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The Fortification of the Firth of Forth 1880–1977

'The most powerful naval fortress in the British Empire'

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PART II

THE DEVELOPMENT OF THE FORTRESS, 1854–1977

'The United Kingdom must always be liable to raids when at war with a European maritime Power whose sea power has not been practically destroyed.'[1]

Chapter 3

FRANCE AND RUSSIA

3.1 'The most extensive injury to shipping', 1854–80[2]

Following the dismantling of the batteries at North Queensferry, Inchcolm, Inchgarvie, Blackness Castle and Dunbar after the Napoleonic Wars, the Government experienced considerable pressure from concerned local municipal and commercial interests about the defenceless state of the Firth of Forth. The Government remained indifferent to these concerns until the outbreak of the Crimean War in October 1853, which prompted some reconsideration of the situation.[3]

Leith Fort and the Martello Tower still survived from the Napoleonic period, but the former was now too far from the sea (the docks had been extended seaward in front of it, while the tower had been unarmed for most of its existence).

In 1854, General Burgoyne, Inspector General of Fortifications, prepared a *Report on the Defences of the Principal Commercial Ports of Great Britain*, the object of which was to address concerns that one or two warships might commit 'the most extensive injury to shipping and stores, and then [retire] with impunity …'. He wrote of the Forth:

> At Leith there are at present twelve heavy guns, mounted for the protection of the harbour and roadstead at Leith Fort and on a tower; it would be, however, very desirable to establish two batteries and a small barrack on the Island of Inch Keith.[4]

As a consequence, the Board of Ordnance approached the Duke of Buccleuch in February 1855 requesting permission to place two batteries and a guardhouse on Inchkeith. Nothing further was done.[5]

In November 1856, Captain Westmacott, RE, wrote a *General Report upon the Defence of the Commercial Harbours in the United Kingdom*, noting, 'In North Britain, the valuable anchorage of the Frith [*sic*] of Forth, and the trade of the Clyde demand protection …'. In describing the Forth he noted:

> [Existing] provisions … leave the Upper Forth, and the important anchorage under Inch Keith, without protection. It is proposed to provide two batteries for six guns each on the Inch Keith, for guns of heavy calibre, to act in connection with a third battery for six guns on Kinghorn-ness opposite, to be associated with floating defences.[6]

In 1856, Lord Palmerston's Government, in the person of Lord Herbert of Lea, Secretary of State for War, finally pledged itself to constructing defences in the Firth of Forth. In 1860, it bought an area of 1.23ha on Inchkeith for four batteries and a group of barrack huts (Fig 11.2).[7] The Forth was not, however, included in the recommendations of the Royal Commission on the Defences of the United Kingdom of 1860, which concentrated its attention on the southern ports more vulnerable to French attack.[8]

In April 1879, the Duke of Buccleuch sold the War Department three further parcels of land on Inchkeith incorporating those already purchased, totalling a little over four hectares. It was also proposed that enough ground might be bought for the government to establish colliery workings on the island to exploit undersea coal deposits. This odd idea never came up again.[9]

Concerned voices were raised about the Government's inaction during subsequent years.[10] In March 1871, the Lord Provost of Edinburgh requested Captain A Moncrieff, City of Edinburgh Artillery Militia and inventor of the Moncrieff 'disappearing' gun carriage, to consider how he might apply his system of fortification to the defence of the estuary.[11] Moncrieff reported that the estuary was without any defence and that its remoteness from reinforcement made it vulnerable to attack and indeed to its being used as a forward base by an enemy. Moncrieff's prescient defence proposals foreshadowed much that would be developed in the estuary in subsequent decades. He also felt it advisable that the Government should purchase the whole island of Inchkeith.[12]

After an inspection on 18 March 1871, Moncrieff identified three positions on which his disappearing gun mountings could be built. He believed that these batteries, in conjunction with mines in both channels and a battery of five guns at Kinghorn Ness, would form a line of defence that could only be forced with difficulty. He proposed a second line of defence, consisting principally of mines covered by a small battery, sited at Inchcolm or further upriver.[13]

Moncrieff's report was the subject of a motion in the House of Commons, on 21 April 1871, by Mr Robert McFie, MP for

Leith Burghs: 'in the opinion of this House, Her Majesty's Government should take into their immediate consideration the present defenceless state of the Firth of Forth, with a view to erecting such defences as appear necessary'. Sir Henry Storks, MP, for the Government, informed the House that the Firth of Forth had been seriously considered along with other parts of the coasts of the Kingdom but, in the light of the vast sums of money already voted that year for military purposes, it was impossible for the Government at that time to spend money for the defence of commercial harbours. Another Scottish member noted that, 'The success which had attended the attempts of Paul Jones [the American naval officer who had terrorised the Forth in 1779 in former times without the advantage of steam should not be forgotten'.[14]

During the Russo-Turkish War of 1877–8, France's alliance with Russia raised concerns about a concerted attack on Britain from the north-east. The Inspector General of Fortifications, General Nugent, on 23 April 1877, summed up the Forth's importance: not only was it the ninth most important commercial port in the UK, but was an important harbour of refuge, gave immediate access to Edinburgh, and its location left it open to an unopposed assault from the Baltic or the Elbe.[15] This, following 25 years of local agitation, finally persuaded the Government to proceed with their plans for fortifying Inchkeith and Kinghorn Ness.[16] Colonel John Yerbury Moggridge, Commander Royal Engineers in Scotland, was instructed to prepare plans for the coast artillery works on Inchkeith and at Kinghorn, based on the original sketches and suggestions made in 1861, and construction began in 1878.

3.2 Technological advances, 1859–80

The second half of the 19th century, and especially its last quarter, saw the maturing of the technology of modern coast defence, much of which would serve until the disbanding of the Coast Artillery 1956. The introduction of iron-clad ships in the French Navy in 1859 prompted radical rethinking of the armament and design of coast defence works[17] – guns of much greater range, accuracy and penetrating power were needed. The major bases in the south had a legacy of older casemated fortresses – muzzle-loading guns pointing through holes in walls – in which it became increasingly difficult to house the new guns.

Rifled Muzzle Loading (RML) guns were introduced in 1866, and existing smooth-bored cannon, now made obsolete, were converted to RMLs by the insertion of a sleeved liner. New pointed ammunition was developed, in due course with hardened tips to increase penetration.[18] The ever-higher velocity shells needed to penetrate growing thicknesses of ship armour became increasingly difficult to manage within the design constraints of muzzle-loading guns and by 1878 work began at Woolwich on the design of a breech-loading gun. The Armstrong armaments company also submitted designs for 8-inch and 6-inch breech-loaders. The latter design caused great interest and the Royal Gun Factory at Woolwich to begin work on its own 6-inch design.[19]

Powerful lights, to illuminate fast-moving torpedo boats and submarine minefields so as to assist lighter QF guns, were developed through an extensive series of tests in ports across the Empire in the years around 1890.[20]

3.3 The Forth, 1880–1903

Between 1878 and 1881, batteries mounting six 10-inch Rifled Muzzle Loading (RML) guns were built at Inchkeith and Kinghorn, to be manned largely by volunteer artillerymen. These forts are described in Chapter 11.

During the 1880s three significant sets of proposals were prepared for the further defence of Kinghorn, Inchkeith and Edinburgh, approved by the necessary bodies and even by the Secretary of State for War, but which were then not proceeded with.[21] They included arming the Leith Martello Tower with a 6-inch Rifled Breech Loading (RBL) gun, placing three 10.4-inch RBL guns on Inchmickery; and building two batteries, both armed with a 9.2-inch and two 6-inch BL guns, at Portobello and Granton (the east and west edges of Edinburgh). Proposals were also made that the inner waters of the Forth should be protected using submarine mines protected by gun batteries. An armament of 10-inch RML and 6-inch BL guns was approved in 1884, but not installed.[22]

In 1887, the Royal Artillery and Royal Engineers Works Committee reviewed the defences of the Forth twice, in February and, after they had actually visited the Forth, in December. In their later report, they recommended that a 9.2-inch BL gun should be added to Kinghorn's armament (this was agreed in 1888 but it was finally mounted only in October 1904), that two heavy QF guns were needed to cover the submarine minefield between Kinghorn and Inchkeith – two 4.7-inch guns were ready for action in 1893, and that light QF guns were necessary to protect the minefield at the Bridge.[23] This was in part because, in the 1870s and 1880s a new threat had been identified – fast craft launching self-propelled torpedoes that, operating in swarms, could overwhelm the defences of a capital ship at sea or in port. At sea the response to 'Torpedo-craft' were 'Torpedo Boat Destroyers', the first of which in the Royal Navy were HMS *Daring* and HMS *Decoy*, ordered in 1892. Torpedo boats were too fast and agile to be hit by slow, cumbrous large guns, and therefore smaller 3-pdr Hotchkiss and 6-pdr Nordenfeldt quick-firing guns were installed on ships and at ports.[24]

Submarine mining in the Forth, 1887–1905

It had been recommended in 1882, by the Morley Committee, that the Forth should be defended by controlled mines, as part of the Empire-wide adoption of submarine mining.[25]

Figure 3.1
Photograph of a test-firing of a line of 16 controlled mines off the Isle of Jura in 1931. The mines were at a depth of about 30ft (Admiralty 1938 *Handbook of Controlled Mining*)

In October 1887 the Forth Volunteer Division (Submarine Miners) Royal Engineers was raised, to be based at Leith, in the old mine depot ship *Dido*, moored in Albert Dock.[26] Submarine mines were laid to block or to narrow channels into anchorages. It was claimed to be both cheap and effective.[27] There were three phases of submarine mining in the Forth: 1887 to 1905; 1915 to 1919; and 1938 to 1945.

In the first phase of mining, from 1887 to 1905, submarine mines were not laid permanently; the volunteer miners only trained to lay their mines, which would be ordered into position when there was believed to be a risk of attack. A shore-based controller could set off a group of the Controlled Mines if an enemy vessel entered the minefield. The Controlled Mines contained 500lbs (*c* 227kg) of gun cotton and had a destructive radius of 30ft (just over 9m). Six mines at 120ft (*about* 36.5m) spacing (to avoid sympathetic detonation) would close a channel 720ft (*about* 220m) across.[28] Fig 3.1 shows the effect of a line of 16 mines being blown in 1931;[29] until 1928 mines had been blown in sets of eight.

In the First and Second World Wars the mines were laid for long periods, being recovered only for maintenance. 'Controlled Mines' were also known as 'Observation Mines', the explosion of which was controlled from a shore station.[30] The first submarine mining station in the Forth was on Inchkeith. On 21 July 1888, about 100 volunteers out of an establishment of 154 went under canvas on Inchkeith for their first annual training camp, which lasted two weeks.[31] The mine testing station on Inchkeith was completed in 1890 in an artificial cave formed well above sea-level, the open end being closed up by a granite wall (Fig 3.2).

In 1887 The Royal Artillery and Royal Engineers Works Committee considered the risk of submarine mines being cleared, under cover of smoke, by enemy launches sufficiently armoured to resist machine-gun fire. They recommended that batteries of Quick Firing guns be established specifically to protect minefields, and that field gun batteries be provided until permanent works could be built: in the Forth, these were to comprise four 6-pdr and one 3-pdr QF guns near the Bridge, and seven 3-pdr QF guns split between Kinghorn and Inchkeith.[32] What was actually installed, both temporary and permanent guns, is shown in Table 1.

Towards the end of 1897 a minefield for instructional purposes was established 1.2km east of the Forth Bridge. The War Office also proposed to establish a submarine mining base at Carlingnose and in the following year they acquired the land. A dedicated mining pier was built in 1903 (Fig 3.3).[33] The mining buildings were erected in the northern part of the

Figure 3.2
The Submarine Mining Testing Station on Inchkeith. The artificial cave was, by 1911, used as a small arms ammunition store. The photograph was taken in the 1980s, before the front was obscured by vegetation (© Ron Morris)

Figure 3.3
The surviving head of the mining pier at Port Laing, Carlingnose, in 2016. The upturned terminals of the tram tracks are visible (© Gordon Barclay)

Table 1

The approved armament of the Forth in 1894, as recorded by the Joint Naval and Military Committee in their report, showing the significant changes recommended by the Committee. (CAB 18/22A 1891–1903) The three 10-inch RML guns listed for North Queensferry may have been carried over in error from an earlier document – this had, indeed, been 'approved' in 1884, but had apparently dropped off the list by 1888. The 'approved armament' in 1888 also included a recommended armament of two 12-pdrs at Inchgarvie, which the 1894 Committee's table omitted for some reason.

Outer Defences	**'Approved' before the Joint Committee, 1894**	**Notes**	**1894 Joint Committee Recommendation**
Site near Portobello	1 x 9.2-inch BL 2 x 6-inch BL	First proposed by the Joint RA/RE Works Committee 1887	No longer considered necessary
Leith Docks			2 x 6-inch
Leith Martello Tower	1 x 6-inch BL	Proposed 1882	2 x 6-inch guns should be mounted at Leith Docks instead
Site near Granton	1 x 9.2-inch BL 2 x 6-inch BL	Joint RA/RE Works Committee 1887; originally suggested for Inchmickery 1882	1 x 9.2-inch BL 2 x 6-inch BL
Inchkeith	1 x 9.2-inch BL 2 x 6-inch BL 2 x 10-inch RML 2 x 4.7-inch QF		Two further 6-inch guns should be mounted instead of the 2 x 10-inch RMLs
Kinghorn	1 x 9.2-inch BL 4 x 10-inch RML 2 x 4.7-inch QF		No longer intended to mount the 9.2-inch gun
South Queensferry	2 x 3-pdr QF	On field mountings	2 x 12-pdr QF
North Queensferry	*3 x 10-inch RML* 2 x 6-pdr QF	10-inch guns carried over in error; see caption	2 x 6-inch guns at Carlingnose; 2 x 12-pdr QF at Coastguard
Inchgarvie	*(2 x 12-pdrs)*	Not included by Committee, see caption	3 x 12-pdr QF

ground already bought for the Carlingnose battery, linked to the pier by a tramway.[34] The Observation Post for controlling the minefield approaches still survives on the high ground near the battery. Submarine mining was a victim, in 1905, of the hubris of the 'Blue Water' school of defence, which asserted that strong fixed defences were unnecessary because of the predominance of the Navy. The Royal Navy also believed that the mines posed a threat to its own vessels. Submarine mining was halted immediately, although the volunteer Forth Submarine Miners continued in existence until they were converted into the Forth Division (Electrical Engineers) (Volunteers) in 1907, to operate the Defence Electric Lights of the fortress.[35]

On an armament chart for the Forth dated June 1903, two areas just below the Forth Bridge were marked as 'EC Mines' and 'Controlled Mines', respectively (Fig 3.4). The red hatched area of the EC Mines covered an area 1,725m by 340m extending across the whole width of the river, between 350m and 760m below the bridge; the controlled mines occupied an area 840m by 285m in the northern channel, to within 220m of the Forth Bridge.[36] Electro-contact (EC) mines were set off by contact from a vessel, but groups of the mines could be turned 'on' and 'off' from the shore station, and when off, they were inert.

The Stanhope Committee – 1887

By 1887 the state of Britain's coast defences was parlous, showing the results of years of lack of investment, and the Secretary of State for War, the Rt Hon Edward Stanhope, convened a committee 'to consider Plans for the Fortification and Armament of our Military and Mercantile Ports'.[37] The total cost of the works they recommended was £4.9M (around £7bn in modern values), plus submarine mining costs of £238,468.

The witnesses to the 1887 committee were unanimous in agreeing that the defences needed strengthening, although the Committee had to weed out a number of improbable contingencies that some witnesses had insisted as needing addressing.

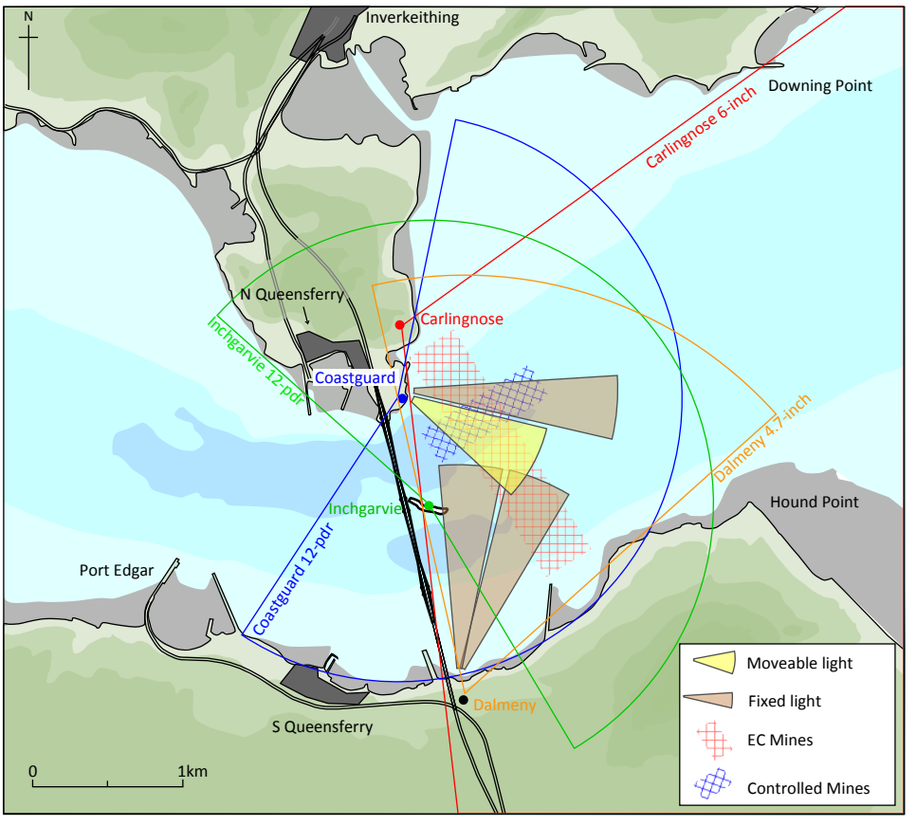

Figure 3.4
The location of the controlled (blue hatch) and EC (red hatch) minefields, as well as the arcs of fire of the guns and areas of illumination of the lights of the inner defences, in 1903. To make the figure comprehensible, the arcs of each pair of guns have been combined to show the total area of water commanded by each battery. Controlled mines could be set off by an observer on shore; 'EC' mines could be set to explode when struck by a vessel, or could be set to 'safe' (the chart is redrawn from an original on file WO 78/5179)

When the Committee turned to the mercantile ports, it noted that, apart from the submarine mining works, nothing had been done to implement the recommendations of the Morley Report of 1882. A sum of £6,937 had been spent on submarine mining in the Forth by this date, with a further £19,163 needed to complete the arrangements. The proposed expenditure on the Forth had not, however, been included in the annual estimates for 1887–8.

The papers of the Committee included a strongly worded report by Sir Lothian Nicholson, Inspector General of Fortifications, about the need to replace muzzle-loading with breech-loading guns, which had:

> caused a complete revolution in artillery … making it possible for ships … armed with these guns to bombard … our coast defences without coming within range of the short RML guns with which the works are armed … The introduction of new type BL guns of long range and high penetrative power into the armament of our coast defences, is therefore obviously of the highest importance and most pressing necessity …[38]

Although some replacements were made, it was not until a decade later, in 1899, that a coherent programme for the prioritised replacement of RML guns was set out (see below).

The Stanhope Committee recommended that the armament of the Forth should have added to it one 9.2-inch BL, two 6-inch BL and two 4.7-inch QF guns, and should lose four 10-inch RMLs. These changes would achieve a reduction in personnel of 15 from the previous armament, and would cost £30,000, plus the cost of works (£12,000).[39]

Further technological advances

As mentioned already, in the 1880s there began a brief fad for guns on disappearing mountings, where the force of a gun's recoil pushed it down into a pit where it could be reloaded under cover, before it was lifted by counterweights or, later, by a hydro-pneumatic ram, back into its firing position. While tests in 1885 showed that HMS *Hercules* did not score a single hit on a disappearing gun, it was not remarked at the time that

the ship did not hit the non-moving parts of the emplacement either; the chances of a ship's gun hitting something as small as a coast gun are very slight. The Hydro-pneumatic ('HP') mount designed by the Elswick Ordnance Company, was, however, adopted for both 9.2-inch and 6-inch guns in 1886. Not many were installed in the UK, but three were used on Inchkeith: for two 6-inch breech-loading guns in the forts on the East and West Stells, and the 9.2-inch installed near the southern end of the island. The complexity of the mechanism, the slow rate of fire, and the restrictions on the firing elevation of guns led to the design falling out favour.[40]

Sir George Clarke, Superintendent of the Royal Carriage Department at Woolwich, oversaw in 1894 the development of a totally new style of coast artillery mounting – where the gun pivoted on a central pedestal and recoiled along its axis against hydro-pneumatic dampers. This is the origin of the Central Pedestal mounting that served until 1956.[41]

To match the new longer-range breech-loading guns, better range-finding equipment was required. Triangulation of distance by two observers on a long horizontal baseline was tried with limited success, but Captain H S S Watkin, RA, realised in 1873 that, if the observing station was raised above sea level, it formed an upright triangle with the observer at one vertex, the second vertex at sea level directly below, subtending a right angle to the third vertex – the target. Measuring the angle of depression from the observer would give the range, if the curvature of earth and the rise and fall of tides were corrected for. The 'Watkins Depression Rangefinder', patented in 1876, became standard equipment in every defended port. At first mounted on a moveable tripod, permanent pillars in standardised sunken emplacements were introduced in 1887;[42] later examples are illustrated in Figs 11.31, 11.34 and 11.35.

Watkins proposed a development of his range-finder which not only calculated the distance to the target, but also took account of its movement and the time taken for the shell to travel. The new instrument was trialled between 1879 and 1887. The 'Depression Position Finder' was to be installed in a well-concealed and protected 'Cell' (the Position Finding Cell, or PFC) sited some distance from the gun (to prevent its view being obscured by gun-smoke) and manned by skilled observers: one kept a sighting telescope trained on the target as it steamed along while the other observer read the plot, which gave the target's position at a selected time corresponding to how long the shell would take in flight.[43] The system, albeit improved, remained in service for the rest of the time that coast artillery was in use. The standard design of a PFC was a small building, partly sunken, with a low wide opening which had to give a clear view of the whole arc of fire of the gun or gun-group it served. Cells had sloping turf-covered roofs, to provide both protection and camouflage (Fig 11.29). The guns were fired by closing a switch in the PFC once the gun was loaded and ready to fire. Position Finding equipment was also mounted in Fire Command Posts to allow the Fire Commander

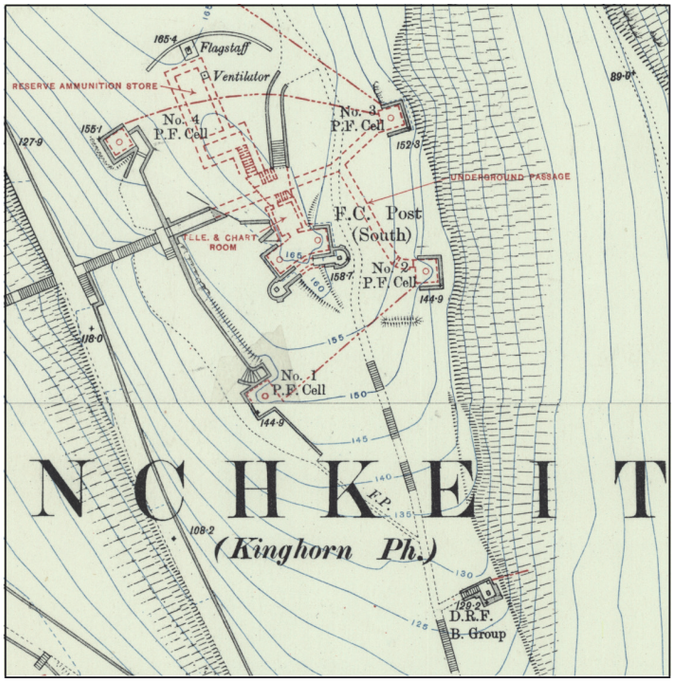

Figure 3.5

The Position Finding Cell complex in the southern part of Inchkeith, as mapped in 1911. The four PFCs are linked by covered passages to Fire Command South. The two northern cells served the middle 9.2-inch gun (firing either east or west), the two northern cells, the southernmost 9.2-inch gun, Group B. To the south is that Group's Depression Range Finder position ('D.R.F. B. Group'). Before the construction of the overhead protection in the Second World War, the two southern 9.2-inch guns could fire over a wide arc from north-east round by south to the north-west, restricted only by the higher ground (Reproduced by permission of the National Library of Scotland)

to determine which battery was best positioned to tackle a particular target. In the Position Finding instruments in the Fire Command Posts, there were often three concrete columns to support an integral chart table, on which was mounted a gridded chart of the water covered by the guns.[44]

The best-preserved PFC complex in the Forth is that on Inchkeith (Fig 3.5), where Fire Command South (between the two southern 9.2-inch guns) was linked by covered passages to four PFCs, which were arranged to cover a large area of water, from the north-east round by the south to the north-west, serving the southern and middle 9.2-inch guns. One pair of PFCs faced east, the other to the west, as the guns had a very large arc of fire (see also Fig 11.28; Fig 11.29). The PFC positions at Kinghorn and on Inchkeith are unique in Scotland (where 9.2-inch guns were a rarity).

At the same time, the 'auto-sight' was developed on the same principles, mainly for the QF guns: the Gun Layer pointed the sighting telescope at the bow wave of the target ship and the gun was given the correct elevation to hit it. Once again, this sort of sight remained in service until 1956.[45]

The 1890s

There was a flurry of meetings in Edinburgh in June and July 1888 to discuss the defence of the Forth in the context of wider national defence issues, with senior representatives of the Admiralty and War Office (Admiral Sir R Vessey Hamilton[46] and General Sir Lothian Nicholson[47]) and the commanding officers of the local Volunteer regiments and artillery batteries.[48]

At this stage, defence proposals included fitting out and manning patrol vessels and the provision of a brigade of Royal Naval Artillery Volunteers to man them. The War Office had already suggested there should be batteries of QF and machine guns to protect the submarine mines and the Admiral felt the War Office should also provide long-range guns in batteries at Leith and on each side of the Forth, on Inchkeith and at Kinghorn and Queensferry.[49]

The press announced, at the beginning of 1889, that the Firth of Forth would be equipped with new guns. Inchkeith was to have one 9.2-inch and two 6-inch breech-loading guns, the two 10-inch RMLs already on-site, two QF guns (of unspecified calibre), and one machine gun. North Queensferry was to receive three 10-inch RMLs, four QFs and two machine guns, while Leith Fort was to be armed with one 6-inch BL gun and 32-pdr smooth-bore guns. In the end, nothing was provided for North Queensferry for over a decade, but the Inchkeith guns were put in place in 1891 (6-inch guns), 1892 (9.2-inch gun) and 1893–5 (4.7-inch QF guns). A 6-inch gun for Leith Fort continued to appear as 'approved' but not mounted, until 1899, when it was dropped.[50]

The Admiralty and War Office were at this time agreed that floating defences in addition to the land batteries and the new third arm of defence, the corps of Submarine Miners, were the only means by which the Firth of Forth could be adequately defended.[51]

The development of the Forth as a naval base and a defended fortress must be seen against wider developments in military and naval organisation and the larger drivers in foreign and domestic politics. The Navy and the Army were in competition for resources. On the one hand, the supporters of a strong navy, the 'Blue Water' school, argued that Britain needed only a strong fleet for the security of the home country, the colonies and the dominions. In the view of the 'Blue Water' school, only a small army was needed, sufficient for colonial policing, its funding always to come second to the needs of the Navy. On the other hand, the 'Large Army' or 'Bolt from the Blue' school claimed, from about 1890 onwards, that Britain was vulnerable to invasion without warning from continental Europe, and that the fleet could not guarantee to prevent a landing. In the first decade of the 20th century, these two schools also reflected the two competing philosophies of British foreign policy: on the one hand, the traditional British 'splendid isolation'; that is, independence from continental alliances and entanglements, foreign policy being designed to prevent any one power dominating Europe and thus posing a risk to British interests; on the other hand, from 1904, the increasing closeness to France and later also to Russia in the face of a growing threat from Germany, and the consequent need to be able to send an expeditionary force to France's aid.[52]

Between 1890 and 1911, the two schools' changing fortunes had significant impacts on the defence of the Forth. The enemy against whom war planning (such as it was) was directed, also changed in this period. From the 1850s, war was considered possible with France, meaning any significant threat was likely to be directed towards the south and south-east coasts of England or southern Ireland. Between 1892 and 1894, France and Russia negotiated an alliance in response to the 1882 Triple Alliance of Germany, Austria and Italy. Britain became increasingly concerned that France and Russia might act in concert against her east coast. As a militant Germany became more of a threat to European stability, France and Britain became formally allied in April 1904 (the *Entente Cordiale*). In 1907, when the Anglo-Russian Convention ended the struggle between the two countries in the Middle East, the Triple *Entente* was established between France, Russia and Britain. Discussions between the French and British General Staffs began in 1905, directed towards co-operation in the event of a war with Germany.

The Joint Naval and Military Committee on Defence reported in 1891 on 'the Defence of Certain Harbours and Positions' at the request of the Secretary of State for War, who had sought advice on 'what sort of defence is it considered will make our defended ports safe against torpedo boats …?'. A notable feature of the Committee's paper was the greater stress than hitherto on the importance of defending Britain's trade and the commercial ports, and Britain's dependence on imported food:[53]

> The Committee are much impressed with the importance of providing for the safety of trade and commerce during a period of war – indeed, the necessity for protecting our exports and imports is of vital consequence to the nation.

Proposed changes in the armament rumoured in 1891, as usual, came to nothing: the arming of the Martello Tower (disarmed since 1869) with a 9.2-inch BL gun, searchlights to be fitted at Leith Fort, and the fortification of the May Island and the Bass Rock. Searchlights and guns at the Forth Bridge were put in place only years later.[54]

The Scotsman reported in February 1892 that despite the importance previously attached by the Navy to the provision of the 'floating defence' – the patrol vessels – the Admiralty now declined to attach any vessels permanently to the Forth, leaving the Army with the whole responsibility.[55]

By late December 1892, the work announced in 1889 – to enlarge and alter the fortifications at Inchkeith and Kinghorn Ness – was nearing completion.

The Joint Naval and Military Committee reported again in 1893 and 1894 on general principles and on the actual defences recommended for each naval and commercial port. Key principles addressed, first, the greater likelihood of raids by cruisers or torpedo craft rather than by capital ships: QF guns with lights mounted to tackle torpedo craft were the priority. The four most important mercantile ports, however (Tyne, Mersey, Clyde and Forth), also required 'a few somewhat heavier BL guns, although not such powerful guns as the 9.2-inch'. The specific section on the Firth of Forth noted that the Forth harbours were, combined, the seventh most important commercial port in the UK, with imports/exports exceeding £20,000,000 in value (around £2bn now) and several enemy cruisers that had escaped the vigilance of British ships might risk an attack. The Committee recommended changes, including lights at North Queensferry to illuminate the water in front of the Forth Bridge.[56]

The coast defences were in a state of flux at the end of the 19th century. Table 2 shows what was mounted and what additions and reductions had either been approved or proposed in 1898 and 1899.[57] The seven different types of gun mounted for training at Leith Fort in both years (Table 2) reflected the bewildering variety of weapons in use at this time: smooth-bored guns had apparently been *added* to Leith Fort between 1898 and 1899! The funds allocated in the Naval Construction Acts of the 1890s allowed, if not a clean sweep of such antique guns from the defences, at least their relegation to the reserve, and ensured that the first line of defence was equipped with the best available: 12-pdr QF, 4.7-inch QF, 6-inch and 9.2-inch BL guns of the latest marks on the most modern mountings.[58]

As noted above, in January 1899, a Joint Naval and Military Conference considered the replacement of muzzle-loading guns by breech-loaders, a potentially very costly project that required careful prioritisation and planning. The BL guns were much superior to the RMLs; for example, the conference noted that a quarter-worn 9.2-inch BL Mk IX or X had a penetrative effect 50% greater than a new 12.5-inch RML, could be fired three times as fast, and its projectiles cost less than half the money. The 6-inch BL Mk VII, when quarter worn, had a penetrative effect about 20% greater than a new 10-inch RML gun, could be fired nearly six times as fast, and its projectiles cost about a quarter of the 10-inch.[59]

The conference recommended that, first, heavy BL guns (9.2-inch calibre and upwards) were to be mounted to cover the approaches to: dockyards and principal naval bases; secondary naval bases; and ports of refuge and strategic harbours, which were liable to be exposed to attack by armoured ships. It was also determined that QF guns and 6-inch guns should cover channels to prevent armoured ships running past and suppressing the fire of the defence's 9.2-inch guns with their own QF guns.[60]

The conference recommended that the Forth was:

> to be defended as a commercial port and secondary naval base. Our ships of war should lie above the minefield at the Forth Bridge, 9 miles from Inchkeith Island, which lies in the centre of the entrance to the Forth.[60]

The conference considered that the armament of the Forth was inadequate, in particular covering the channel between Inchkeith and Kinghorn (Table 2). Even the changes then in hand (the South Fort on Inchkeith getting new 6-inch BL guns; replacement of four 10-inch RML at Kinghorn with a 9.2-inch and two 6-inch BL; two 6-inch at Carlingnose) would not, in their view, be enough. In particular, the guns in the southern part of Inchkeith were 'not a sufficiently strong defence for a port of the importance of Leith, with an import and export trade of £14,000,000 sterling …' The conference considered that the 4.7-inch QF guns on Inchkeith were in the wrong place in the estuary for their anti-torpedo craft role, and recommended that 9.2-inch BL guns of the latest type should be sited there instead, which would command not only the approaches but the North Channel.[60]

It was suggested that the two 4.7-inch QF guns on Inchkeith could, with advantage, replace the two 12-pdrs approved (but not yet installed) for South Queensferry (Dalmeny). This would result in the Inner Defences covering the minefield being: North Queensferry: two 6-inch Mk VII BL; two 12-pdr QF; Inchgarvie: two 12-pdr QF; and South Queensferry: two 4.7-inch QF.[60]

The proposals of the conference were largely carried through: the two 9.2-inch guns were added to Inchkeith in 1903–4; the single Mk I 6-inch gun in the north fort was replaced by a pair of Mk VII 6-inch guns in 1903 (the other Mk I 6-inch in the west fort remaining in situ on its disappearing mounting); the 4.7-inch QF guns were mounted at Dalmeny in 1900. Proposals to mount two 6-inch guns on the Martello Tower were not, however, implemented.[61]

In December 1900, a joint conference between the Admiralty and War Office convened to reconsider the forms of more localised attack that Britain faced rather than full-scale invasion.[62] The general threats identified at this meeting, albeit with changes in emphasis and detail, remained much the same for the next 20–30 years.

With the French still considered the most likely enemy, the Forth was believed to be at risk only from torpedo craft or destroyers, even before war was formally declared. It was this risk of pre-emptive action that led the conference to develop the idea of the 'Precautionary Period' before a state of war, during a state of growing tension, when there would be 'every probability' of torpedo attack. In that period, consequently, anti-torpedo armament would be fully manned and booms would be placed.[63]

The result of the deliberations up to the end of 1900 was a flurry of activity in the Forth at the turn of the century as new batteries were built and existing ones re-equipped. Table

Table 2

Summary of the official armament lists showing what was actually mounted in 1898 and 1899, and what was recorded as 'approved' or 'proposed' in 1899. Being 'approved' did not mean that the guns would eventually be mounted: circumstances or underlying principles might change before the money was found. The close-defence machine-guns for the batteries are not shown. (CAB 18/19 1898–1910)

	Mounted 1898	**Mounted 1899**	**Alterations approved/proposed 1899**	
			Additions	**Reductions**
Leith Fort	2 x 10-inch RML†	2 x 10-inch RML†	1 x 6-inch BL Mk II†	
	3 x 80-pdr RML†	3 x 80-pdr RML†		
	2 x 64-pdr RML†	2 x 64-pdr RML†		
	2 x 40-pdr RBL‡	2 x 9-inch RML†		
	1 x 9-pdr RML†	4 x 32-pdr SB†		
		1 x 68-pdr SB†		
Near Granton	Proposed 1898	Cancelled		
Martello Tower			2 x 4.7-inch QF	
Inchkeith	1 x 9.2-inch Mk I BL	1 x 9.2-inch BL Mk I	2 x 9.2-inch BL Mk X	
	2 x 10-inch RML	2 x 6-inch BL Mk VII ‡		
	2 x 6-inch BL Mk VI	2 x 6-inch BL Mk VI	2 x 6-inch BL Mk VII	
	2 x 4.7-inch QF	2 x 4.7-inch QF		2 x 4.7-inch QF
Kinghorn	2 x 10-inch RML ‡		1 x 9.2-inch BL Mk X	4 x 10-inch RML
	2 x 10-inch RML		2 x 6-inch BL Mk VII	
	2 x 4.7-inch QF			
South Queensferry	2 x 3-pdr QF§	2 x 3-pdr QF (on loan to Glasgow)	2 x 4.7-inch QF	2 x 3-pdr QF
Inchgarvie			2 x 12-pdr QF	
North Queensferry	2 x 6-pdr QF§	2 x 12-pdr QF	2 x 6-inch QF	

(† = drill only; ‡ = dismounted; § In Army Ordnance Depot charge)

Table 3

The mounted armament of the Forth on 1 December 1901 and in December 1902, with additions and reductions approved or proposed. Between December 1901 and 1902 Inchgarvie and Carlingnose had been armed; Coastguard had been added to the list, and armed with two 12-pdr QF guns. One of the Inchkeith 4.7-inch guns had been removed, and the other was noted as being due for removal. The 9.2-inch Mk I and two 6-inch Mk VI guns on Inchkeith (in italic) were *still* on disappearing mountings. The 1901 list was the last in which guns for drill and practice were included; note the bewildering range of training weapons mounted at Leith Fort, including five SB (smooth bore) guns.

1 December 1902	**Mounted 1 /12/1901**	**Mounted 1/12/1902**	**Alterations approved/ proposed 1902**
Leith Fort	2 x 12-pdr		
	2 x 10-inch RML ‡	Drill and practice guns not shown in 1902 list	‡ = for drill only
	2 x 9-inch RML ‡		
	3 x 80-pdr RML ‡		
	2 x 64-pdr RML ‡		
	4 x 32-pdr SB ‡		
	1 x 68-pdr SB ‡		
Inchkeith	*1 x 9.2-inch BL Mk I on disappearing mount*	*1 x 9.2-inch BL Mk I on disappearing mount*	
	2 x 6-inch BL Mk VII	2 x 6-inch BL Mk VII	
	2 x 6-inch BL Mk VI on disappearing mount	*2 x 6-inch BL Mk VI on disappearing mount*	Two 6-inch BL Mk VII guns approved/proposed to replace these.
	2 x 4.7-inch QF	1 x 4.7-inch QF	Two 9.2-inch BL Mk X approved/ proposed to replace this; one of the 4.7-inch guns already removed.
Kinghorn	4 x 10-inch RML	4 x 10-inch RML	Approval/proposal recorded to replace these with one 9.2-inch BL Mk X and two 6-inch Mk VII
	2 x 4.7-inch QF	2 x 4.7-inch QF	
Dalmeny	2 x 3-pdr QF (on loan to Field Arty depot, Glasgow)	2 x 4.7-inch QF	2 x fixed DELs
Inchgarvie		2 x 12-pdr QF	
Carlingnose		2 x 6-inch BL Mk VII	
Coastguard	Not listed	2 x 12-pdr QF	2 x moveable DELs

3 shows the defences of the Forth in December 1901 and a year later, in December 1902, recording a mixture of completed and yet-to-be-completed improvements.[64]

The earliest known scheme for the electric lighting of the Inner Line (1903) comprised two fixed beams just below the Dalmeny Battery, each of 16° dispersion at water level, controlled from a station in the battery, and, on the north side, two beams, one moveable through a 30° arc and the other fixed, with a 16° dispersion (Fig 3.4).[65]

The way in which the defences were to be used, and how they fitted into a larger plan, were set out, as far as we can tell for the first time, in 1899. The first 'modern' defence scheme for Scotland for which we have found a surviving copy, however, was the 'Scottish District Defence Scheme' dated 1900, a

revision of the 1899 document. It included detailed plans for the defence of the Forth, Clyde, Tay and Aberdeen (no attack was expected north of Aberdeen or the Clyde) against Russia and/or France, perhaps with Denmark as an ally. The general scheme of defence was to man the existing guns, lay submarine mines in the three estuaries, and to concentrate large land forces near the larger towns (Aberdeen, Dundee, Edinburgh, Glasgow and Greenock) to act against any enemy landing.[66]

The defence of the Forth was arranged into 'Outer', 'Inner' and 'Mobile' elements, to deal with attack by two or three cruisers and possible landings by 1,000–1,500 men. The Outer Defences comprised the guns at Inchkeith and Kinghorn (see below), with infantry garrisons for their protection (575 on Inchkeith, firing from prepared positions on the high ground of the island). Larger forces would be placed behind entrenchments inland from the coasts to protect important dockyards and towns. The Inner Defences were to protect the minefield and the Forth Bridge, but it was recorded that the armament was at that date 'not yet mounted'. The 'mobile' element comprised bodies of Regular and (mainly) volunteer infantry, and volunteer cavalry and artillery, placed in postures of defence around Edinburgh and Kinghorn.[67]

'The Portsmouth of the north to be'[68] *– the announcement of the new Rosyth naval base*

By the turn of the 20th century, the Royal Navy had grown so much that British naval bases were becoming overcrowded, and a committee on the capacity of naval anchorages and dockyards had recommended the formation of another naval base, the most advantageous position for it being in the Firth of Forth. In January 1902, Admiral Wharton, the Hydrographer of the Navy, advocated the choice of a site above the Forth Bridge, and on 2 March 1903 the Navy Estimates, which included mention of a new dockyard, were laid in the House of Commons by the First Lord of the Admiralty. On 5 March 1903, Prime Minister Arthur Balfour announced in the House of Commons that a new naval base would be built at St Margaret's Hope, Rosyth, and that the Government had been 'for some months in negotiation for the land'.[69] Two days later, the local press noted that the defence of the Forth had in recent years come into great prominence; Inchkeith had been transformed into a powerful fortress and Kinghorn Ness had also been armed with Quick-Firing, Breech-Loading guns of great range, 'while from the more recently constructed forts guarding the Forth Bridge, where the river narrows, an enemy in the estuary could be completely swept and riddled with shot and shell'.[70]

The occasionally expressed assumption that the Forth's armament grew as a consequence of the decision to build Rosyth can be shown to be false. As noted below, the armament actually reduced.[71]

'The problem of Home defence is part of the greater problem of Imperial defence . . .':[72] *the Committee of Imperial Defence*

At the same time as proposals were being developed for Rosyth, another profound change to Britain's military and naval organisation was being made which would affect the planning and implementation of the defence of the Forth. It had been clear since the 1880s that greater co-operation was needed between the Navy and Army, beyond the occasional joint conference of the kind mentioned above. No formal mechanism existed below Cabinet level for the co-ordination of naval and military strategy. Attempts to improve matters were blocked by vested interests in the services and amongst their supporters (including the Royal family).[73]

The disastrous failures in military planning and co-ordination in the Boer War (1899–1902) woke up British politicians and the largely un-militaristic British public to the country's potential weakness and vulnerability. The final straw was the embarrassingly public exposure of the chasm between the Royal Navy and Army at the Imperial Conference of 1902 when, in front of senior representatives of the Empire, the two forces presented completely opposing and unco-ordinated views of the defence needs of the Empire.[74]

The response was the development, between 1902 and 1904, of the Committee of Imperial Defence (CID), generally chaired by the Prime Minister not only with the political heads of the armed forces (the Secretary of the War Department and the First Lord of the Admiralty) and other key political members, but with the professional heads of the services, the First Sea Lord and the Chief of Staff, sitting as equal members. It also had its own secretariat to organise business and take and circulate minutes. At this date, and indeed until the middle of the First World War, the Cabinet did not have a secretariat nor formal minutes.[75]

Much of the CID's early work was concerned with Home Defence, and the development of the Forth's defences is chronicled in the CID minutes. In 1909, a Home Ports Defence sub-committee was established, chaired by the CID's secretary, with the Directors of Naval Intelligence and Naval Ordnance and the Assistant Director of Torpedoes (all from the Royal Navy) and the Directors of Military Training, Artillery, and Fortifications & Works from the War Office. This became the forum for discussions that would determine the type and level of defences of naval and commercial ports. Unfortunately, the CID did not solve all the problems of co-ordinating naval and military policy.[76]

Notes

1 WO 33/515.
2 WO 33/5.
3 Smith 1985: 90.
4 WO 33/5.

5 GD 224/514/12.
6 WO 33/5.
7 RHP 48586.
8 Saunders 1984: 472.
9 T1/15865.
10 Saunders 1984: 472.
11 In a 'disappearing' mounting, a coast artillery gun was visible only at the moment it was aimed and fired; the firing recoil forced the gun down on its carriage into the gun pit, where it was reloaded under cover, before being returned to the firing position. The counterweights of Moncrieff's system were replaced by hydro-pneumatic pistons in the more sophisticated Elswick disappearing mount, which was widely adopted.
12 Moncrieff 1871 (Edinburgh City Archives).
13 *The Scotsman*, 10 April 1871; Morris and Barclay 2017.
14 Hansard April 1871 'Scotland: Defences of the Firth of Forth – Observations', *Hansard* HC Deb 21 April 1871 vol 205 cc 1520–8.
15 Referred to in Stevenson 2014; we have not located the original reference.
16 Smith 1985: 91.
17 Hogg 1974: 27.
18 Hogg 1974: 39–41.
19 Hogg 1974: 72.
20 WO 396/5.
21 WO 33/39; CAB 18/22A.
22 CAB 18/22A.
23 WO 33/396/3; CAB 18/22A. The Royal Artillery and Royal Engineers Works Committee was established in 1884, to bring 'into closer relations the departments of Inspector-General of Fortifications and Director of Artillery', because of the 'number and intricacy of the questions in which both departments were concerned … were great and growing'. The standing committee comprised officers from both departments and, interestingly, the naval officer attached to the Inspector-General's staff.
24 *The Times*, 5 June 1885.
25 WO 33/39; Brown 1910: chapter 3.
26 *The Scotsman*, 10 October 1887; Brown 1910: 182.
27 Brown 1910: 1.
28 Admiralty 1914.
29 Admiralty 1938.
30 In the Second World War, the two terms referred to different things – the term 'controlled mines' was used to differentiate those laid within a detector loop from 'observation mines', which relied, as in the past, on a shore observer seeing a vessel or partly submerged submarine within the minefield to blow the mines.
31 *The Scotsman*, 25 July 1888.
32 WO 33/396/3.
33 WO 78/3548; Registers of Scotland. Fife, search sheet 14771; MT10/883/4.
34 *Fife Free Press*, 7 March 1903.
35 Brown 1910: 182.
36 Brown 1910: 182; WO 78/5179; WO 78/5183.
37 CAB 7/6.
38 CAB 7/6.
39 CAB 7/6.
40 Hogg 1974: 76–8.
41 Hogg 1974: 78–9.
42 Moore 1995; Moore 1998.
43 WO 396/5.
44 Moore 1995: 82–3.
45 Hogg 1974: 83.
46 An officer with a distinguished service in the Far East, who became First Sea Lord in July 1889.
47 A Royal Engineer officer with a distinguished career in the Crimea and in India, who at this time was Inspector-General of Fortifications.
48 *Fife Free Press*, 30 June 1888.
49 *Fife Free Press*, 30 June 1888; *The Scotsman*, 5 July 1888.
50 *Fife Free Press*, 12 January 1889; CAB 18/19.
51 *The Scotsman*, 10 December 1889.
52 Dunlop 1938: 152; Johnson 1960: 37.
53 WO 32/6355.
54 *Fife Free Press*, 23 May 1891; 29 August 1891.
55 *The Scotsman*, 15 February 1892.
56 CAB 18/22A.
57 CAB 18/19.
58 CAB 18/19; Hogg 1974: 89.
59 CAB 7/6.
60 CAB 7/6.
61 CAB 7/6.
62 CAB 38/1/4; WO 106/44; WO 33/189.
63 CAB 38/5/83.
64 CAB 18/19.
65 WO 78/5179; Barclay and Morris forthcoming.
66 WO 33/173.
67 WO 33/173.
68 *London Illustrated News*, 26 August 1905: 288.
69 The myth has grown up that the 'invasion novel', *The Riddle of the Sands* (Childers 1903), was influential in the decision to establish a North Sea naval base, an idea given retrospective credence by Winston Churchill. The book, however, was published in May 1903, two months after Balfour's speech and 16 months after Wharton's report.
70 *Fife Free Press*, 7 March 1903.
71 CAB 18/19.
72 WO 33/2857.
73 Johnson 1960: 15, 30.
74 Johnson 1960: 6, 31, 49.
75 Johnson 1960: 49.
76 Johnson 1960: 58, 94–5.