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The Bow and Arrow Versus the Atom Bomb: Air Defence in Scotland 1945-1955

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ABSTRACT
This article proposes that the development of Britain's air defence system in the 1950s should be viewed concurrently with that of her nuclear deterrent. Faced with a new threat from the Soviet Union in the late 1940s, Britain began engineering a new generation of anti-aircraft weapons. Using Scotland as a case study, the strategic relationship between air defence and nuclear deterrence will be explored in the British transition from a defensive to an offensive stance, and orientation toward American nuclear technologies in the late 1950s.

Introduction

> [T]he critical situation of this country should it be attacked with thermo-nuclear weapons, to which I referred in my last report, persists. You will recall that I said "…if the whole of the Russian L.R.A.F. attacked this country in widespread raids highly concentrated in time, we would… have absolutely no chance of survival by night, and by day only a miracle could save us." Since then there has been no accident or inspiration of science, which I contended was required to reverse the predominance of attack over defence.[1]
>
> Air Marshal Dermot Boyle, 1955

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[1]The UK National Archives (hereinafter TNA) CAB 21/3433, 'The State of the Air Defences of the United Kingdom: December 1954', Air Defence Commander's report to the COS, 22 March 1955, p. 1. LRAF means Long Range Air Force.

The advent of new technologies and geopolitical realities in the Cold War forced British strategists to rethink their approach to national defence. This would have a huge impact on the way in which Britain's air defence was organised and the responsibilities of the armed forces. Early Cold War British thinking was heavily coloured by the experience of German air raids in the 1940s, particularly attack by unmanned V-weapons that suggested a new way of warfare.[2] From 1945 Britain's strategy was shaped by a self-awareness of her unique geographical vulnerability and long-standing fear of enemy bomber penetration.[3] The British Chiefs of Staff Committee (COS) began planning the country's post-war air defence a year before Nazi Germany's surrender. In the immediate aftermath of victory, their Sub-Committee on the Allocation of Active Air Defences proposed a ten-year plan that assumed two years' warning of another major war. Assessing potential threats, the Sub-Committee discounted the non-existent German and 'relatively weak' French air forces but highlighted the 'strong air force' of her wartime ally the Soviet Union.[4] Anticipating the obsolescence of anti-aircraft artillery in the face of faster bombers, the Sub-Committee argued that new defences were needed, including guided weapons in the long-term and modernised guns in the interim. These measures would become fundamentals of British air defence planning until the mid-1950s. Under the plan, Britain was divided into 'Defended' (the eastern and southern coasts) and 'Shadow' (the west coast north of St David's Head in Pembrokeshire) areas protected by a 'nucleus force' of Anti-Aircraft and Fighter Commands in peacetime, mobilising to a 'full-scale force' in the event of war.[5] The plan was formulated in the pre-Hiroshima world, and by 1946 the COS were already reconsidering it in light of a rapidly changing, albeit unclear strategic picture. Before 1947 Britain did not consider nuclear war with the Soviet Union likely owing to her underestimation of the latter's atomic progress.[6] Nonetheless late in 1946, the Joint Planning Staff concluded that in strategic terms 'the enemy is Russia'.[7]

In 1949 the COS convened a scientific-military Air Defence Committee to consider how to develop Britain's air defences up to 1957 in an austere economic climate. The

[2]Matthew Jones, *The Official History of the UK Strategic Nuclear Deterrent Volume I: From the V-Bomber to the Arrival of Polaris, 1945-1964,* (London: Routledge, 2017), p. 5.
[3]Ian Clark and Nicholas J. Wheeler, *The British Origins of Nuclear Strategy 1945-1955*, (Oxford: Clarendon Press, 1989), p. 76.
[4]TNA CAB 82/19, 'Air Defence of Great Britain During the Ten Years Following the Defeat of Germany', 15 June 1945, Annex II, p. 3.
[5]Ibid., pp. 7-9.
[6]Margaret Gowing, *Independence and Deterrence: Britain and Atomic Energy, 1945-1952 Volume I*, (London: Macmillan, 1974), pp. 209-210.
[7]TNA AIR 8/1446, 'Future Scale of Air Attack on the United Kingdom', 7 December 1946, Annex I.

Committee recommended modernising the Royal Artillery's existing arsenal of 3.7 and 5.25 inch guns, and developing new fully automatic medium and heavy anti-aircraft guns capable of faster rates of fire, the latter at higher altitudes.[8] Echoing Britain's policy of nuclear deterrence, the Committee emphasised that 'the most potent method of defence against atomic attack will be in our ability to deliver an overwhelmingly heavier scale of atomic attack than the enemy'.[9] Guided weapons would ultimately be the most efficient means of improving anti-aircraft lethality to meet the threat posed by 'weapons of mass destruction'.[10]

Heightening tensions between the western allies and the Soviet Union following the 1948 Berlin crisis, communist victory in China, and insurgencies elsewhere in Asia moved the COS toward a more offensive policy. In 1950 they soberly acknowledged that Malaya demonstrated how 'Cold War merges imperceptibly into something very like hot war'.[11] As the Korean War raged, the Joint Planning Staff recognised the military co-dependency of Britain, Western European powers and the United States. American atomic supremacy was also conceded: 'the "Pax Atlantica" rests to-day on the atomic weapon as the Pax Britannica of the 19th century rested on the British fleet.'[12]

In 1952 the Air Defence Committee frankly admitted 'the fact that no known form of defence can prevent a really determined enemy, provided he is suitably equipped, from dropping a proportion of his atom bombs on this country has completely altered the air defence problem.'[13] Their report indicated that by 1957 new surface-to-air guided weapons (SAGWs) would make heavy and medium anti-aircraft artillery practically obsolete. In the estimation of Anti-Aircraft Command's wartime commander-in-chief, General Sir Frederick Pile, the guided missile was the 'weapon of the future' to supplant the fighter interceptor.[14] His prediction was echoed in 1954 by Sir Robert Cockburn, director of scientific research on guided weapons at the Ministry of Supply, who declaimed that the missile would 'undoubtedly replace the fighter as the killing

[8]TNA AIR 8/1786, 'Air Defence of the United Kingdom in 1957', Air Defence Committee (ADC) report to the COS, 1949, p. 5.
[9]Ibid., p. 14. On the Attlee government's early commitment to deterrence, see John Baylis and Kristan Stoddart, *The British Nuclear Experience: British Nuclear Strategy 1945-1964*, (Oxford: Oxford University Press, 2015), p. 13.
[10]TNA AIR 8/1786, 1949, p. 17.
[11]TNA, AIR 20/11154 'Defence Policy and Global Strategy', 1 May 1950, p. 13.
[12]TNA AIR 20/11154, 'Defence Policy and Global Strategy', 29 May 1951, p. 5.
[13]TNA AIR 8/2474, 'Air Defence of the United Kingdom up to 1957', report to the COS, April 1952, p. 3.
[14]General Sir Frederick Pile, *Ack-Ack: Britain's Defence Against Air Attack During the Second World War*, (London: George G. Harrap, 1949), p. 392.

weapon'.[15] However, in the early 1950s Britain lagged behind the United States and the Soviet Union in the field of guided weapons.[16] The Committee argued that medium anti-aircraft guns could still be effective against aircraft flying below 15,000 feet and proposed continuing the modernisation of the Royal Artillery's arsenal for defending major ports, shipping channels, naval repair centres and convoy and fleet anchorages.[17]

After the Soviet Union successfully tested a hydrogen bomb in 1953, the COS were once again forced to re-evaluate. Planning was complicated by inter-service rivalry, defence budget cuts and disagreement over whether to prepare for a short or a long 'broken-backed' war. Of the 'Three Pillars' responsible for Britain's national defence, the RAF advocated preparing for a short war whereas the British Army and Royal Navy anticipated an inconclusive initial nuclear exchange after which the 'broken-backed' belligerents would have to fight on.[18] Amid this contention, Britain's armed services were not only competing for limited resources but also struggling to define their respective roles in the nuclear age.

The history of Anti-Aircraft Command during the Second World War has been documented by Colin Dobinson, with valuable information on the early post-war period.[19] Wayne Cocroft and Roger Thomas's landmark work has recorded Britain's Cold War air defence network in England, with significant reference to Scotland.[20] Scottish Cold War history has also been the subject of significant commentaries in the last two decades.[21] This case study of Air Defence of the United Kingdom (ADUK) in

[15]TNA DEFE 8/46, ADC Working Party minutes, 2 September 1954, p. 4.
[16]See Stephen Robert Twigge, *The Early Development of Guided Weapons in the United Kingdom, 1940-1960*, (Reading: Harwood, 1993); Richard Moore, 'Surface-to-Air Guided Weapons for UK Air Defence in the 1950s', *Prospero* 2 (Spring 2005), pp. 193-212. On early Soviet SAGWs, see David Miller, *The Cold War: A Military History*, (London: Pimlico, 2001 [1998]), pp. 288-289.
[17]TNA AIR 8/2474, April 1952, p. 14.
[18]Clark and Wheeler, *The British Origins of Nuclear Strategy*, p. 183; John Baylis, *Ambiguity and Deterrence*, (Oxford: Clarendon Press, 1995), p. 144; Richard Moore, *The Royal Navy and Nuclear Weapons*, (London: Routledge, 2001), Ch. 2.
[19]*Anti-Aircraft Command: Britain's Anti-Aircraft Defences of the Second World War*, (London: Methuen, 2001); see also Ian Hogg, *Anti-Aircraft: A History of Air Defence*, (London: Macdonald and Jane's, 1978); N. W. Routledge, *History of the Royal Regiment of Artillery: Anti-Aircraft Artillery 1914-55*, (London: Brassey's, 1994).
[20]P. S. Barnwell (ed.), *Cold War: Building for Nuclear Confrontation 1946-1989*, (Swindon: English Heritage, 2003); see also Mike Osborne, *Defending Britain: Twentieth-Century Military Structures in the Landscape*, (Stroud: Tempus, 2004), Ch. 7.
[21]Brian P. Jamison (ed.), *Scotland and the Cold War*, (Dunfermline, Cualann Press, 2003); Niall Barr, 'The Cold War and Beyond', in Edward M. Spiers, Jeremy Crang and

the Scottish context will examine Britain's early Cold War air defence strategy, arguing that it should be seen concurrently with the development of her offensive nuclear capability. In the early 1950s the Churchill government attempted to balance the urgency of reviving Britain's economy with investing in home defence at a time when public anxiety over a possible nuclear confrontation was growing. The Strath Committee's 1955 report to the Cabinet laid bare Britain's vulnerability to new Soviet thermonuclear weapons and linked the credibility of her deterrent to the nation's preparedness for surviving a nuclear attack.[22] In the decade after NATO's formation in 1949, Britain came to see collective security within the bloc as vital to safeguarding her approaches, particularly from the north where expanding American air defences could bolster the RAF's patchy control and reporting organisation. Until the late 1950s, however, British military planning and industrial production were guided by the ideological imperative of 'national technological security'.[23] Britain relied on her indigenous ingenuity to engineer new air defence systems in the 1950s. In so doing, she failed to modernise her anti-aircraft guns, and her success in producing SAGWs was restricted by government imposed budgetary constraints limiting their deployment and further development. Combined technical and financial uncertainty in air defence planning anticipated Britain's technological orientation toward the United States for provision of her nuclear deterrent at the close of the decade.

In considering the Scottish dimension, the author will focus primarily on the British Army's role in air defence, and especially heavy and medium anti-aircraft infrastructure – a relatively neglected area of Britain's early Cold War military history. After outlining the provisions made for Scotland in this period, the four 'gun defended areas' (GDAs) under Anti-Aircraft Command's 3 Group (Scotland and Northern Ireland) will be described individually. In the analysis of ADUK in Scotland, reference will also be made to the RAF's and the Royal Navy's part in its planning and organisation. Archival lacunae, especially the lack of surviving Territorial Army and Royal Naval Reserve unit diaries, have produced disparity between paper plans and the facts on the ground. Research findings have accordingly been based on the archaeological record as well as documentary evidence. These will demonstrate how the logistical shortfall between

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Matthew J. Strickland (eds), *A Military History of Scotland*, (Edinburgh: Edinburgh University Press, 2014), pp. 600-624; Trevor Royle, *Facing the Bear: Scotland and the Cold War*, (Edinburgh: Birlinn, 2019).

[22]Jeff Hughes, 'The Strath Report: Britain Confronts the H-Bomb, 1954-1955', *History and Technology* 19, 3 (2003), pp. 257-275; Matthew Grant, 'Civil Defence and the Nuclear Deterrent, 1954-1968: Strategic Imperative and Political Expediency', in Matthew Grant (ed.), *The British Way in Cold Warfare*, (London: Bloomsbury, 2011), pp. 52-54.

[23]David Edgerton, *Warfare State: Britain, 1920-1970*, (Cambridge: Cambridge University Press, 2006), p. 104.

military planning and the reality of localised situations can enhance our understanding of strategic issues and external factors influencing top-level decision making.

The 'air defence problem' in Scotland

Air defence planning in the late 1940s took place with Britain in a state of flux as she struggled to repair her shattered economy and maintain her status as a world power. Scotland was initially allocated nucleus force anti-aircraft defences for the Clyde and Forth GDAs with fighter cover from the RAF's 13 Group headquartered at Inverness. The Defended Area was divided into two sectors: 'Turnhouse' covering eastern and central territory south of Inverness and 'Kirkwall' for the Highlands, Orkney and Shetland.[24] Continuing its wartime role, the Home Office Key Points Intelligence Directorate identified centres of military-industrial importance for the provision of anti-aircraft guns. Key points, such as the Royal Navy's torpedo factory at Greenock and Rosyth naval dockyard were in vital areas for any potential war effort and therefore prioritised for the nucleus force.[25]

From the outset the planning efforts of Anti-Aircraft Command and Fighter Command were hampered by three problems: lack of manpower, availability of gun sites for full-scale deployment, and the urgency of overhauling the RAF's control and reporting organisation which underpinned the entire air defence system. In 1946 the Sub-Committee on the Allocation of Active Air Defences reported that it was necessary to restrict the Defended Area to England between Flamborough Head in Yorkshire and Portland Bill in Dorset.[26] In response, the Cabinet Defence Committee called on Anti-Aircraft Command to plot its expansion over the following two years in cooperation with Fighter Command. The Royal Observer Corps would be reactivated to boost the RAF's control and reporting network and the War Office would be authorised to acquire land for new gun sites.[27] The recall of Territorial Army units in 1947 was intended to provide a fresh pool of recruits as demobilisation and the departure of skilled tradesmen to more attractive civilian jobs were diminishing available manpower. Specifically, the exodus of servicemen from the Royal Electrical and Mechanical Engineers deprived Anti-Aircraft Command of vital technical knowledge. In July 1947 the COS' reconstituted Sub-Committee on Air, Coast and Seaward Defences warned that even with the introduction of National Service, it would not be possible to deploy the nucleus force 'quickly at full strength' before

[24]TNA CAB 82/19, 15 June 1945, Annex II, p. 8, and map in Appendix A.
[25]TNA CAB 82/20, 'Vital Areas and Key Points in the United Kingdom Essential to the War Potential', 9 September 1946.
[26]TNA CAB 82/20, 'Short Term Plan for the Air Defence of Great Britain', 6 June 1946, p. 2.
[27]TNA CAB 82/20, 'Air Defence of Great Britain', note by the Joint Secretaries, 9 August 1946.

1952.[28] By 1949 the scale of nucleus and full-scale forces envisioned in 1945 had proved unrealistic. The Sub-Committee still highlighted insufficient manpower; in Scotland only half the anti-aircraft defences and limited fighters were available to protect the high priority Glasgow and Clyde GDA. Fighter cover remained sparse outside the contracted 'Main Defended Area' from Flamborough Head to Portland Bill and control and reporting was practically negligible. The Sub-Committee concluded that 'should an air offensive be launched against this country, without a warning, we should be virtually defenceless.'[29]

Attempts to revise the original ten-year plan were abandoned in favour of the 'Igloo' scheme based on a reduced number of gun sites and proportionate manpower. Pre-existing Second World War gun sites were earmarked for modernisation and new 'virgin' sites were to be acquired to broaden the layout. Both 1938 and 1941 pattern heavy anti-aircraft emplacements were replaced by a new pattern designed to accommodate modernised 3.7 inch guns.[30] Given added impetus by the Malayan and Korean conflicts, Igloo was a phased pre-mobilisation scheme to deploy medium anti-aircraft artillery at 54 sites in 'vulnerable areas', including Britain's main ports, with regular Royal Artillery regiments able to man half the troop positions at 30 hours' notice from the summer of 1951. In the second phase, a further 54 sites were to be made ready for deploying all regular units in peacetime. By 1957 a total of 665 sites would be operational after the acquisition of additional virgin sites by the War Office.[31]

Contemporaneously with Igloo, the Air Ministry launched the colossal 'Rotor' project to overhaul the RAF's control and reporting infrastructure for atomic warfare. Under Rotor, new radar stations with subterranean bunkers were constructed on Scotland's east coast and covering her northern approaches.[32] To protect command, a Type R4 bunker was excavated for the RAF sector operations centre (SOC) at Barnton Quarry in Edinburgh between 1951 and 1954.[33] A Royal Artillery control and reporting

[28]TNA AIR 8/1446, 'Air Defence of Great Britain,' report to the COS, 9 July 1947, p. 3.
[29]TNA CAB 122/379, 'Air Defence of the United Kingdom', report to the COS, 21 March 1949, p. 4.
[30]See Dobinson, *Anti-Aircraft Command*, p. 145, p. 332. On the new pattern 3.7 and 5.25 inch gun emplacements, see Cocroft, Thomas and Barnwell (ed.), *Cold War*, pp. 152-153.
[31]TNA DEFE 8/19, 'Anti-Aircraft Defences', War Office report, 5 April 1951, Annexure III, p. 15.
[32]For a description of Rotor at national level, see Cocroft, Thomas and Barnwell (ed.), *Cold War*, pp. 86-87.
[33]Edinburgh City Archives, Acc. 370, Box 4, EP/3/9/1, Mott, Hay and Anderson architects' drawings for the Air Ministry, 1953-1954.

battery, predominantly a territorial unit with a small regular component, would work alongside RAF personnel under the authority of the latter's sector commander. From the SOC, the fire control troop would relay instructions to the anti-aircraft operations room (AAOR) in the GDA. Meanwhile the reporting troop would alert all AAORs within 100 miles of the plots on the table at the RAF combined filter and plotting centre (CFP). The CFP would receive intelligence from Royal Observer Corps group headquarters and RAF radar stations to identify incoming enemy aircraft. Joint AAORs (JAAORs) operated in areas where anti-aircraft and coast defence artillery were accompanied by the guns of Navy warships. Communication would be via telephone lines, with VHF wireless as a contingency, to be operated by the Army's Royal Signals and Women's Royal Army Corps units.[34]

Between 1951 and 1954 new AAORs were constructed under the Ministry of Works for the four Scottish GDAs: Glasgow and Clyde; the Clyde Anchorage; Forth and Rosyth and Loch Ewe. AAORs were situated at a distance from the gun sites to offer a degree of protection from atomic, biological and/or chemical weapons. Unlike Second World War gun operations rooms, AAORs were built to a standard design as two-storey steel reinforced concrete bunkers; some were above ground, others semi-sunken. They were not intended to withstand a ground burst from an atomic bomb at close range nor the effects of radiation fallout. Upon mobilisation the AAORs would be manned by Royal Artillery fire command troops and gun batteries supplied from local Anti-Aircraft Ordnance Depots, Equipment Ammunition Depots and Intermediate Ammunition Depots, with technical and logistical support of Royal Electrical and Mechanical Engineers, Royal Ordnance and Royal Army Service Corps units. In Scotland, 'mixed' fire command troops were composed of regular and territorial soldiers. In the early 1950s, the concept of dividing Scotland into two sectors was preserved with a new SOC and CFP to be built at Inverness for the 'Sector of the Isles'. Plans for a separate SOC had been dropped by 1954 and all Scottish AAORs remained under the Caledonian SOC at Barnton Quarry.[35]

Igloo was never completed on a national scale and was implemented unevenly in Scotland. After Anti-Aircraft Command's mobilisation scheme was abruptly curtailed in 1953, much of its Scottish organisation withered and was confined to paper planning. Although land for gun sites was legally protected under the 1947 Town and Country Planning Act (Scotland), the War Office faced difficulties requisitioning sites owing to competition from local authorities, keen to build new housing. Emplacements also required sufficient distance from power lines to allow for radar guided gun-laying which meant finding accommodation with the Scottish electricity boards. As a result,

[34]TNA WO 106/5914, AA Command Standing Orders for War, March 1954, Section A, p. 11.
[35]TNA, ADM 1/24859, Note by the Admiralty Director of Plans, 15 January 1954.

anti-aircraft defence of vulnerable areas remained inadequate to meet the potential threat. Anti-Aircraft Command was officially disbanded in Scotland on 2 August 1955 with the headquarters of 12, 77 and 78 AA Brigades placed in 'suspended animation' by the War Office.[36]

Glasgow & Clydeside

As it contained a high priority vulnerable area, a major industrial centre with numerous key points for shipbuilding and armaments production, Glasgow and Clydeside was the only Scottish GDA included in the Igloo scheme.[37] The new AAOR for the Glasgow and Clydeside GDA was built in the grounds of Torrance House at East Kilbride, which would serve as 68 AA Brigade's wartime headquarters prior to the bunker's completion in 1953.[38] Glasgow and Clydeside was the only Scottish GDA to be allocated immediate anti-aircraft defence with 28 guns to be deployed when Anti-Aircraft Command was mobilised on M(AA) Day.[39] At the start of Igloo, regiments mainly comprised territorials from Glasgow and Lanarkshire, with one from Belfast and three northern English units from 5 AA Group.[40]

From archaeological evidence, however, it would appear that not all gun sites were successfully requisitioned, and in several cases the War Office had to improvise. At the onset of Igloo in 1951, 53 gun sites were earmarked either for inclusion in the first two phases of Igloo, or for future requisitioning by the War Office.[41] Medium anti-aircraft emplacements were built to the new pattern for 3.7 inch guns at Brackenhurst (near Bellsmyre), Drumbowie, Midnetherton (near Carmunnock), East Yonderton and Mugdock.[42] Elsewhere new pattern heavy anti-aircraft emplacements were constructed for 5.25 inch guns at Pattiston, Limekilnburn and Stockiemuir.[43] The archaeological remains suggest that Anti-Aircraft Command was forced to depart significantly from the original Igloo list; many new emplacements were never built and some pre-existing ones only partially modernised. Nevertheless in 1952 an inter-

[36]TNA WO 32/14627, War Office memorandum to Anti-Aircraft Command Headquarters, 25 June 1955.
[37]TNA DEFE 8/21, 'Vulnerable Areas', Sub-Committee for Air, Coast and Seaward Defences report to the ADC, 4 December 1951, Appendix A, p. 3, and map in Appendix B.
[38]TNA WO 106/5913, AA Command Mobilisation Scheme, April 1952, Appendix F.
[39]TNA, WO 106/5912, AA Command Mobilisation Scheme, October 1951, Appendix E Part 2.
[40]TNA WO 106/5912, October 1951, Appendix A, Section 3, p. 1.
[41]TNA WO 106/5911, AA Command Mobilisation Scheme, April 1951, Appendix QA.
[42]TNA WO 106/5912, October 1951, Appendix QA; see also Canmore IDs 107533, 107534, 43809, 107523 and 105603 for the archaeological record.
[43]See Canmore IDs 106351, 105315 and 106350.

service report concluded that the inner Clyde between Greenock and Glasgow had 'strong MAA defences' although a later report to the Air Defence Committee noted 'serious gaps' in the northern approaches.[44]

By 1954, construction of the AAOR and a limited number of new emplacements was complete. Telephone lines connected the AAOR to the SOC in Edinburgh and a wireless mast allowed for radio communication with the gun batteries. On paper at least, a total of ten Royal Artillery regiments were available for deployment.[45] A military camp was also established at the AAOR, for which the War Office later paid £932 in compensation to the East Kilbride Development Corporation for replanting trees on the site.[46]

The Clyde Anchorage

Air defence planning for the Clyde Anchorage GDA was more rudimentary than its Glasgow and Clydeside counterpart. The bunker at Inverkip was designed to be operated with the Royal Navy as a JAAOR. Construction work began in 1951 on a hillside position overlooking the Firth of Clyde. Out of 28 gun sites identified after Igloo was initiated, none seem to have been prioritised for the Clyde Anchorage.[47] A Second World War site at Flatterton was part-modernised with two new pattern 3.7 inch gun emplacements.[48] New pattern 5.25 inch gun emplacements were also constructed at Rosneath and Wemyss Bay.[49]

The 77 AA Brigade took part in the 'air defence phase' of NATO's Exercise Mariner held in September-October 1953. During Mariner the Clyde Anchorage from the Dunoon/Cloch Point line to the Tail of the Bank was jointly defended by 'blue' forces

[44]TNA DEFE 8/28, 'Defence of Vital Shipping Channels', Admiralty report to the ADC, 30 June 1952, p. 9; DEFE 8/29, 'Surprise Atomic Attack – The Toll', report by E. J. Kingston-McCloughry, Chief Air Defence Officer, to the ADC, 16 October 1952, p. 3.

[45]TNA WO 106/5915, Anti-Aircraft Command Mobilisation Instruction, May 1954, Annexes A, F.

[46]South Lanarkshire Archives, East Kilbride Development Corporation Minutes Vol. X (1957-58), 1 March 1958, p. 240.

[47]TNA WO 106/5912, October 1951, Appendix QA.

[48]See Canmore ID 105645.

[49]See Canmore IDs 106348 and 107527. Rosneath was of strategic significance in 1951 owing to contemporary plans for an Anglo-American submarine base on the Gare Loch (TNA ADM 1/21931, Letter from W. V. McCaig to the Secretary of the Admiralty, 10 September 1951). The site at Wemyss Bay is listed under the Glasgow/Clydeside GDA (TNA WO 106/5912, October 1951, Appendix QA) but given its location south-west of Inverkip this must be in error.

consisting of Army artillery, Navy warships and RAF aircraft. The Navy's seaward defence headquarters was located at Cloch Point along with anti-small battle unit (ASBU) guns manned by the 105 Coast Artillery Brigade.[50] Information on incoming 'orange' (enemy) aircraft was passed to ships of the striking fleet from the SOC at Barnton Quarry via the JAAOR at Inverkip.[51]

Despite the lack of modernised gun sites, the Clyde Anchorage JAAOR was fully operational with telephone and wireless communications connected by late 1953. After it was relinquished by the War Office, the bunker was taken over by the Navy and recommissioned as an emergency wartime headquarters in the 1960s, staffed by the Royal Naval Reserve unit HMS Dalriada during several exercises.[52]

The Forth & Rosyth

The Forth and Rosyth GDA covered multiple key points, including the Rosyth naval dockyard, Port Edgar and the ports of Granton and Leith. Planning for new anti-aircraft artillery defences proceeded slowly with the JAAOR at Craigiehall, near South Queensferry, scheduled to be completed last out of the four.[53] The bunker was located in the grounds of Craigiehall where 3 AA Group was headquartered. Troops from only two 'mixed' heavy anti-aircraft regiments (494 [M] based at Edinburgh and the mobile 558 [M] from Coatdyke, later 471 [M] headquartered at Dunfermline) equipped with 3.7 inch Mk 2C guns were to be deployed across 12 sites.[54]

[50]Cloch Point was earlier listed as a potential gun site by Anti-Aircraft Command, and the Exercise Mariner plans note an existing ASBU battery there (TNA ADM 116/6327, Outline Plan for the Improvised Seaward Defence of the Clyde, 16 May 1953, p. 4). A subsequent report complained that the coast artillery units had not participated on a 'war footing' with territorial troops mostly participating at weekends (TNA ADM 116/6327, 'Exercise Mariner – Seaward Defence Phase' report to the Flag Officer, Scotland, 15 October 1953, p. 28).

[51]TNA ADM 116/6327, General Orders for A.A. Defence Exercise in the Seaward Defence Phase of Exercise Mariner, 27 August 1953. Although not mentioned in documentation, it is assumed that the JAAOR was manned by the Royal Artillery 77 (M) fire command troop as per the current mobilisation scheme (TNA WO 106/5913, April 1953, Appendix G). For a broader discussion of Exercise Mariner, see Brian Lavery, *Shield of Empire: The Royal Navy and Scotland*, (Edinburgh: Birlinn, 2007), p. 399, and Moore, *The Royal Navy and Nuclear Weapons*, pp. 97-98.

[52]See the memoirs of the former Commodore Clyde Rear Admiral P. G. La Niece, *Not a Nine to Five Job* (Yalding: Charltons, 1992), p. 221.

[53]TNA DEFE 8/19, 5 April 1951, Attachment to Annexure VI, p. 20.

[54]TNA WO 106/5912, October 1951, Appendix A, Section 3, p. 2; see also Norman E. H. Litchfield, *The Territorial Artillery 1908-1988*, (Nottingham: The Sherwood Press, 1992), p. 300, p. 292, p. 283.

In 1952 the Air Defence Committee proposed to the COS that the Forth be prioritised for medium anti-aircraft artillery.[55] Concerned by the comparatively weak defences in the Firth of Forth, the Admiralty pressed for increased medium anti-aircraft firepower to defend the narrow shipping channel west of the Isle of May. This allowed access to the base at Rosyth and the emergency convoy anchorage in Largo Bay off the east coast of Fife.[56] Despite naval pressure, little progress seems to have been made with modernising gun emplacements in the Forth and Rosyth GDA where plans relied largely upon 'rehabilitating' Second World War sites.[57] In the early 1950s, coast artillery defences were gradually dismantled before the organisation was disbanded in 1956.[58] By 1954, the JAAOR at Craigiehall was operational for coordinating anti-aircraft fire from onshore gun emplacements with Navy warships in the Firth of Forth launched from Rosyth and Granton.[59]

Loch Ewe

Of all the Scottish GDAs, Loch Ewe best illustrates the competing interests of the 'Three Pillars' through its ad hoc planning and unresolved logistical issues. Loch Ewe was not among the Scottish GDAs proposed by the Air Defence Committee in 1949.[60] Its subsequent inclusion was almost certainly at the behest of the Royal Navy. Conceived as a JAAOR, construction began on the bunker at Gairloch in 1951 and was completed in 1953. Originally the guns on Loch Ewe would be crewed by territorial troops from 362 Heavy Anti-Aircraft Regiment. However, it had to be replaced by the territorial 501 Heavy Anti-Aircraft Regiment headquartered in Aberdeen owing to the former's meagre strength.[61] In the event of war, transporting guns by road from the railway station at Achnasheen would likely have been difficult, even impossible in winter when the single track frequently became impassable.[62]

[55]TNA AIR 8/2474, April 1952, p. 20.
[56]TNA DEFE 8/28, 30 June 1952, Annex.
[57]Structures can be found at the following gun sites: Myrend (Canmore ID 84195), Kinghorn (84257) and Liberton (118887).
[58]TNA, WO 305/141, 245 Armament Unit Battery RA, Record of Unit Tasks 1 April 53 to 1 March 54, 26 March 1954, Appendix A; see also Gordon J. Barclay and Ron Morris, *The Fortification of the Firth of Forth 1880-1977*, (Edinburgh: Society of Antiquaries, 2022), p. 81.
[59]TNA ADM 1/25641, Port Plan for Granton and Leith, 1 June 1954, Appendix 8, p. 1, and map at Annex A.
[60]TNA AIR 8/1786, 1949, Fig. 1.
[61]TNA WO 106/5912, 1 October 1951, p. 2; see also Litchfield, *The Territorial Artillery*, p. 272.
[62]TNA ADM 1/25630, Office of the Flag Officer Commanding Scotland and Northern Ireland report to the Admiralty, 5 January 1950, p. 4.

Defence arrangements for the Loch Ewe GDA continued to be subject to inter-service discussions after the Igloo scheme was put into action. In February 1952, Loch Ewe became a priority two defended port as an 'Advanced Fleet Anchorage, Fleet Working Up Base and Convoy Assembly Point'.[63] Under NATO's Emergency Defence Plan, Loch Ewe was to act as an assembly point for Scandinavian convoys, a scenario rehearsed during Exercise Mariner. Further cooperation with the Navy on developing the defensive infrastructure on Loch Ewe was agreed by the Army's Scottish Command and 3 AA Group. The Navy envisaged a seaward defence headquarters at Leacan Donna, an examination battery at Camas Cliabhach and an ASBU battery at Rubh' a' Choin, armed with two 3.7 inch guns each.[64] The Army stressed that it could not meet the Navy's requirements for anti-aircraft gun emplacements in the short term, owing to the prerequisite of building new roads and hard standings. Mobile anti-aircraft guns could be provided, but at the expense of the examination battery.[65] Archaeological remains would suggest that Second World War emplacements on Loch Ewe were adapted for mobile 3.7 inch guns, but not modernised to the new pattern, at Rubh' a' Choin and Tournaig.[66]

Collaboration between Anti-Aircraft Command and the Navy over the latter's plans for Loch Ewe seems to have broken down in 1953. In 1952 the Air Defence Committee recommended Loch Ewe for continued medium anti-aircraft artillery protection.[67] Under political pressure to downsize regiments, the COS instead opted to forsake the Loch Ewe GDA at the beginning of 1953. At a joint command meeting in Portsmouth in February, it was nevertheless reported that 'a large J.A.A.O.R was being built and was practically complete at Loch Gairloch, and that gun sites on Loch Ewe were being progressed.' The RAF observed the lack of airfields suitable for 'modern fighters' and radar coverage in the area, as well as an SOC for the Sector of the Isles. The Flag Officer Scotland countered that two naval airfields at Dounreay and Lossiemouth were available.[68] Commander-in-Chief, Portsmouth, Admiral John

[63]TNA ADM 1/25630, Letter from the Office of the Flag Officer Scotland to the Admiralty, 29 January 1952, p. 4.
[64]TNA ADM 1/25630, Letter from the Office of the Flag Officer Scotland to the Admiralty, 3 October 1951; ADM 1/25630, 29 January 1952, p. 2.
[65]TNA ADM 1/25630, Minutes of meeting at the Admiralty, 7 May 1952, p. 2.
[66]See Canmore IDs 98094 and 98096. I am indebted to Allan Kilpatrick at Historic Environment Scotland for additional information from recent surveying. The work done at Rubh' a' Choin may indicate a temporary solution for the ASBU battery. As the 501st was equipped with Mk 3A mobile guns, adapting the existing emplacement at Tournaig would have been logical.
[67]TNA AIR 8/2474, April 1952, p. 14.
[68]TNA ADM 1/24859, Minutes of meeting at Portsmouth, 5 February 1953, p. 2.

Edelsten, wrote to the Admiralty the following month, emphasising that any reduction in Loch Ewe's thin air defences would be 'unacceptable'. Commander-in-Chief Eastern Atlantic Area, Admiral George Creasy, intended Loch Ewe to be the emergency anchorage for the Fleet's northern bases. Edelsten reasonably argued that anti-aircraft defences would be essential, given the likelihood of the Clyde and Forth being primary targets in any Soviet attack.[69] No reply to Edelsten's appeal was forthcoming for nearly a year, at the point when Anti-Aircraft Command was being wound down, and the response was unsurprisingly negative.

There would appear to be no record of the JAAOR for the Loch Ewe GDA ever being made operational. The General Post Office may not have actually connected it to the SOC in Edinburgh, although a wireless mast was erected for communication.[70] Ironically, in 1954 the Admiralty's Gunnery and Anti-Aircraft Warfare Division briefly investigated the possibility of establishing 'a small naval A.A. operations room' for Loch Ewe while seemingly unaware of the JAAOR's existence at Gairloch.[71]

SAGWs & The Nuclear Deterrent

Following the Air Defence Committee's advice to the COS, the Air Ministry assumed control of Britain's guided weapons programme in 1953 in a move that would eventually spell the end for Anti-Aircraft Command.[72] Anticipating the introduction of guided weapons by 1958, the COS concluded that medium anti-aircraft regiments would become redundant and Anti-Aircraft Command would 'gradually dwindle' to light anti-aircraft defence in the intervening period.[73] Organisationally Anti-Aircraft Command had always been the RAF's junior partner. The Air Defence Commander of the United Kingdom was also commander-in-chief of Fighter Command and ADUK's sectoral control system relied on the RAF's control and reporting infrastructure. Under the Churchill government's 1953 Radical Review, the COS were forced to consider a drastic curtailment of ADUK to reduce defence spending. The government's June Directive effectively abandoned the concept of 'broken-backed war' in favour of planning for six weeks' intense nuclear conflict with Britain's 'survival

[69]TNA ADM 1/24859, Letter from Admiral John Edelsten to the Admiralty, 5 March 1953.
[70]TNA WO 106/5913, October 1953, Appendix H; Highland Archive Centre, CRC/3/1/80, Minutes of the Ross and Cromarty County Council Highways Committee, 14 January 1960, p. 49. The County Council purchased the wireless mast from Scottish Command for £2 in 1960.
[71]TNA ADM 1/24859, Note by the Admiralty Director of Gunnery and Anti-Aircraft Warfare Division, 8 March 1954.
[72]TNA AIR 8/2474, April 1952, p. 17.
[73]TNA DEFE 8/39, 'Air Defence of the United Kingdom', COS report, 2 March 1953, p. 7.

forces' relying on the United States Strategic Air Command 'to break the Russian will to fight' in that period.[74] The RAF had seized the initiative not just in the guided weapons programme, but in driving British strategic policy toward attack over defence.

Modernisation of the Royal Artillery's arsenal proceeded too slowly to have any real impact, and in 1953 the COS halted the programme of adapting the 3.7 Mk 2C gun.[75] The Royal Armament Research and Development Establishment's new automatic-loading medium and heavy anti-aircraft guns, codenamed 'Red Maid' and 'Green Mace', were both cancelled before entering production. Vickers' own medium anti-aircraft gun was also scrapped at the prototype stage.[76] Industrial inertia notwithstanding, the Army had not been blind to the inevitability of SAGWs replacing the heavy anti-aircraft gun. In 1951 the Royal Artillery confidently saw the new heavy anti-aircraft gun as a contingency against its English Electric-designed 'Red Shoes' missile not entering service by 1957. In the period 1950-1951, the Royal Artillery was also in negotiation to acquire the American Terrier missile system and enquiries were made about it being manufactured in Britain.[77] As the Igloo scheme was being implemented, the War Office ordered a small stock of Terrier missiles for training purposes at the Trials Establishment Royal Artillery in Anglesey.[78] Internal discussion within the Royal Artillery moreover reveals a keen awareness of the potential of nuclear-tipped projectiles for destroying faster aircraft at greater distance in the 'medium band'.[79]

The COS understood that SAGWs would be ineffective at heights of under 10,000 feet.[80] To compensate Anti-Aircraft Command's commander-in-chief, Lieutenant-General Sir Charles Loewen, advocated a 'three-decker defence' consisting of light and medium anti-aircraft guns at lower levels, and SAGWs at high altitude. This combination of anti-aircraft weapons would balance the effectiveness of medium guns and guided weapons, against enemy sorties at different altitudes with forces of varying

[74]Quoted in Clark and Wheeler, *The British Origins of Nuclear Strategy*, p. 184; see also Baylis, *Ambiguity and Deterrence*, pp. 166-167.
[75]Routledge, *History of the Royal Regiment of Artillery*, p. 437. The ADC proposed that the Mk IIC be converted to be transportable and fully automatic firing the 'Littlejohn' squeeze-bore shell (AIR 8/1786, 1949, p. 5).
[76]TNA WO 32/13049, 'New HAA Gun' meeting notes, 5 January 1951; see also Routledge, *History of the Royal Regiment of Artillery*, pp. 437-438.
[77]TNA WO 32/13049, 5 January 1951. Terrier was designed as a ship-to-air missile so presumably the intention was to modify the launcher for the Royal Artillery's use.
[78]TNA DEFE 8/19, 'Introduction of Terrier into U.K. Defences', War Office statement to the ADC, 28 May 1951, Appendix, p. 2.
[79]Major R. Elsmie, 'Future A.A. Thoughts', *The Royal Artillery Journal* LXXX, 4 (1953), p. 254.
[80]TNA DEFE 8/39, 2 March 1953, p. 5.

size.[81] British eyes were already fixed on the US Army's more advanced surface-to-air missile technology, however, as the Nike Ajax system was ready for deployment in 1953.[82] For its part, the RAF strengthened Anglo-American cooperation, liaising with the US Air Force's air defence study Project Charles, and hosting Conference Ally at RAF Old Sarum in February 1953. Crucially, one of the conference's major conclusions was that the 'successful emergence of the surface-to-air guided weapon, especially in the United States, has made it unnecessary to put any further effort on the medium AA gun'.[83]

The COS' mindset was shifting in an offensive direction, even before the Soviet Union's detonation of a thermonuclear weapon in August 1953 redefined the air defence problem. In February 1953, General Sir Nevil Brownjohn wrote to Winston Churchill, 'an air defence system designed to inflict an attrition loss rate on the enemy is no longer adequate; we must aim at annihilation of the atom bomb carriers.'[84] In addition to the hydrogen bomb, the Air Defence Committee had to face the prospect of nuclear ballistic missiles on top of the existing 'flying' threat they had hitherto considered. Chairman Sir Frederick Brundrett expressed a general concern about the inadequacy of the Rotor programme's second stage, scheduled to begin in 1954, which was designed to counter the 'flying' threat only.[85] The combination of governmental pressure to reduce defence expenditure, inter-service rivalry and rapid nuclear weapons evolution, forced the COS into a series of hasty, if pragmatic decisions.

In 1955 the Air Defence Committee noted that the COS now placed ADUK third in its order of priorities behind the nuclear deterrent and preparing for 'cold or limited war'.[86] The COS' deprioritisation of ADUK may have been influenced by the Committee's own scepticism over the effectiveness of the two principal SAGWs under development: 'Red Shoes' and 'Red Duster'. The Committee considered both to be of insufficient range and adherence to a point defence principle rendered obsolete by the hydrogen bomb.[87] The Bloodhound Mark I missile, developed for the RAF by the Bristol Aeroplane Company and Ferranti under the codename 'Red

[81]TNA DEFE 8/39, 'Note on the Problem of Producing a Balanced A.A. Force', paper for the ADC, 13 April 1953, pp. 2-3.
[82]See Hogg, *Anti-Aircraft*, p. 142.
[83]TNA DEFE 8/39, Joint report to the ADC on 'Conference Ally', 27 February 1953, p. 17.
[84]TNA CAB 21/3433, Letter from General Sir Nevil Brownjohn to Winston Churchill, 23 February 1953.
[85]TNA DEFE 8/38, ADC Minutes, 26 October 1953, p. 6.
[86]TNA DEFE 8/38, ADC Minutes, 27 July 1955, p. 2.
[87]TNA DEFE 8/70, 'Air Defence of the United Kingdom', ADC draft report to the COS, 25 June 1954, p. 10.

Duster', was originally intended to protect vulnerable areas, by mounting it on existing gun emplacements. When the COS opted not to manufacture Red Shoes and Red Duster for operational use, the Air Ministry lobbied them to reconsider, citing public cognisance of Nike missiles defending American cities, and the expectation that SAGWs would soon replace guns in Britain after Anti-Aircraft Command's disbandment.[88] The Ministry produced four schemes for the COS' consideration based on available budget, with two leaving Scotland and Northern Ireland entirely undefended. The schemes were informed by economic pragmatism and recognised the Ministry of Supply's interest in coordinating peacetime production for home defence with the lucrative export market for advanced British military technology.[89] Against Anti-Aircraft Command's balanced view of air defence, the RAF persisted in viewing SAGWs as a means of meeting what it perceived as the greater threat from high altitude bombing. The air defence problem at lower levels became more acute with evolving Soviet aircraft and missile technology. Consequently, at the close of the 1950s, under political pressure to cut costs, the Air Ministry deprioritised Bloodhound in favour of English Electric's supersonic Lightning interceptor. By 1959, the government would only countenance defending the nuclear deterrent itself, compelling the RAF to emplace Bloodhound missiles in a limited pattern protecting V-bombers and American Thor missiles based at English airfields.[90] As Scottish airfields were only to be used as dispersal bases for the V-Force, Bloodhound missiles were not deployed to Scotland after their introduction in 1958.

English Electric's Red Shoes (renamed Thunderbird) mobile anti-aircraft missile system was eventually deployed with the Royal Artillery's 36 Guided Weapons Regiment in the British Army of the Rhine after its introduction in 1959. The Royal Artillery also found a new role operating American-made Corporal missiles as NATO's first nuclear-capable battlefield weapon. Testing began on 23 June 1959 at a newly built guided weapons range on the Hebridean islands of South Uist and Benbecula.[91] Tactical nuclear weapons offered the possibility of preventing a Soviet invasion of Western Europe, fulfilling the Air Defence Committee's earlier recommendation to buttress

[88]TNA DEFE 8/70, 'Introduction of Surface to Air Guided Weapons into the Air Defence of the United Kingdom', Air Ministry note to the COS, 9 August 1955, Introduction, p. 2.

[89]Ibid., Appendix A, p. 12. Bloodhound Mark I was exported to Australia and Sweden. See Cocroft, Thomas and Barnwell (ed.), *Cold War*, p. 173.

[90]Richard Moore, *Nuclear Illusion, Nuclear Reality: Britain, the United States and Nuclear Weapons, 1958-64*, (Basingstoke: Palgrave Macmillan, 2010), pp. 126-128.

[91]See Fraser MacDonald, 'Perpendicular Subline: Regarding Rocketry and the Cold War', in Fraser Macdonald, Rachel Hughes and Klaus Dodds (eds), *Observant States: Geopolitics and Visual Culture*, (London: I. B. Tauris, 2010), pp. 267-289.

NATO's chances of 'holding the enemy on or east of the Rhine'.[92] By the 1960s, however, British anxiety over a Soviet invasion of Western Europe had given way to fears of bomber and ballistic missile strikes launched from new Arctic military complexes. This new reality brought Scotland's geostrategic importance into sharper focus for British, American and NATO war planning.

Conclusion

British attempts to resolve the air defence problem reveal a lack of strategic foresight on the part of military planners. Post-war austerity and political pressure to shrink defence budgets encouraged short-termism, and the irresistible gravitational pull of American technology that culminated in Britain signing the Mutual Defence Agreement with the United States in 1958. There were other economic factors at work, such as the need to balance production of advanced military technology for home defence with a profitable export market. From the mid-1950s two closely related nuclear missile projects were in development for the Air Ministry. Scientific research into nuclear SAGWs probed the possibility of an anti-ballistic missile (ABM) system for ADUK but was deemed too complex and costly to realise by 1961.[93] The previous year saw the cancellation of the Blue Streak intermediate range ballistic missile programme. The superpowers were able to continue developing ABM alongside ballistic missile systems partly on account of superior resources, but also through consistently prioritising air defence from the beginning of the Cold War as the corollary of their nuclear arms race. Although still beleaguered in the 1950s, Britain possessed the scientific and industrial capacity to produce high technology, as demonstrated by her rapid progress in the field of nuclear reactors. In contrast to the United States, which excluded military officers from its air defence studies viz. Projects Charles and Lincoln, Britain's efforts were hamstrung by inter-service competition that exacerbated political restrictions on strategic problem-solving. The aborted modernisation of the Royal Artillery's anti-aircraft guns augured bigger defence project cancellations such as Blue Streak and the British Aircraft Corporation's TSR-2 aircraft, which were terminated at the prototype stage and after massive investment.

In the early 1950s Scotland was in many ways England's poor relation in ADUK, excluded from the Main Defended Area and allocated insufficient firepower to defend vulnerable areas under the Igloo scheme. Scotland's centrality in subsequent British strategic thinking is nonetheless closely related to the air defence problem of this period which henceforth persisted and took new forms. Earlier predictions of the fighter's obsolescence were shown to be wholly premature. The absence of SAGWs made the fighter interceptor indispensable, along with maritime reconnaissance

[92]TNA AIR 8/2474, April 1952, p. 7.

[93]Concerning British research on nuclear SAGWs as a possible 'stepping stone' to an ABM system, see Moore, *Nuclear Illusion, Nuclear Reality*, pp. 126-129.

aircraft. American, and later British Polaris ballistic missile submarines were based on the Clyde owing to its strategic northerly position and because the same Atlantic security issues were paramount. No longer peripheral, Scotland became a key node in NATO's war plan, situated close to the Greenland-Iceland-UK Gap and NATO's Nordic flank. The RAF and Royal Navy were forced to galvanise their air and seaward defence infrastructure to extend fighter cover and maritime patrols from airfields at Leuchars, Kinloss and Lossiemouth. Vulnerable areas of the Clyde, Forth and Loch Ewe remained potential targets, but with new key points: inter alia the Navy's submarine base at Faslane and armaments depot at Coulport; the joint RAF-Navy maritime headquarters at Pitreavie and the NATO oil storage depot at Loch Ewe. The dilemma of Britain's 'national technological security' continued to bedevil higher political and military echelons when discussing the nuclear deterrent, but also the Quick Reaction Alert fighters for intercepting Soviet aircraft and ships. Just as the Heath government pursued 'Super Antelope' (subsequently codenamed Chevaline), a British re-engineering of Polaris to overcome the Soviet ABM system, American Phantom F4 aircraft were likewise technically indigenised as the FG1 and FGR2.

Britain's nuclear deterrent did not ultimately remedy her unique geographical vulnerability to aerial penetration during the Cold War. This was nowhere truer than from her northern approaches, which remained at risk of long-range attack by Soviet aircraft and submarines operating from Arctic bases. High-level military fears of a 'knock-out blow' being delivered by the Soviet Union from Western Europe in the early 1950s were equally justified from the Arctic thereafter.