during the summer, when sail drill was the major priority. In fact, difficulties always arose as officers were often called away to their ships in the middle of courses.[3] Despite these problems, huge numbers were trained, 2566 officers and men being instructed in 1893 and 4087 in 1899, although not all of this work was satisfactory.[4]

The Whitehead torpedo never found widespread popularity in the fleet, a point recognised by Lord John Hay when he suggested increased practice in 1886 to improve efficiency.[5] The 'practice' which consumed so much time and attracted so much odium, was in fact, merely a matter of running the torpedoes to ensure that they were in working order. The enormous percentage of 'successful' runs reported were at a 200 foot target from 300 yards, and in no way

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1. Richmond diary 25 Jan 1899; Richmond Mss, RIC 1/6.
2. Richmond diary 5 Feb 1898; ibid, RIC 1/4.
3. Vernon 1890 and 1891; ADM 189/10, 189/11. Also Richmond diary 24 April, 1899, Richmond Mss, RIC 1/6.
4. Vernon 1901; ADM 189/21.
5. Hay memo nd; ADM 116/356.

reflected war capability or accuracy at torpedo practice. Nor were they intended to do so. The concept of 'battle' practice and realism simply did not exist.[1] Practice was further hampered by successive Admiralty circulars which emphasised the necessity of avoiding loss. The 1879 circular ordered practice in shallow waters, and in 1881 deeper water practice was allowed only with the use of a lighting and buoyancy apparatus. 1886 saw permission for deep-water practice being given only if shallow water was not available, and as a 'result of full consideration and forethought'. In 1892, the limited practice of the fleet was actually restricted further, and only after a prolonged resistance from the torpedoists Jeffrey and Durnford was the circular revised. However, exercises which involved high speed evolutions in shallow waters naturally remained unpopular in the fleet.[2]

Nor did torpedo officers always carry out their duties conscientiously. In 1901, for instance, the exercises at Platea showed a total ignorance of the gyroscope, mainly stemming from an unwillingness to use it or keep the supplies in good order.[3] This argues for an indifference to the job which must have rubbed off on other aspects of the work. Even in well-run ships torpedo disasters were not unusual, as Richmond remembered.[4] Professional indifference among the destroyer squadrons appalled Keyes when he joined the Devonport flotilla in 1902.[5] As late as 1905 target practice consisted of aiming at a target which was towed on a fixed

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1. Successive Vernon reports. For the issue of realism, Richmond diary 22 June, 1909; Richmond Mss, RIC 8.
2. Fleet circulars of 1879, 1881 and 1886, with correspondence, in ADM 116/356.
3. Vernon 1901; ADM 189/21.
4. Richmond diary 7 April, 1899; Richmond Mss, RIC 1/6.
5. Keyes op cit pp 320-21.

course at a speed of about 15 knots. The only chance of an error therefore lay in incorrectly allowing for a known speed. For night practice the destroyers were similarly told the course and speed of their target.[1]

Indeed, realistic torpedo practice was specifically forbidden. One serving officer complained:

> The firing of Very Lights to represent the firing of a torpedo is a dangerous convenience and leads to actions being perpetrated in peace time that would not be dreamed of in war. Of course, it is not always justifiable to fire a torpedo, but due to the truly awful penalty of a week's search for a torpedo which in nine cases out of ten we all know that only a miracle will bring to the surface, it results in practice that commanding officers will only fire torpedoes in a flat calm. In calm weather the conditions for successful torpedo attack are almost universally of the worst, so that even when torpedoes are fired we get little or no useful information or experiences from the risk.[2]

This was indeed a serious development, for in the 1880s and 1890s torpedoes had at least been fired, although information gleaned from such activity was limited. By the 1900s, however, the cost and scarce reserves of the increasingly sophisticated gyroscoped torpedoes precluded risking them. Serving officers were quite fairly annoyed at this restriction, for the costs of gunnery practice often came to £800 for ten minutes firing. Callaghan vigorously supported his subordinates, arguing that heater torpedoes should be fired to hit over long ranges and losses accepted as inevitable.

It was unavailing. Economy prevailed.[3]

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1. Orders for Plymouth TBDs 1896; ADM 1/7281, Orders for Plymouth TBDs 1897; ADM 1/7325.
2. Henderson to DNO, 8 Aug, 1912; ADM 1/8269.
3. Tudor (DNO) minute 20 Jan, 1913. Callaghan to Tudor 21 Jan, 1913;ibid.

The torpedo was regarded as a subsidiary weapon, and therefore never received the attention lavished on the gun. This was particularly so after the Russo-Japanese War had discredited the torpedo. Although a scheme of prize-firings for torpedoists was instituted, it was quite unrealistic and received the contempt of the fleet.[1] Furthermore, opportunities to use torpedoes in major fleet evolution exercises were seldom taken.[2]

There were other faults in torpedo practice which seriously impaired its usefulness. Torpedo firings were preceded by a lengthy period of preparation, which would inevitably not be possible in war. But the torpedo fittings then in general use made it impossible to fire at short notice. There were none available to enable torpedoes to be slung up in a submerged flat ready for use. Lieutenant Drax observed: 'A great mental effort has been made to foresee how torpedoes would be fired <u>in action</u>; but no brain has perceived the fatuous absence of realism in our periods of preparation.'[3]

Furthermore, even with these intensive preparations, torpedo failures were exasperatingly chronic. Beatty was so concerned at the rate of gyroscope failures that he ordered a court of inquiry into each one, and in May 1914 ordered torpedo fitting drills to be as regular as gunnery drills. The problem of torpedo reliability

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1. Bacon minute 13 May, 1909; ADM 1/8147. Richmond diary 27 Oct, 1909; Richmond Mss, RIC 1/8.
2. Jellicoe report on PZ exercises 1912; ADM 1/8268.
3. Drax to Commodore Calthorpe 4 June, 1911; Drax Mss, 1/26. Also Drax memo 10 May, 1912; <u>ibid</u>, 1/10.

nevertheless persisted.[1] This inadequate material preparation augured ill for the future.

Vernon had been conceived as an instructional school, had grown with the scope and scale of underwater weapons and come to represent this branch of naval warfare. Because of its specialised expertise, however, Vernon was also in a position to provide the DNO with an advisory service on torpedo matters. This important function served to emphasise the technical nature of Vernon's expertise and obliged it to be a research and development organisation. Fisher had originally suggested that the Torpedo Committee should base its work on Vernon, since experiment and instruction would mutually benefit from being in close proximity.[2] From this close relationship of training with development Vernon emerged as the source of all naval wisdom on underwater weaponry.

The research and development function inevitably remained a by-product on a ship under such pressure to educate and instruct. Advances were made through the inventiveness of individual torpedo officers. Wilson, for instance, developed a net-cutter for attachment to torpedoes, Gallwey a torpedo controlling apparatus and Ottley the blockade mine. But such activity was limited to individual curiosity on Sunday afternoons, which was when Captain Arthur developed the first system of protective nets.[3]

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1. Beatty memoranda 20 May, 1914 and 13 June, 1914; ibid.
2. Fisher 'Naval Torpedo Warfare' 14 Nov, 1872; Phipps Hornby Mss, Phi 121a.
3. Bradford op cit p. 114.

The deficiency of this system was highlighted by a report from France in January 1881. Captain Gordon of Vernon, commenting on the reorganisation of the Torpedo School there, wrote:

> One principal feature seems to be the constitution of a permanent experimental committee, which must, no doubt, carry more weight than the decision of the Captain of the Torpedo School alone ... I think, sooner or later, we shall have to adopt some such Committee, with perhaps an engineer and a gunnery officer as members.

The DNO, Rear-Admiral Herbert, commented:

> This is a very important and necessary function, which I may exemplify by stating the same function in this country is performed by the captain of Vernon alone, who has in addition to supervising the instruction of all officers and men, to examine and report on all new plans, superintend fittings of all ships, overlook reports on torpedo practice of seagoing ships, in addition to the ordinary discipline and routine of a man of war. I think many of these duties might be delegated to a committee.[1]

Gordon urged action:

> It is possible that while war and disturbance seem far off, these delays may be looked upon by the country with apathy, if not with complacency, in the belief that we are going fast enough, and that the completion or the perfecting of one thing, will only be the signal for commencing something else. But in torpedo warfare, with all other nations straining after improvement and efficiency, nothing but an earnest and liberal administration in this branch of the service can keep us on a level, or as we must strive to be, ahead of all other powers.[2]

Despite this attention, no action was taken.

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1. Gordon minute 28 Feb, 1881, Herbert minute 3 Mar, 1881; Foreign Torpedo Warfare. Printed Pamphlet, Naval Library.
2. Vernon 1881; ADM 189/1.

The weakness continued and was aggravated by the crushing pressure of work as the scope and scale of underwater weapons increased. The Captain of Vernon was

> regarded as the expert in detail of all that appertains to most forms of underwater warfare, and from personal experience I know the post is so burdened with paper work and detail that it is impossible for him to devote the time and attention so necessary to the broader aspects of his work, but on the other hand, the various forms of warfare for which he is responsible are so intimately connected with one another that the severance of any one from the main establishment would result in increased cost and loss of efficiency.[1]

This was the pattern established from the outset, when Fisher himself had noted the need for two senior officers, because one would often be absent.[2] The Captain of Vernon was always a member of the Torpedo Design Committees of the 1880s and 1890s, and although this arrangement was logical enough, such a function could be pursued only at the expense of the ship.

The attempt to marry a school, a research and development institution and a commissioned ship, was doomed to failure. A ship inevitably means a high turnover of staff, and as a school, Vernon was overworked. Rapidly changing members of staff were therefore never able to work consistently on research even had they been given the opportunity and time to do so. The staff turnover was reflected in the changing composition of the Torpedo Design Committees, which again hindered work.[3] Manoeuvres and reviews as

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1. R.S. Phipps Hornby report. Armaments Personnel Committee 8 Feb, 1916; Phipps Hornby Mss, Phi 205.
2. Fisher to Phipps Hornby 9 Dec, 1875; ibid, phi 121b.
3. See Chapter 2 a.

well as ordinary postings interrupted steady work.[1]

The technical nature of torpedo officer training has already been noted, and the research role of Vernon emphasises its importance. Whether it was necessarily correct that all officers should be virtually factory artificers, was another matter. Perhaps the root of the problem was the failure to distinguish between training for schools and supply appointments, and training for sea appointments. By this time, too, the narrowly technical education which torpedo officers were receiving covered an enormous field. The use of electricity throughout ships by 1914 probably merited a specialist officer, but because electricity had been such a significant element in the early mines it remained the responsibility of the torpedo lieutenant. Rear-Admiral R.S. Phipps-Hornby summarised all the faults of the system, when in 1919 he recommended a completely new emphasis in officer education:

> The RN Cadets would be given only sufficient knowledge of steam, electricity and hydraulics to enable them to intelligently use, operate where necessary, and supervise the working of machinery of these natures, and devote most of their time to history, strategy, tactics, international law and duties appertaining to the preparation for and conduct of war ... the torpedo officers would thus merely be specialists in the use and control of their weapons.[2]

Far from recognising such faults, however, Vernon officers clung with surprising obstinacy to the traditional detailed technical

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1. See p. 76. Also Vernon 1887; ADM 189/7
2. R.S. Phipps Hornby. Armaments Personnel Committee, 8 Jan, 1919 Phipps Hornby Mss, Phi 205.

education. Egerton and Durnford, for instance, resisted the Selborne scheme of reduced specialist training with considerable vigour.[1] Richmond commented on them: 'People who have spent some time in either the gunnery or torpedo schools become involved with the idea that they are the only places where people can learn anything'.[2] The pattern had been set from the beginning, with the emphasis on survival, it had been reinforced by the educational pattern, and entrenched by the desire not to lose any of the school's departmental influence. As Sir George Tryon observed, the Vernon philosophy would turn the service into a navy of specialists, as Vernon detached itself from the fleet and became obsessed entirely with itself.[3]

Despite the handicaps, Vernon's officers in fact often achieved a high standard of technical ability. As the history of torpedo development showed, the complexities of the question were not beyond them, and Whitehead never dazzled them with technicalities. Nevertheless, the inventor was always able to keep ahead by virtue of his innovatory genius and his superior experimental facilities. As time progressed and as the scope and complexity of Vernon's duties increased, so the difficulty of reconciling the role of technical expert with naval officer was bound to increase. The officer could choose between two courses, or fall between two stools. Gallway chose the factory, Wilson the Navy. By the 1900s the duality was

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1. Egerton memo n.d.; H.G. Thursfield Mss, Thur 1. Also Hough op cit. p. 155.
2. Richmond diary 22 May ? ; Richmond Mss, RIC 1/4.
3. Tryon to Phipps Hornby, 9 June, 1891; Phipps Hornby Mss, Phi 120c.

no longer practical. The failures of those years and the inadequacies exposed by the test of war reflect this failure to come to terms with changing circumstances.

The staff of Vernon suffered from experimental facilities as inadequate as the instructional resources. Torpedoes could be run only on the Woolwich canal, but this was a mere 300 yards long and available only during spring tides. By 1885 a 450 yard range was ready at Chatham but increased torpedo ranges soon rendered this inadequate. The Committee which had recommended the increased accommodation for Vernon also recommended as 'essential' an 800 yard salt-water range at Forton or Haslar Creek. This was in July 1884, and by the time it had been constructed ranges had increased still further. All torpedoes had to be run at Portland where the range was 1800 yards. Whitehead never lost the advantage of his Fiume and Portland ranges, where 2000 yards of salt water adjacent to his factory provided the perfect facilities.

The crushing burden of work and the ever-increasing complexity and scope of the underwater weapons question, set in the context of inadequate and overcrowded facilities, explains the increasing numbers of failures in the pre-war years. Anti-submarine work and underwater sound detection are the two major omissions. Mining was another. The steady development of mine warfare technology had not been assisted by the Admiralty's stop-go policy in the 1880s and 1890s and renewed activity in the 1900s was equally hindered by a curious administrative arrangement under which the semi-independent Naval Gunwharf at Portsmouth took charge. Vernon was too busy to arrange

co-ordination of effort, which in any case depended on the character and temper of the two officers involved, so that there was a good deal of confusion, duplication of effort and wasted work.[1] As events showed, there was also little progress. Vernon was being asked to do too much with organisation, facilities and training which were still essentially those of the 1880s and 1890s. The primitive improvisations of the nineteenth century were slowly being overwhelmed by the technical innovations of the twentieth.

As if this were not bad enough, Vernon bore yet another responsibility. The supply and organisation of the torpedo service also devolved upon it, and chaos invariably followed. In 1884, for instance, the TB flotilla was ordered to be ready for service with the Duke of Edinburgh by 30 May. 'Our position on 16th June, after a fortnight's warning, was that of the remaining eleven boats in England, not one was ready in all respects for service, and it was not until 23rd June that the eight boats which had been ordered, were prepared to face their first trial.' There was no system of supplies, and storehouses had to be pillaged, an operation which resulted in such equipment as buckets without handles.

> Different systems prevailed at different ports, at Plymouth the boats had been fitted out by the captain of the steam reserve, the consequence being that they were complete in every detail as regards stores ...; at Portsmouth they were not out of Dockyard hands until 21st June ... [and] being thus commissioned, the steam reserve would have nothing to say to them; at Chatham, the captain of the steam reserve had charge of them, but the stores were not drawn, and had to be put into the boats as best could be without any proper provision being made to rescue them.[2]

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1. Interim Report of Armaments Personnel Committee 23 Sept 1916; Phipps Hornby Mss, Phi 205.
2. Edinburgh report 4 Aug, 1884. Enclosure to Vernon 1884; ADM 189/4.

Edinburgh met the same sort of problems again in 1886. The three TBs of his Mediterranean fleet were not equipped with torpedoes and were armed with Nordenfelt machine guns arranged to fire only two barrels at a time because the boats could not stand the strain of all four barrels being fired at once! The two 112 foot TBs were not equipped until after Edinburgh's blockade of the Greek coast, for which they were needed, was over! The torpedoes themselves took two months to reach Malta[1] and arrived with no pistols, primers or exercising heads.

This Vernon responsibility was another indication of the variety and extent of the duties devolving upon it. The torpedo depot at Portsmouth was responsible for supply and repair. While the Whitehead was relatively primitive, it was just about possible for Vernon to combine this function with instruction and experiment. With the increasing scale of the job, however, the anomaly was obvious. It was as if Excellent controlled the engineering staff of the Gun Mounting Stores. This essentially civil function was handled by active service ratings whose composition was constantly changing and who in war would leave for active service, with a consequent breakdown of the supply system.[2] It was a recipe for chaos.

The overall conclusion can hardly be encouraging. The circumstances of Vernon's evolution dictated the nature and extent

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1. Edinburgh report 9 Nov, 1886; NID 120.
2. Henderson memo 28 Jan, 1903; Henderson Mss, HEN 9/9.

of its duties and facilities, neither of which was ever assessed rationally. The organisation remained much the same as that founded by Fisher, the education offered was cast in the same mould, and the torpedoists came to regard any criticism of a patently antiquated institution as a criticism of the quality of the torpedo service. In fact, the quality of many officers was very high, though the enormous increase in their tasks inevitably began to have its effect from the 1900s onwards. Vernon's duties became simply too many and too varied for the existing organisation to cope. Vernon's failure was therefore primarily an administrative failure born of a lack of clear thinking, or indeed any thinking at all, about the steps necessary to grapple with a revolution in weapons technology. Technical failure and personal mistakes, which are never absent from any organisation, are magnified or limited by the environment in which they occur. The chaos of Vernon was perfectly suited to maximise all such failures and mistakes.

CHAPTER ELEVEN - THE TEST OF WAR 1914-18

> The continuous development of the mine and the torpedo make it impossible to establish a close watch on the exits from the Heligoland Bight with heavy ships. To do so for a long period of time would mean a steady and serious wastage of valuable units from the above causes, and, if prolonged, would effectively alter the balance of naval power.[1]

Underwater weapons had by 1914 caused a fundamental change in British naval strategy. The Grand Fleet moved to Scapa Flow, the northern-most anchorage in the British Isles, and imposed a strategic long-distance blockade of the North Sea, which was now given over almost entirely to the skirmishing of the smaller vessels, the submarines, destroyers and minelayers which had themselves driven away the battleships. The realities of warfare imposed on the Service by Callaghan the previous year, were precisely those forecast by Murray Sueter a mere ten years earlier.[2]

Scapa offered a refuge from the mine and submarine, against which the battleships were painfully vulnerable. The loss of the dreadnought Audacious mined in the Irish Sea in October 1914 was ominous, while the submarine danger was emphasised by the loss of the Hogue, Aboukir and Cressy. The clearest indication of the battleship's vulnerability however came in the Gallipoli campaign. The pre-dreadnought battleships Triumph, Goliath, Majestic, Ocean and Irresistible were mined or torpedoed at the Dardanelles and capsized with appalling rapidity, a fact which surprised even so competent an officer as Admiral de Robeck.[3]

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1. Admiralty testimony to the C.I.D., 29 Mar, 1913; quoted in CAB 16/28A.
2. See p. 223.
3. De Robeck report, 7 June, 1915; ADM 116/1428.

The fact was that underwater protection had been seriously neglected on Sir William White's battleships, and although the dreadnought design was in many respects superior this too was never intended to be a complete guarantee against sinking and was no guarantee at all against crippling injury. This knowledge obliged Jellicoe to exercise such caution that only three dreadnoughts suffered underwater damage during the entire course of the war. Their resistance to injury was a marked vindication of the dreadnought design compared with the older ships.[1] The battle cruiser Inflexible, mined in the Dardanelles, was protected from a magazine explosion by its armoured longitudinal bulkhead, which diverted the force of the initial explosion. The battleship Marlborough torpedoed at Jutland, was saved by the same constructional system. Her forward boiler room, undefended by any bulkhead, was flooded which caused her to drop out of the line but she was by no means fatally injured.[2] The one fatal dreadnought casualty, the Audacious, was not sunk by the direct effects of the mine explosion, damage from which was limited by the vessel's transverse bulkheads. The mortal flooding was caused by heavy seas washing the decks, sweeping into the junior officers' bathroom and from there penetrating a non-watertight door into the port engine spaces and the machinery of X turret.[3]

Mere survival however was not enough. A crippled battleship is as useless as a wreck and the paucity of dreadnought casualties

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1. See pp. 103-6.
2. DNC memo Damage by mine or torpedo to unbulged vessels, n.d.; ibid.
3. DNC memo Experiments on underwater protection and its application to warships 1913-20 n.d. Printed pamphlet, Naval Library.

is explicable because they were not hazarded precisely because they were vulnerable to crippling damage. For all the post-dreadnought improvements in ship construction therefore, the Grand Fleet suffered from the same strategic paralysis which would have affected a fleet of pre-dreadnoughts and often did affect them when faced with the more limited threat of the TB in the manoeuvres of the 1890s. 'Our ships previous to the war had not been designed to withstand torpedo fire ... this proved a real menace to the navy'.[1] It is indeed a serious indictment of pre-war preparations that the only certain defence which Jellicoe could employ was to decline action and avoid all risks. It was the very antithesis of the Service's initial reactions to the problem, which had been well summarised by Sir George Tryon in 1876,[2] and which the Navy was now obliged by the experience of war eventually to adopt.

The issue of underwater protection for capital ships could no longer be shelved. Pre-war experiments had tested the vulnerability of the Queen Elizabeths to torpedo attack, and the DNC was determined to improve their protection. In a memo of October 1914 he suggested that there could be 'no question that underwater attack must be regarded as a greater menace than has hitherto been the case', and that modifications to ships' designs were necessary. The trials had indicated clearly that distance from the explosion was the major factor in minimising its effects.[3] He therefore proposed a system of bulges to be fitted experimentally to the old cruiser Edgar. The

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1. Final Report of Post War Questions Committee, 27 Mar, 1920; ADM 1/8586.
2. See p. 83.
3. Tennyson d'Eyncourt Memorandum relating to new construction 12 Oct, 1914; ADM 1/8397.

Board was enthusiastic. Tudor praised this 'practical proposal'; Battenberg commented: 'This is a good idea, the reduction of speed is immaterial'; Churchill sanctioned the immediate preparation of the materials.[1]

Unfortunately, such a system caused two major problems when applied to battleships. Firstly the increased beam size would make most docks unusable. Secondly there was a considerable effect on speed, a major consideration on dreadnoughts which had been of no significance on the old Edgar. D'Eyncourt therefore proposed a steel girdling bulge for the Royal Sovereign class which were then under construction. This would be cheap and easy and have no limiting effect on speed. Fisher endorsed the project with enthusiasm and the Rs became the first battleships to be fitted with bulges. These were shallow ten-foot affairs which consequently gave only incomplete protection, but allowed full speed at increased power.[2]

The principle of bulging was now accepted and d'Eyncourt worked the concept into the design of the Renown and Repulse. By employing the oil tanks as part of the bulges he ensured a depth of 14ft. in the protective structure, while maintaining a beam of only 90ft. The same idea was used in the Courageous, Glorious and Furious. This particular form of bulging in fact employed very much the same principle as that of the dreadnought design, which was based on maximising the distance from explosion to bulkhead. The extra area

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1. Tennyson d'Eyncourt proposals 21 Oct, 1914, Tudor minute n.d., Battenberg minute n.d., Churchill minute 23 Oct, 1914; ADM 116/1428.
2. Tudor memo, 27 Feb, 1915, Fisher minute 5 Mar, 1915; ADM 138/509.

designated as 'bulge' gave more protection, but was necessarily limited so long as the actual beam of the ship was not increased. The Renown for instance had a bulge of 14ft., but on the Iron Duke the gap between the side of the ship and the armoured bulkhead protecting the magazine was 11½ft., so that the protection of the former vessel was only marginally better than the 'non-bulged' ship.[1] Bulging could be decisive only when it involved a significant addition to the ship's hull, but this again raised the problem of dock accommodation which was simply not available.

D'Eyncourt pressed his experimental work with vigour, working in close collaboration with a committee of distinguished scientists for whom the Admiralty facilities at Chatham and Portsmouth were made available. This civilian expertise was used effectively to influence the designs of ships built during the war and their experiments forecast roughly the actual effectiveness of bulge protection.[2] The DNC and the Controller, Bartolome, pressed ahead with the work[3] and a committee presided over by Lord Jellicoe supported their efforts in its report of November 1918. This report which was 'strongly in favour' of bulging recommended a scale of protection for new vessels which it was hoped would resist up to eight torpedo hits, and the bulging,of those dreadnoughts already in service.

Unfortunately proposals of this sort were very long term matters, for the only suitable dock, that at Portsmouth, was busy bulging the

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1. Admiralty memo, Capital Ships 1905-14, Jan 1918; ADM 116/1428.
2. See Note 3, p. 299.
3. Tennyson d'Eyncourt memo 25 July, 1918; ibid.

Renown and Repulse, an operation which was expected to take at least a year. The recently completed highly modern Rosyth docks would be rendered useless by the increased beam of the battleships.

> The amount of dock accommodation for capital ships which existed before the war was inadequate even for peace needs and in no sense whatever for war requirements ... In view of the great and increasing menace of the torpedo in modern warfare, the committee cannot but view the situation with considerable misgiving, having in mind the fact that all German dreadnought types are fitted with under-water protection which is generally superior to that fitted to the great majority of our existing ships of the same type.[1]

During the course of the war, therefore, the battleship strength of the Royal Navy was vested in vessels which could in no way be considered invulnerable. This stemmed from a deliberate act of policy pursued since the introduction of the torpedo and characterised by a memo from Bartolome:

> I contend that we have the power to accept the torpedo menace in a sane and businesslike manner, and that we are not doing so, and that we are continually making improvements in our protection against gunfire and almost ignoring the far more dangerous results of torpedo fire.

Battleships had in fact been built to 'accept' gunfire, but not to 'accept' torpedo fire.[2] Only under the pressures of war were the serious defects of that policy becoming recognised, while the brilliant work of d'Eyncourt, his staff and his civilian advisers was at the same time giving the lie to the suggestion that complete protection was impossible.

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1. Report of Committee, 4 Nov, 1918; ibid.
2. Bartolome minute, 1 Aug, 1916; ibid.

The failure to provide for adequate protection against mines cost the Grand Fleet heavily in terms of freedom of action, for Jellicoe refused to enter the North Sea without minesweepers whose speed would have the effect of restricting the battleships and exposing them to submarine attack.[1] The Germans mined with a freedom and generosity which was not anticipated before the war, and Jellicoe now paid the price. Vernon was still experimenting in vain with a form of mine-catching fender extending over the bows[2] and until the invention of the paravane in 1916 no adequate protection was available.[3]

The submarine caused even more trouble and succeeded in driving the fleet from Scapa Flow. In 1914 it was believed that the anchorage was beyond the range of German U-boats and that even if they reached Scapa 'the currents are so extraordinary and so incalculable that it is not thought possible that submarines could make their way under water into the harbour'.[4] These two assumptions were soon found to be unsound. The navigability of the waters around Scapa had been judged by a very superficial reading of the North Sea Pilot,[5] and the range of submarine activity could and should have been anticipated from the 1912 manoeuvres, when D4 travelled 1,500 miles and had been capable of doing an additional 750.[6] The mere 500 miles from Wilhelmshaven to Scapa was an easy

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1. Jellicoe to Battenberg, 18 Aug, 1914. Quoted in Marder, op cit. II, 74.
2. Vernon to Admiralty, 4 Oct, 1914; ADM 138/468.
3. Marder op cit II 73.
4. Churchill to C.I.D. 28 Nov, 1913; CAB 16/28A.
5. Note by C.I.D. secretariat. North Sea Pilot. Appendix to D.I.D. N.E. Coast Defences Sub-Committee 1912; ibid.
6. W.H. May Narrative of 1912 manoeuvres 31 July, 1912; May Mss, May 10. See pp. 240-1.

journey by comparison. The evidence was therefore available, but unlike the 1890s when similar evidence in the manoeuvres had resulted in frantic activity, no action was taken. The Grand Fleet's main base was therefore totally devoid of protection against submarine attack. Beatty commented: 'It is only Divine Providence that has saved us from an appalling disaster'.[1]

The C-in-C himself had used submarines astutely in the 1913 manoeuvres and had been a leading figure in the development of the 'diving destroyer' concept. His ideas and foresight undoubtedly led him to ascribe to the submarine powers which in 1914-18 it did not yet possess, and this, combined with his realistic assessment of the vulnerability of his capital ships, led him to a perhaps excessive caution. The fact was that a squadron of fast-moving, zig-zagging and screened battleships made an extremely difficult target for a submarine, handicapped as the latter was by its slow submerged speed. Without these precautions of course the capital ship was vulnerable, as the fate of the Formidable demonstrated. This vessel was torpedoed in the Channel while steaming at 10 knots with neither zig-zag nor escort precautions.[2] If the proper measures were taken, however, the battleship could rely on the limitations of the submarine to prevent a successful attack, just as the ironclads of the 1890s had been able to rely on the very similar limitations of the TB for a similar degree of security.

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1. Marder, op cit II, 69.
2. ibid, p. 98-9.

The submariners had never had any illusions about the limitations of their craft,[1] and the validity of their pre-war assessments was clearly illustrated during the war. The 'success' of the submarine trap of 1913 repeatedly eluded the wartime practitioners, for the submarine, like its predecessor the TB, was and remained a weapon of opportunity and chance which exploited rather than created opportunities. In this capacity it could be deadly, but equally it could be innocuous if the chance did not present itself. Like his predecessors in the manoeuvres of the 1890s however Jellicoe took note of the potential damage which could be inflicted on a suitable chance occasion and did his utmost to ensure that the chance never arose. For as long as the fleet could not 'take' torpedo fire it was the potential rather than the actual achievements of the submarine which dictated their effect on the conduct of war in the North Sea, just as the potential of the TB had dictated the course of the manoeuvres in the 1890s.

Ever since the failures of the 1870s and early 1880s to develop the torpedo as a seagoing weapon it had been relegated to a secondary role in the Royal Navy. This had been accentuated during the debate on the TB issue, so that by the 1900s it was unthinkable that the torpedo should be regarded as an offensive weapon for the use of the Royal Navy. This historical development goes far to explain the failure of the capital ships to use their torpedoes at Jutland, and the limited part played by the British destroyers in that battle. The Germans were never faced by the threat of a massive torpedo attack because the British destroyers had been drilled to defend

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1. See p. 250.

the capital ships and they did precisely that. The concept of defence by offence mooted by Tryon, Hall, Colomb and latterly by Richmond, de Robeck and Callaghan, had been lost in the pre-occupation with the immediate dangers posed to the fleet and the grip of traditional ideas on the role of the destroyer.

This question raises an interesting contrast between the attitude taken towards the submarine and the destroyer. The latter was by tradition a defensive arm of the fleet; she owed her inception to this consideration and her origins dictated her subsequent employment. Pre-war attempts to reconsider this function were revived by Beatty and Hood, who in August 1915 urged on Jellicoe the proposition accepted by his predecessor, that attack was the best form of defence. The C-in-C, strongly influenced perhaps by his pre-war examinations of the TB menace[1] refused to alter the defensive role allocated to the destroyers.[2] On the other hand, he considered that the best reply to the U-boat menace was an attack by British submarines on the German fleet. In November 1915, he urged that 'E' class overseas submarines should be stationed on the Tyne for his use. 'It is quite certain that the German battle-fleet will be accompanied by submarines, and we shall be at a great disadvantage if our own submarines are not in a position to take offensive action against the German battle-fleet.'[3] He was, in other words, advocating a different principle of action for the two types of vessel, although their capabilities were virtually identical and although there was every reason for the same arguments applying to

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1. See pp. 164-5.
2. Hood to Jellicoe, 27 Aug, 1915, Beatty to Jellicoe, 28 Aug, 1915, Jellicoe reply 7 Sept, 1915; ADM 137/1966.
3. Jellicoe to Admiralty, 24 July, 1915 and 8 Nov, 1915; ADM 137/1926.

both. The difference in function of the two types owes much to their history which cast them in roles which were then enforced by tradition. The destroyer was for the defence of the fleet; the submarine on the other hand had come to embody the tradition of the Polyphemus and the offensive use of the torpedo at sea. In 1916 in fact the destroyer was technically more suitable for this function than the submarine, a fact recognised by the re-evaluation of its role in the Grand Fleet Battle Orders after Jutland.[1] By then of course it was too late.

This emphasis on the submarine as an offensive fleet auxiliary exercised great influence on the develcpment of submarine policy, reaching its culmination in the creation of the steam-driven 23 knot 'K' class submarine[2] a remarkable misdirection of energy, since a destroyer could do the job equally well, and the submarine was by its very nature not at its best operating against a battle-fleet observing the proper precautions[3]. Nevertheless, not all effort was wasted, for the submarine was able by its unique qualities to revive the very function which it had been instrumental in eliminating. 'It proved most effective when it operated where its own surface fleet could not go and where the enemy really needed to use the sea.'[4] In 1914-1918 the submarine was employed with considerable success in the second role envisaged for it by pre-war thinkers. British submarines operated with considerable success in the Heligoland Bight. The traditional blockade was now enforced by the newest of the

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1. Marder, op cit III, 225.
2. Jameson op cit p. 258-9.
3. See p. 229.
4. Jameson op cit p. 82-4 contains an excellent analysis of the employment of the submarine 1914-18.

weapons which had once threatened to overturn all the old ideas.

The emphasis on 'fleet' development which was so natural to the Royal Navy, also had the effect of leading the Service to expect that the Germans too would concentrate on attacking the fleet. This explains the careful thinking of Keyes and Callaghan on the anti-submarine problem, although it makes all the more inexplicable the failure to realise the implications for harbour defence. It also serves to emphasise the contrast between the advanced state of submarine development and the rudimentary state of anti-submarine measures, which had been allocated to the already overloaded Vernon.

In the event, the submarine in the North Sea never threatened the balance of sea power. While the Grand Fleet could do little to eliminate the threat, the submarine was equally, limited in its ability to hurt battleships. Although U-boat commanders became increasingly proficient in their attacks on patrolling vessels and restricted the Grand Fleet to waters north of the Horns Reef parallel,[1] the main battleship strength of the Royal Navy remained safe as long as it observed the necessary precautions.

The Great War, however, saw a new and wholly unexpected expansion of the U-boat's sphere of operations, which posed a greater danger than any 'diving destroyer' or submersible Polyphemus. Submarine warfare against merchant shipping had been mooted by Captain

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1. Marder, op cit III, 252.

Murray Sueter in 1904, while the 'Naval Review' and Sir Percy Scott had noted the possibility of such a campaign in 1914.[1] Only Lord Fisher however had categorically asserted that the enemy would resort to such tactics.[2] For the same humanitarian reasons which had prompted observers to conclude that (pace the Jeune Ecole) a TB war against merchant shipping in the 1890s was unthinkable, so too the prospect of submarine war against commerce was dismissed.

When the Germans adopted this course, therefore, two urgent problems were raised. Firstly, the U-boat had to be not merely evaded but fought and defeated. The Western Approaches could not be denied to commerce in the same way that the North Sea was closed to battleships. The danger could not simply be accepted and avoided. Secondly, a whole new administrative and operational effort was necessary, for submarine warfare now had to be tackled as a sphere of naval warfare in its own right, a status which it was naturally not accorded when it was merely an adjunct to other forms of naval warfare. The scale of the problem could not in all fairness reasonably have been anticipated. Nevertheless, it is indisputable that the test of war found the navy lacking the means to counter the submarine, an organisation capable of directing research into anti-submarine work and with only minimal knowledge of the problems involved. Only under the pressure of war was a serious effort made to counter the submarine and the direction and coordination of these efforts left much to be desired.

Work proceeded under the aegis of three bodies. H.M.S. Vernon

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1. See pp. 223, 269.
2. Fisher 'The Oil Engine and the Submarine' Jan 1914; Jellicoe Mss Add Mss 48993.

continued its pre-war work, and a new establishment at Hawkcraig (near Aberdeen) began its own experiments on underwater detection. At the same time a ccmpletely new body was deployed, consisting of civilian scientists. The Board of Inventions and Research (BIR) was established to investigate a wide variety of scientific matters as they affected all aspects of war; one of its major priorities was the development of anti-submarine measures.

This tripartite arrangement was not a success, and the distinct lack of progress made eventually resulted in a review of the situation by a committee under the chairmanship of Sir Sothern Holland.[1] The faults exposed were glaring and critical. The main difficulty was the complete lack of cooperation between the three arms. The BIR was independent of any government department, a situation deliberately engineered with the intention of endowing it with some measure of freedom of action; the result was to isolate it from those departments whose cooperation was necessary. Not until April 1916 were the heads of the technical departments of the Navy placed on the committee, while naval suspicion of civilians did not help matters. Compartmentalisation and departmental defensiveness, so marked a characteristic of Vernon since its inception, now served to keep the BIR at arms length from the Navy, while Commander Ryan of Hawkcraig was consistently hostile to the civilians who were foisted on him, and proceeded without benefit of consultation with anybody.

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1. Report of the Sothern Holland Committee, 25 Oct, 1917, with comments and criticisms from naval officers and scientists; ADM 116/1430. Eventual solution in Admiralty circular 18 Jan, 1918; ibid. Also Geddes to Fisher 18 Dec, 1918, 1 Jan, 1919; Bragg Mss.

The other contribution of the committee was to emphasise the appalling inadequacies in naval scientific research facilities. 'The Mining Section /of HMS Vernon 7 was cramped while the old floating hulks do not form convenient laboratories or workshops, and delicate researches could hardly be carried out under such conditions'. In short, the Navy lacked both the facilities and organisation necessary to meet the technical needs of a twentieth century war. The improvisations of the 1870s and 1880s had finally outlived their usefulness.

In other respects, however Sir Sothern Holland's committee was too sweeping and unjust in its criticisms, perhaps because it started from the premise that 'Science' was the panacea for all ills, and failed to take account of some of the genuine problems of applying scientific knowledge. The constitution of the BIR, with its complete separation from the Service, inevitably led to competition and jealousy, and to ascribe this entirely to naval pride was to miss the weakness of the initial arrangement. The Committee recommended that Experiment and Research should be centralised under the direction of a civilian establishment. The expertise of civilians was indeed useful and likely to be more productive in the long term than the essentially empirical work of the naval scientists. But this did not mean that the real abilities of some of the latter should be ignored. Ryan, for instance, was an able man who was as responsible as the distinguished Professor Bragg for the development of the 'single diaphragm directional hydrophone' - an important development in submarine detection. His knowledge of science combined with his appreciation of Service needs could have enabled

him to control the direction and relevance of the work done while the scientists used their brains in his support. It might have preyented many ruffled feathers and would certainly have been a more practicable administrative arrangement. The eventual solution was indeed along roughly these lines. Scientists were assigned to separate technical departments with Professor Charles Merz appointed as Superintendent of Experiment and Research in a purely advisory role, under the Third Sea Lord, to coordinate research activities. This however was not until January 1918.

The executive organisation for coordinating the anti-submarine war was organised rather more speedily. In December 1916 the Anti-Submarine Department was formed in Whitehall under Admiral Sir A.L. Duff, who inherited a disastrous situation which was resolved ironically by a measure (the introduction of convoys) which owed nothing to the Admiralty organisation. Nevertheless, the Head-quarters framework was at last there, though it was not until March 1918 that the scientific element was thoroughly involved. Professors Bragg and Merz formed a small executive committee, under the aegis of DASD, to control experimental work under vastly improved research conditions at Harwich. At this late hour therefore the organisation was finally complete.[1]

This steadily improving organisation and the increasing technical measures available to the Royal Navy were, however, useless unless properly applied, and the fundamental weakness of the British anti-submarine effort was the totally misguided strategy employed.

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1. Captain W.W. Fisher. Memo on organisation of A/S Division, 20 Mar, 1918; ADM1/8272.

The origins of this mistaken approach lay in the experience of the TB which had appeared to offer a similar challenge. The Admiralty had always rejected the concept of defending merchant shipping on the grounds that it was impossible and distracted resources from the main task. It had therefore developed the TBD to take the offensive and, by patrolling off the TB bases, to eliminate the menace at source. The shortcomings of this strategy, apparent to the impartial observer, were brushed aside, and indeed it held a certain logic in the very limited context of maintaining the blockade of the French Channel ports. Extended to the North Sea, however, it made much less sense and applied to the campaign against submerging vessels in the wide expanses of the Western Approaches it made no sense at all. The war demonstrated what could and should have been deduced from the manoeuvres with the TB; that the submarine could not be found just by sailing up and down looking for it. In consequence, patrolling and hunting completely failed to suppress the menace. The 'defensive' convoy on the other hand obliged the submarine to approach the escort first if it wished to attack the merchant ships (though its main attribute was in clearing the seas of targets for the submarine by concentrating all ships in one place) and was a much more effective and economical method of bringing together hunter and hunted. The Navy resisted to the eleventh hour this simple measure which defeated the U-boat; they did so on the basis of a solidly entrenched emotional commitment to the offensive, backed up by what were deemed to have been the practical experiences of the preceding 40 years. The pre-war years had been poor preparation, serving merely to confirm the prejudice

for unsuitable methods which owed much more to emotional appeal than logic, and as in the employment of the TBD with the fleet, firmly setting the Royal Navy down a mistaken path.[1]

The anti-submarine war required entirely new skills for large numbers of seamen. Indeed, so many men became involved in the new hydrophone work that Duff's successor, W.W. Fisher, felt it necessary to press for the establishment of hydrophone listeners as a completely separate branch of the Service.

> The degree of success in the hunting and destruction of enemy submarines depends so largely on the skill and training of the listeners to be employed ... that the importance of this service can hardly be over-estimated.[2]

The importance of the question was at last recognised.

> Had we in 1901 ... concentrated on solving and developing submarine detection, the basis of successful anti-submarine work, and trained skilled personnel in its use, the desired result would have been obtained by 1914, and it is not too much to say that the whole course of the war would have been changed to our advantage and the length of the war shortened.[3]

Matters were however not that simple, for a new branch of men practising the new skills would inevitaboy be small, with limited promotion prospects, a matter of particular significnace for the

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1. The introduction of convoy, and its advantages in the campaign against the submarine is comprehensively discussed in Marder, op cit IV, 115-66 and 256-92. For the development of the 'offensive' myth, this Study Chapters 5a + b, 6 and 7, passim.
2. Fisher to Admiralty 26 Feb, 1918; ADM 1/8516.
3. Admiralty Conference conclusion, 16 Feb, 1919; ibid.

officers; and if this problem were significant enough even after the wartime expansion it would have been even greater before the war, when the anti-submarine task was perceived in understandably narrow terms. The solution was sought by making the 'listening' service a branch of communications along with telegraphy and signalling. Unfortunately listening and w/t requirements were different and could only be practised at the expense of the other. There was also a danger that the recruiting of listening specialists affecting the recruiting of communications specialists. Eventually, though not until after the war, matters were resolved by the creation of a separate corps of listeners recruited from seamen of AB rating. This arrangement allowed the continuation of specialised recruiting to the other branches while employing previously unskilled seamen in the new specialisation.[1]

This was a substantial step in the right direction, but it is interesting that immediate post-war developments were at the same time wrecking the cohesion which the anti-submarine service had gained from the unified direction of the war arrangements. The organisation was fragmented,[2] with the Captain (A/S) subordinated to the Commander in Chief at Portsmouth and acting merely as a coordinator. The Signal School teaching Asdic, the submarine service teaching submarines and Vernon teaching hydrophones took over the constituent elements of anti-submarine war, and in each case relegated them to positions of minor importance.[3] This

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1. Communications Branch Committee recommendations n.d. Admiralty circular 10 Feb, 1912; ibid.
2. Captain J.D. Tillard to Admiral S.R. Fremantle 17 Oct, 1924; ADM 116/2410.
3. Tillard to Fremantle, 17 Oct, 1924; ADM 116/2410.

virtually repeated the errors of the pre-1914 era when Vernon had been overloaded. Now again the various schools were bound to give priority to their main purposes. The fault was obvious and in 1924 when the Captain (A/S) urged the amalgamation of practical study, tactical teaching and Admiralty policy under 'specially experienced naval staff' at Portland, in order to tackle 'this vast science of subaqueous sound' in an organised way, there was no objection.[1] The result was the Underwater Weapons Establishment at Portland, the practical recognition of the lessons and successes of the wartime ASD. Only with the formation of this establishment was it possible to put the same emphasis on meeting the submarine as on developing it. Portland was the necessary counterpoise to Dolphin which was missing before 1914; its absence contributed substantially to the inadequacy of the measures to meet the impending crisis. The submarine had been applied in a manner which could not reasonably have been anticipated in a civilised Edwardian world. But the proper organisation along the lines eventually developed was necessary whatever the precise nature of the threat; and this the Royal Navy had failed to provide. The adoption of submarines by the Royal Navy had been justified in 1901 on the grounds that counter-measures could then better be devised. In fact it had taken the war to force the Admiralty into taking the measures necessary to achieve that end.

Just as the scale and nature of submarine activity in the war

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1. ibid.

confounded all expectations, so too did the use of mines. Previous experience had suggested their use as a tactical weapon on a limited scale. Fisher, for instance, envisaged a form of trench warfare between the fleets,[1] while the Russian and Japanese fleets had apparently used ambush mining techniques in 1904-5.[2] This was the type of activity envisaged with some apprehension by Jellicoe, who pressed for a fleet minelayer so that he could employ the same tactics against the Germans.[3] As with the submarines, its relevance to fleet actions was the major consideration, and its application was anticipated in a local and tactical context. The one pre-war suggestion on strategic mining, from the DOD Ballard in 1913, had met with no response.

During the course of hostilities, however, the Royal Navy laid no fewer than 128000 mines[4] and employed them as a major strategic weapon against the U-boat. Such developments were not without resistance from the entrenched dislike of mining which had played a prominent part in relegating the mine to a minor role in the pre-war decade. Winston Churchill was the prime mover behind this prejudice persisting into the war years, arguing that mines would foul the waters which the Royal Navy might need to use. At the same time he had no faith in the efficiency of mines at blockading U-boats in their harbours. As late as May 1915 therefore only three small minefields had been laid in the Heligoland Bight.[5]

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1. Fisher memo 'Submarine automatic mines'; Kemp op cit II, 93-103.
2. See p. 262.
3. Jellicoe to Tudor 12 Oct, 1916; ADM 137/1883.
4. Cowie, op cit. 86.
5. British mining policy in this period is well covered in Marder, op cit II 79-81.

The submarine menace could not be ignored however, and small minefields were laid in certain proclaimed areas off the English and Scottish coasts to trap U-boats as they converged on focal areas or prominent headlands.[1] Jellicoe employed the once-despised defensive mine in the protection of Scapa Flow and urged a more widespread adoption of this precedure in other parts of British home waters. He argued that while mines laid in enemy waters could be removed at the will of the enemy and could as Churchill claimed impede British warships, mines laid in home waters could be a very effective defensive measure provided their position was known. For this reason Jellicoe allowed German mines to remain in position off the Forth, while defensive minefields steadily increased in number around the coasts of Britain.[2]

Jellicoe was at the same time pressing insistently for a more vigorous policy of offensive mining to prevent the U-boats entering and leaving their North Sea harbours,[3] a policy which was pursued gradually and cumulatively. The problem was that the available mines were of very poor quality, a result of neglect and policy changes of the pre-war years. They seldom exploded when touched and invariably broke their moorings. These weaknesses were accentuated when the mines were used in deeper waters; strategic mining, the potential of which was gradually being realised, was therefore very difficult.[4]

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1. Cowie, op cit p. 46.
2. Rear Admiral (M) memo, Jan, 1919; ADM 137/1885.
3. Jellicoe to Admiralty, 14 Aug, 1915; ADM 137/1937.
4. Marder, op cit. II, 77.

Attempts to block the Dover Straits with a system of mined nets failed because the U-boats simply dived under the obstacles. Not until the end of 1917 were there enough deep-water mines of adequate quality to permit the laying of a deep minefield which blocked the loophole effectively. Once this was done, the Channel passage was barred to the submarine. 'The Dover Straits barrage had practically denied the English Channel to the U-boats'.[1] The U-boats were henceforth obliged to use the much longer northern route, and efforts were made to apply the same blocking policy here. From September 1917, a total of 71,000 mines was laid in a 240 mile stretch of the deepest part of the North Sea between the Orkneys and the Norwegian coast. The sheer scale of the operation, inconceivable three years earlier, prevented its total success. The barrage could not be patrolled, Norwegian territorial waters were used by the Germans, the depth and extent of the water was too great, and the mines were again unreliable. Unlike the Dover minefield the Northern Barrage never became a death-trap for submarines, but it constituted an acceptance of a significant strategic role for the mine and undoubtedly hindered the German submarine effort.[2]

The offensive mining of the Heligoland Bight was an altogether different matter from the defensive barrages, for mines laid in enemy waters were exposed to enemy counter-action and the effectiveness of such a policy depended on the vigour and

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1. ibid V 66.
2. ibid V 66-76 and Cowie, op cit 62-72 contains admirable summaries of this operation.

effectiveness of the minelaying. Throughout 1915 and 1916 the number of mines increased only slowly and sporadically, but in January 1917 Beatty took up Jellicoe's appeal, urging an extensive semi-circular barrage across the entrance to the Heligoland Bight which he considered should be patrolled to prevent enemy minesweeping activity. The latter condition was crucial to the effectiveness of a successful mining policy and was applied with increasing efficiency. Eventually, sheer numbers told against the German minesweepers. While a mere 1782 mines were laid in 1916, 15,686 were laid in 1917 and 21,000 in 1918. By February 1918, the dangers of these waters obliged the U-boats to be routed via the Kattegat, thereby shortening the productive cruise of each submarine and adding to the difficulties already imposed by the defensive mine barriers.[1] It was a striking testimony to the utility of large-scale defensive mining which had made possible an effective blockade at a fraction of the cost which would have been involved by employing traditional methods.

The experience of war had therefore caused a complete reversal of British attitudes. From being a neglected weapon of limited tactical applicability, the mine became an extensively used strategic device to eliminate a major threat to British sea power. Nor was this solely a reflection of the scale and length of the war which surpassed all reasonable expectations; it was a reflection of British failure to recognise the value and usefulness of the submarine mine and of the tendency to consign it to the place it had held throughout the nineteenth century, that of a defensive auxiliary

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1. Cowie op cit p. 82.

with which the Royal Navy felt it should properly have little to do. The war experience makes all the more creditable the conclusions of Keyes and Callaghan in their pre-war investigation of anti-submarine measures.[1] The mining Sub Committee of the Post-War Reconstruction Committee, formed to consider the lessons of the war, noted the dramatic change. Before the war, surface operations had attracted the main burden of attention so that it had been in Britain's interests to secure the abolition of the mine. The development of the submarine, however, made it necessary to employ every possible weapon against the underwater threat.

> At present, the mine constitutes one of the methods of combatting submarines, and hence in our opinion the advantages we should derive from its unrestricted use when a belligerent far outweigh any advantages we should derive from it either as a belligerent or as a neutral, from its abolition or restriction. We therefore recommend that, until some equally efficient method of combatting submarines is devised, the policy of this country should be to resist any proposals for the restriction of the use of mines in naval warfare.[2]

The submarine which had earlier been expected to render the mine redundant had, on the contrary, caused its widespread adoption. Nowhere was this more so than in the despised controlled mining used to defend harbours and channels, the main activity of the torpedoists in the nineteenth century and the primary reason for their being held in contempt by the rest of the Service. Technical developments had by now at last made controlled

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1. See pp. 228-31.
2. Report of Reconstruction Sub-Committee on Mines, 8 Oct, 1918; ADM 116/1636.

mining an effective form of warfare.[1] Indeed it was hoped to block the English Channel with the aid of the new improvements and, although the war ended before the scheme was put into operation, the principle was firmly established that: 'Controlled mining must always form one of the main weapons to counter and combat the submarine'.[2]

The low priority given to mining in the pre-war years was reflected in the totally inadequate preparations which hampered the execution of policy during the war. British mines were not good enough, the 'Elia' and RN mechanical mine 'neither of which possessed the required degree of sensitivity' being abandoned in early 1915 and December 1917 respectively. Not until October 1917 was an adequate mine adopted, when the Vernon 'H' horn type, a direct copy of the German model, was developed. The lack of a 'well-equipped and staffed Mining School with adequate funds' was sorely felt. Not until the Naval Gunwharf at Portsmouth was expanded in December 1916 were adequate facilities provided for mining and experimental work.

Equally, the minelaying force of old converted cruisers and adapted merchant ships 'did not embody the essential characteristics required for their special work, having neither speed, coal endurance, nor capacity'. Given that speedy laying was often necessary in mining, the force was never adequate. As late as March 1918 the minelayers were capable of laying only 4,000 mines per month, whereas Rear-Admiral (M) Field estimated that 100,000

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1. Bragg to Admiralty 7 Nov, 1939; Bragg Mss. Captain G.E. Frazer. Notes; Frazer Mss, FRR 13.
2. Reconstruction Sub-Committee on Mines, 8 Oct, 1918; ADM 116/1636.

had to be laid in the North Sea alone, as well as 1,000 per month elsewhere. The purpose built minelayers caused as many problems as they solved. HMS Abdiel for instance, so eagerly awaited by Jellicoe, had to be altered several times after commissioning in the summer of 1916 before being able to lay her mines at the speed at which she was designed to cruise. The British mining campaign, ultimately effective though it was, became so only after several years and remained an improvised affair, with all the consequent drawbacks: 'the policy of converting merchant ships and obsolete men of war into minelayers may have been necessitated by various causes, but it cannot be said to be a satisfactory one'.[1]

The experience of war therefore displayed the complete bankruptcy of Admiralty mining policy. Material had been neglected and its use completely misconceived. After 1914-18 that was at least unlikely to happen again, but there remained the problem as with the anti-submarine question, of establishing a rational organisation to direct the mining effort. Rear-Admiral R.S. Phipps Hornby who was delegated to consider this issue, suggested that a mining department covering both material and its application to war should be established on the War Staff.[2] This proposal was rejected and the eventual organisation divorced material from tactics. Minesweeping and minelaying both became branches of the Operations Division, while material aspects were handled by the Director of Torpedoes and Mining (DTM) who was subordinate to the Fourth Sea

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1. Report of Committee on the Future Organisation of the Mining Service 15 May, 1919; ADM 1/8559. The difficulties with Abdiel in ADM 137/1883.
2. Phipps Hornby report 5 Jan, 1917; ADM 1/8478.

Lord, and who advised the Operations and Anti-Submarine staff on operational aspects of his work.[1] It was an arrangement which was designed to take account of the many specialisations of underwater weapons while maintaining a broad view of the sphere as a whole. At the very least it was very much more effective than the primitive organisation with which the Navy had entered the war.

Just as the war had exposed the inadequacies of the organisational preparations, so it precipitated the crisis in personnel training, which had been looming in the pre-war years.[2] Bogged down in a mass of detailed technical work covering a sphere of activity which was developing and expanding at an extraordinary rate, the torpedo officer could no longer reasonably be expected to cope. For the first time, the needs of the torpedo service were systematically analysed by the Armaments Personnel Committee under the chairmanship of Rear-Admiral R.S. Phipps-Hornby.

Hornby's first conclusion was that the Captain of Vernon could no longer be expected to be a specialist in everything; responsibility would have to be sub-divided. On the other hand he recognised the logic of concentrating both the experimental and instructional sides of underwater weaponry within the dominions of a single school, in order to associate practical experience with research and design work. Separate institutions would lead to duplication of effort, and 'the various forms of warfare for which he [Captain HMS Vernon] is responsible, are so intimately connected

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1. Jellicoe minute 3 Jan, 1917, Tudor minute 8 Jan, 1917; ADM 1/8487.
2. See Chapter 10, particularly p. 292.

with one another that the severance of any one from the main establishment would result in increased cost and inefficiency.'[1] He proposed that all forms of underwater warfare should be under the general coordinating responsibility of a senior officer with sections subdivided under him, each dealing with thesis and antithesis of one form of warfare: 'I propose ... to centralise as far as detail is concerned and to coordinate as regards policy and the more important considerations of training and preparation for war.'[2]

It is unclear from his proposals whether Phipps Hornby had fully grasped the extent of the explosion in underwater warfare. His report constituted precisely the sort of dispassionate analysis which would have prepared the ground for adequate preparation in the pre-war years; it is difficult however to conceive that the immense organisation proposed would have been helpful in the light of the experiences of 1914-18. The various branches of underwater weaponry could by now hardly be said to belong to the same 'school', except by the merest historical coincidence that they had always done so in the past and were all concerned with weapons active under water. Even the latter consideration did not apply to signalling work, which remained related to Vernon because of its association with electricity. Even this, though, was by now such a specialised and complex business that there were good grounds for detaching it from Vernon. Again, it was only by historical accident that it had become a Vernon responsibility in the first place. The various

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1. Phipps Hornby report, 8 Dec, 1916; Phipps Hornby Mss, Phi 205.
2. Phipps Hornby memo 5 Dec, 1916; ADM 1/8487.

branches had now become highly specialised. Mining was in a separate establishment and like signalling required special skills. Anti-submarine warfare demonstrably required its own place. Phipps Hornby's solution, adequate in 1914, was by 1918 out-moded; and his recommendations were not pursued.[1]

His comments on education and training of officers were however apposite. He observed that it would be unwise to specialise officers for the various branches of underwater warfare, for fear of leading them into fields with few prospects of promotion to executive posts; nor would it be possible to educate them fully in the technical aspects of all the branches without falling into the trap of pre-war years, when technical expertise had been the only consideration. In the new circumstances mastery of all aspects was in any event impossible. Hornby therefore proposed a wide-ranging basic training to complement the highly skilled ratings and artificers and to produce naval officers rather than mere artificers.[2] His report sounded the death-knell of the old system. The technical expertise of the Victorian naval officer had served the Navy well,[3] but it was unrealistic to expect the same system to survive into the twentieth century with its increasing and wide-ranging complexities. The system was already under strain by the 1900s[4]. Like the ramshackle organisations which had been superseded by the urgent requirements of the war, it could no longer continue.

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1. See Chapter 10, particularly pp. 290-2 for background.
2. Report of Armaments Personnel Committee on Personnel for Torpedo and Electrical Duties 17 Dec, 1918; ADM 1/8456. Further report 8 Jan, 1919: Phipps Hornby Mss, Phi 205.
3. See p. 293.
4. See Chapter 10, pp. 296-7.

The experience of war was therefore salutary and painful for the Royal Navy, emphasising the inadequacies of its preparations during the years of peace. Most immediately apparent were the material shortcomings. The mine had failed consistently and an adequate model was eventually produced only by copying from the Germans; anti-submarine weapons simply did not exist; minesweeping facilities were sketchy; and the capital ships on which depended the supremacy of the Grand Fleet lacked an effective defence against the mine and torpedo, whether delivered by submarine or torpedo boat. All this exposed the pre-war reluctance of the Service to engage in any serious research of its own and emphasised that while in the nineteenth century it had been possible to rely on the initiative of private industry, supplemented by ad hoc inspirations from Vernon, the complexities of twentieth century warfare required the active cooperation of industry, science and the two services aiming towards a clear and logically determined goal. In fact these three elements seldom even had the opportunity to cooperate since they hardly ever came into contact. It took the pressure of war to persuade the Service that the subject was now too big and too complex for the old methods to work.

Equally damaging however were the strategic and tactical errors which either emanated from or merely aggravated the material failures, and whose origins lay in the lengthy and tortuous history of naval experience and thinking of the previous half-century. Even had a suitable mine been available, for instance, it is doubtful whether it would have been used effectively because of the prejudices which had become entrenched in pre-war thinking; although the scale

of the war could scarcely have been anticipated, the use of mines in defensive blocks, where it proved so effective, was unthinkable to the pre-war mind. Similarly, the British submarine service had been developed into a very effective force which acquitted itself well; anti-submarine methods however were non-existent. As in the 1870s, when the potential of the torpedo vessel was being developed but not yet countered, both the technology and the grasp of the implications were non-existent. The problem had in fact been evaded for half a century and the result was the virtual paralysis of British naval power in the North Sea from 1914-18. Only then did 'bulging' at last begin; but by then it was too late.

These were the consequences for the war in the North Sea - the war most easily predictable and whose nature was the more easily anticipated - of the Navy's failure to come to terms with technical developments whose effect was predictable enough. Less amenable to futurology was the submarine war against commerce. Nothing in pre-war experience could reasonably have predicted the scale of this campaign; but the failure of material counter-measures and the inflexibility of mind which precluded the application of effective strategy and tactics are directly attributable to pre-war experience. The late development of the depth charge and detection methods, and the difficulties with an effective mine stemmed from the neglect of unfashionable Vernon; and the obsession with hunting, the continued rejection of convoy and the neglect of mining stemmed from decades of preoccupation with the 'offensive' spirit. Only an unfair application of hindsight would condemn the Navy for its failure to anticipate the scale and nature of the submarine war;

materially and psychologically however, the base from which it began its war against the U-boat was hopelessly inadequate.

The experience of half a century therefore provides an instructive blaze of contrasts: extensive and praiseworthy individual achievements together with material and institutional failures and an unsatisfactory ultimate result. There was a complete failure of higher direction in appreciating and facing the issue; the problems of organisation and education were never confronted; and good work conducted as it was in a vacuum was substantially wasted. St. Vincent's dilemma was never answered and the problem was as acute in 1914 as in the 1870s.

The problem is however easier of diagnosis than of solution, even in retrospect. If the problem was institutional, then it is arguable that a Naval Staff, with the function of thinking through the problems was essential; and that had such a body existed then Admiralty thinking would have been clearer. Indeed, since the main problem was lack of thought by men overburdened with administration, then the creation of a naval staff was essential. There is however no reason to believe that this would necessarily have solved all problems. This is partly because the technology was uncertain and complex and was bound to remain a matter for conjecture - even if that conjecture were at least informed. More importantly however any staff organisation is only as good as the people who man it, and is vulnerable to all the prejudices of those men and of its age. There is no reason to believe that a naval staff would necessarily have produced any better ideas, or had they done

so that they would have been put into practice. Ballard's mining plans were, after all, shelved. And much earlier Bridge, as head of the nearest thing that the Navy had to a staff, was instrumental in quoshing a constructive debate on the torpedo-boat. Indeed, it is just as likely that a staff would have institutionalised and reinforced the errors and prejudices which led to the failures of 1914-18.

The solution undoubtedly lay in the application of sound clear minds within the right institutional framework; even then the practical consequences, not least financial, would have had to be faced. The difficulties thrown up by the development of weapons of underwater warfare were not capable of easy solution. But it is hoped that this study will have illuminated the genuine difficulties and indicated where things might have been done better; and thereby provided some explanation for the inadequacies of the Royal Navy's response to them.

ABBREVIATIONS

(a) Used in Notes

ADM - Admiralty papers in the Public Records Office

Brassey - Brassey's Naval Annual

CAB - Cabinet papers in the Public Records Office

FIC - Foreign Intelligence Committee

INA - Transactions of the Institute of Naval Architects

IND - Digest of weeded Admiralty papers - Public Records Office

Mss - Private papers

Naval Library - The Naval Library, Ministry of Defence

NID - Naval Intelligence Department

RUSI - Journal of the Royal United Services Institution

USM - United Services Magazine

Vernon - Annual Report of HMS Vernon

WO - War Office papers in the Public Records Office

(b) Used in Text

(A)DNC - (Assistant).Director of Naval Construction

(A)DNI - (Assistant) Director of Naval Intelligence

(A)DNO - (Assistant) Director of Naval Ordnance

ADT - Assistant Director of Torpedoes

A/S - Anti-Submarine

BIR - Board of Inventions and Research

C-in-C - Commander in Chief

CID - Committee of Imperial Defence

DASD - Director Anti-Submarine Division

DMO - Director of Military Operations (War Office)

DNM - Director of Naval Mobilisation

DOD - Director of Operations Division

DTM - Director of Torpedoes and Mining

EM - Electro-Mechanic (mine)

EC - Electro-Chemical (mine)

ICMS - Inspecting Captain of Minesweeping

ICS - Inspecting Captain of Submarines

MG - Machine Gun

QF - Quick Firing Gun

RE - Royal Engineers

RGF - Royal Gun Factory

RL - Royal Laboratory

RNR - Royal Naval Reserve

SGT - Seaman Gunner Torpedo (rating)

TB - Torpedo Boat

TBD - Torpedo Boat Destroyer

TDC - Torpedo Design Committee (several)

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A. Unpublished Official Papers

Admiralty Papers at the Public Records Office. Two main series of papers contained considerable information which formed the basis of much of the Study: ADMI contained registered files of the Admiralty Secretary's Department and ADM 116 contained similar registered files of bulky size on particular subjects. ADM 137 (1914-18 War Histories) was of use in the final chapter. Both main series have been weeded but it was possible to glean some information from the digest of files which had been destroyed; this digest is covered by the reference IND.

Two other ADM series were helpful. ADM 138, located in the National Maritime Museum, contained details of the design and construction of individual ships and was invaluable in writing Chapter 6. ADM 189, which was consulted in the Naval Library, Ministry of Defence, comprised the annual reports of HMS Vernon and was useful throughout.

The Naval Library also contained the papers of the Foreign Intelligence Committee (FIC) and the Naval Intelligence Department (NID), which were fundamental sources for Chapters 4 and 5.

Occasional papers of the War Office (WO) and of the Committee of Imperial Defence (CAB) were useful.

In addition to these papers, the Naval Library contained a variety of unpublished papers, many of which are of internal Admiralty origin and would have justified PRO preservation. All provided helpful material. The most useful was Julian Corbett and Admiral Sir Edmond Slade's Maritime Operations in the Russo-Japanese War 1904-5.

B. Unpublished Private Papers

Particularly valuable were the Bridge and Thursfield papers, which revealed much of the background to the official sources for the naval manoeuvres of the 1890s; the Sir Geoffrey Phipps Hornby papers, for extensive correspondence with a variety of naval officers in the 1880s; the Noel and May papers which contained similar material for the 1890s and 1900s; the Richmond papers for a wealth of critical comment from the 1890s, onwards; the Drax papers for commentary on Fleet tactics in the pre-war years; the de Robeck papers for destroyer tactics and thinking in the 1910s; and the Keyes papers for the pre-war submarine service.

Barlow Mss: Vice Admiral Sir Charles Barlow: National Maritime Museum

Baynes Mss: Rear Admiral H.C.A. Baynes: National Maritime Museum

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Drax Mss: Admiral Sir Reginald Plunkett-Ernle-Erle-Drax: National Maritime Museum

Frazer Mss: Captain G.C. Frazer: National Maritime Museum

Hamilton Mss: Vice Admiral Sir Frederick Hamilton: National Maritime Museum

Vesey Hamilton Mss: Admiral Sir Richard Vesey Hamilton: National Maritime Museum

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Jellicoe Mss: Admiral Lord Jellicoe: British Museum

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Thursfield Mss: Rear Admiral H.G. Thursfield: National Maritime Museum

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C. Contemporary Published Sources

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In addition there were a variety of articles in the following publications:

The United Services Magazine (USM)

The Transactions of the Institute of Naval Architects (INA)

The Journal of the Royal United Services Institution (RUSI)

The Naval Review

Brassey's Naval Annual.

The quality and usefulness of these varied widely, but the RUSI contained for instance a very informed and representative debate on the torpedo boat menace in the 1880s.

D. Secondary Published Sources

Seminal to any study of the Royal Navy in this period is Arthur Marder's outstanding work. Ruddock Mckay's book is an excellent biography of the ubiquitous Fisher, and Peter Padfield's Aim Straight gives a very readable if somewhat partisan account of Sir Percy Scott's gunnery revolution. Paul Kennedy provides the wide historical background for the period. Also included in this section are two University of London War Studies PhD theses: David Henry's includes a thorough chapter on the pre-war years of the R.N. submarine service, and Philip Towle's includes an excellent exposition of the Admiralty's reaction to the mine warfare of the Russo-Japanese War. Other books in the list are confined to those actually cited or which proved particularly useful; it does not constitute a complete list of all works consulted.

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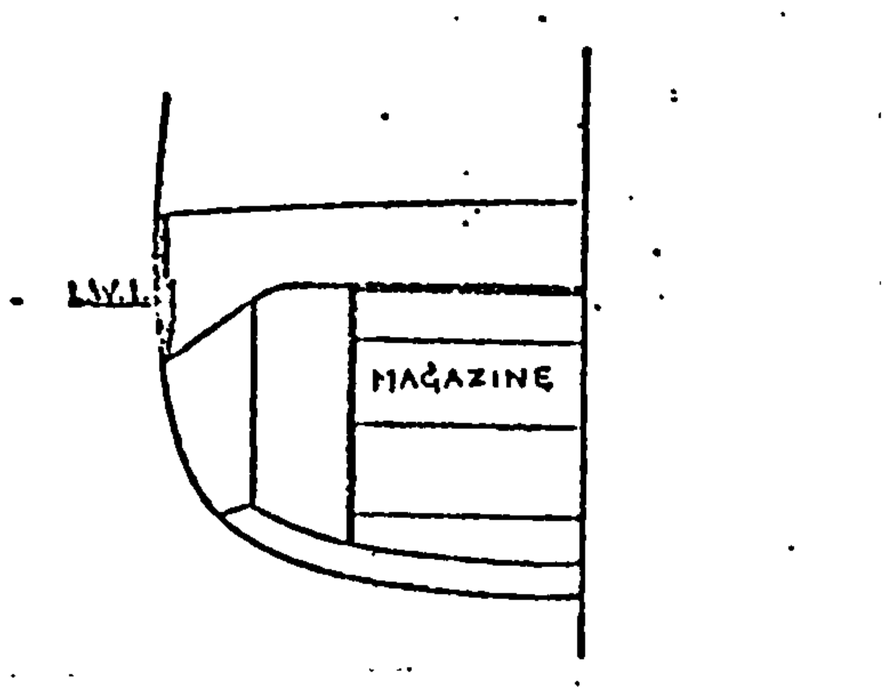
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APPENDIX ONE

Underwater design of Tsarevitch (Source: Kemp, Fisher Papers, I, 252).

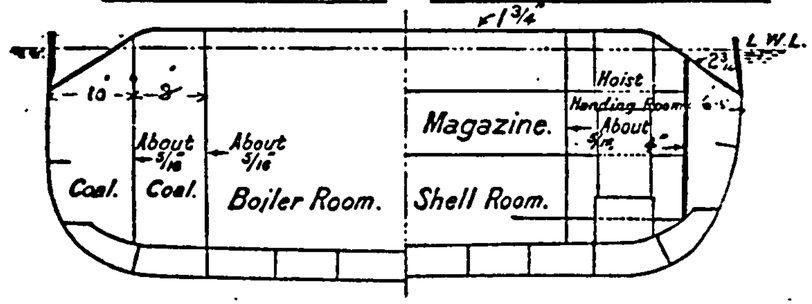


Underwater designs of Dreadnought battleships (Source ADM 116/1428)

UNDERWATER PROTECTION.
BATTLESHIPS.

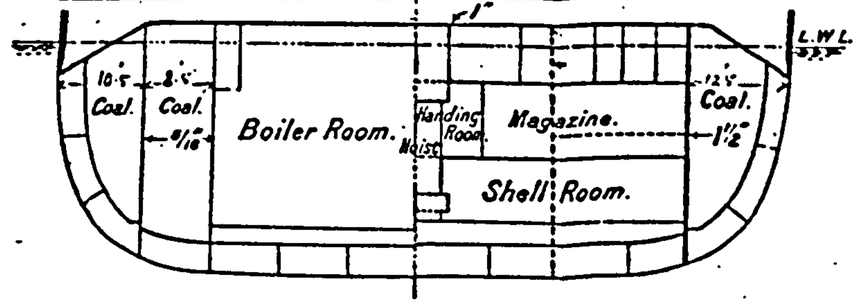
"DREADNOUGHT."

SECTION THRO' FUNNEL. SECTION THRO' "Q" BARBETTE.



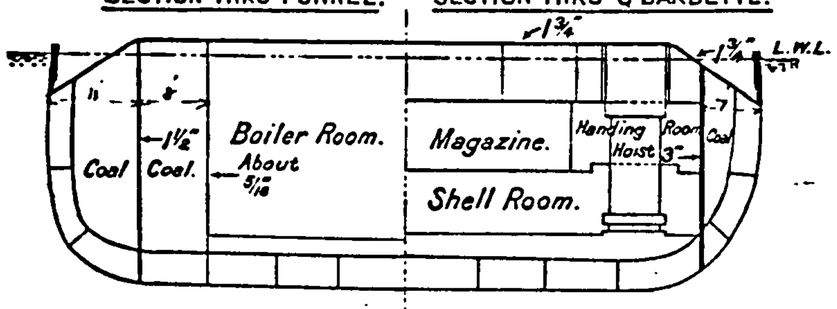
"KING GEORGE V."

SECTION THRO' FOR^D FUNNEL. SECTION THRO' "Q" BARBETTE.



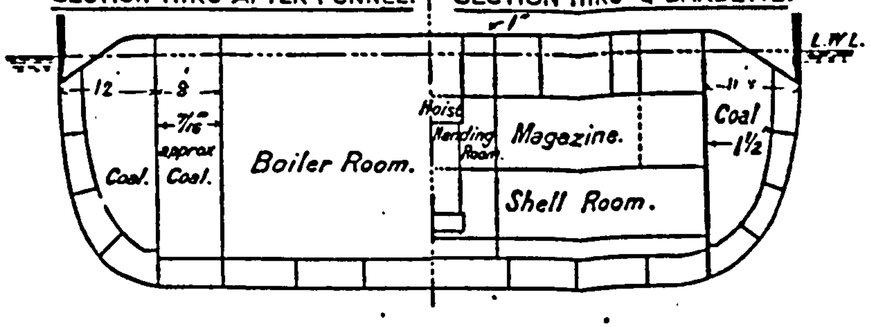
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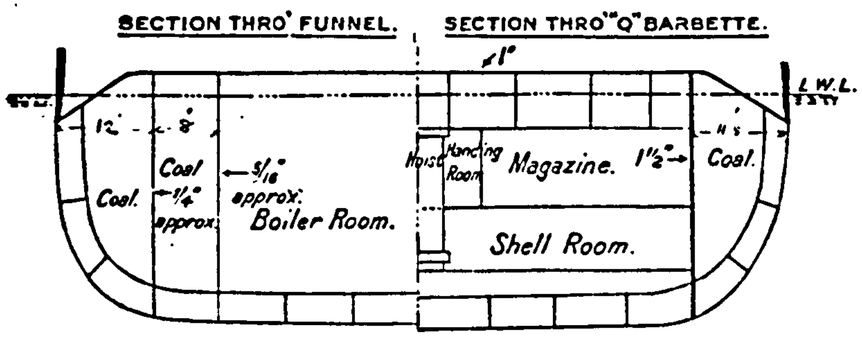
"IRON DUKE."

SECTION THRO' AFTER FUNNEL. SECTION THRO' "Q" BARBETTE.



"ORION" CLASS.

SECTION THRO' FUNNEL. SECTION THRO' "Q" BARBETTE.



"QUEEN ELIZABETH."

SECTION THRO' FUNNEL. SECTION THRO' "X" BARBETTE.

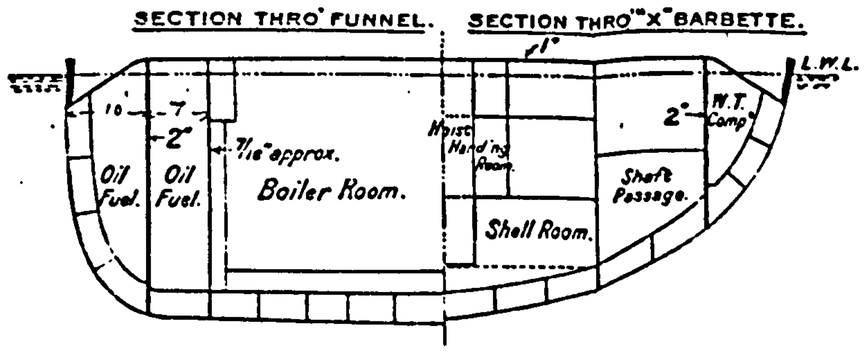


Plate I.

Malby & Sons, Lith.