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Peripheral vision: Operation Rotor, radar infrastructure and state power in Scotland 1950–1957

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ABSTRACT

Formulated as the Cold War was intensifying in 1950, Operation Rotor was intended to restore the Royal Air Force's control and reporting organisation on Britain's east coast. Planning exposed the country's vulnerability to a Soviet attack from the north and new radar stations were built in northern and western Scotland. Rotor brought about a northerly reorientation of Britain's air defences that, along with economic and technological factors, ultimately saw them integrated within the North Atlantic Treaty Organisation's intercontinental early warning system. Like other major defence projects of the period, Rotor also had a significant effect on Scottish society as wartime mass organisation was revived and Royal Air Force units encountered local communities, often in rural areas. The new infrastructure had developmental potential, bringing with it electricity and other modernisation, but Rotor's colossal cost and the overriding priority of national security could likewise be at odds with local needs. This article will examine why Scotland became of greater strategic importance in the 1950s and also assess Rotor's societal impact and its implications for British state power.

INTRODUCTION

Britain's experience of devastating aerial bombardment and the threat of invasion from Western Europe during the Second World War cast a long shadow as successive governments sought to rebuild the country's shattered economy. Euphoric victory quickly gave way to renewed fears of attack as the Soviet Union tightened its grip on East Germany and Czechoslovakia in 1948 and successfully detonated an atomic bomb in August the following year. Shortly before the Cold War turned hot in Korea, the Chiefs of Staff advised the Cabinet Defence Committee:

> Western Europe, even if not invaded initially, could not survive the defeat of Britain. So it is literally vital that, in addition to playing their due part in the defence of the outer bastion, the British must be able to defend themselves. An efficient air defence is so essential to the safety of the main base in the United Kingdom that all necessary measures to ensure its early development must be given the highest priority.[1]

To counter the Soviet threat the British government initiated a monumental air defence infrastructure project codenamed 'Operation Rotor' that would ultimately conjoin the outer and inner bastions around the strategic fulcrum of Scotland. During this period the Chiefs of Staff convened an Air Defence Committee under the chairmanship of Henry Tizard, Chief Scientific Adviser to the Ministry of Defence. Tizard's Committee identified the need for the Royal Air Force (RAF)

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to overhaul its control and reporting system to give complete coverage of the approaches to the United Kingdom. In the Committee's estimation, renewing the control and reporting system was fundamental to achieving effective anti-aircraft defences, including fighter interceptors, artillery and new guided weapons, which it considered 'the most promising method of countering the threat of weapons of mass destruction'.[2]

Early in 1949, prior to the Soviet atomic bomb test, the Chiefs of Staff devised a 'Short-Term Plan' for rehabilitating Second World War 'Chain Home' radar stations. Protecting the 'Main Defended Area' between Flamborough Head and Portland Bill on England's eastern and southern seaboard, as well as approaches to London, was given priority. Amid mounting international tensions, Operation Rotor was approved by the Air Council in June 1950. One of its principal objectives was to close the gap in the RAF's control and reporting system between Flamborough Head and the Moray Firth in north-eastern Scotland. This would prove a race against time as Soviet technology rapidly advanced to the hydrogen bomb and jet bombers by the mid-1950s. At this juncture the centre of gravity of British strategic thinking shifted away from the wartime scenario of enemy attack from occupied Western Europe. As the Soviet Union developed formidable military bases in its Baltic republics, and later in Arctic Russia (Osherenko & Young 1989: 31), Britain and its allies in the North Atlantic Treaty Organisation (NATO) had to contend with the prospect of nuclear strikes from the north. Hence Scotland, and its northern approaches in particular, became central to the Rotor programme as it progressed between 1950 and its completion in 1957.

When studying Scotland's defence, historians must consider the United Kingdom context because the armed forces are organised on an integral basis. Two underlying factors shaped the contours of Operation Rotor: Britain's stricken post-war economy and its strategic relationship with the United States. In its conception, the Rotor programme was one of the most ambitious and expensive defence infrastructure projects in British history, estimated to cost around £51.5 million.[3]

The demands Operation Rotor placed on government departments were enormous and, in some areas, constrained civil infrastructure development. For example, the provision of landline communications for Rotor stations would absorb almost the entire output of the General Post Office's duct and cable contractors for two years. There was to be a virtual moratorium on the General Post Office laying new trunk cables that were not required for Rotor at a time of increasing traffic on its public trunk service.[4] During Rotor's first year the programme was delayed by shortages of steel, cement, labour and radar components. Rotor ran concurrently with other defence projects of unprecedented cost and had to compete for resources with, among other schemes, the development of the atomic bomb and guided weapons (Twigge 1993; Moore 2005). Rotor was consistently undermined by economic malaise, exacerbated by the massive rearmament programme initiated by Clement Attlee's government under American pressure to hold back the tide of communism in Asia (Barnett 2011: 40–2). Thereafter Conservative governments reduced defence expenditure in a cumulative process punctuated by the 1953 'Radical Review' and the 1957 White Paper *Defence: Outline of Future Policy* in the aftermath of the Suez crisis (Baylis 1995: chapter 5; Peden 2012: 1087–8). In the White Paper the Minister of Defence, Duncan Sandys, elevated nuclear deterrence above all, scaling down conventional forces and abolishing National Service (Pierre 1972: 161, 170; Vinen 2015: 367–8). Defence retrenchment curtailed Rotor in its early stages and skewed high-level decision-making. Economic decline notwithstanding, the British state continued to prioritise defending its imperial possessions, especially in the Middle East. Rotor was to be accomplished alongside Operation Vast, a scheme for upgrading the RAF's overseas radar stations and providing equipment to allies in Europe and the Commonwealth. Implementing Vast drained the resources available for Rotor and perpetuated the RAF's overstretched deployment east of Suez.

Operation Rotor was formulated at a time when Britain's strategic relationship with the United States was complex and, at times, strained. The McMahon Act passed by the US Congress in 1946 forbade direct cooperation with Britain in the field of atomic energy. American isolationism led Britain down an 'indigenous' path towards a doctrine of independent nuclear deterrence (Clark & Wheeler 1989: 15). Britain was, however, contemporaneously a recipient of conventional military aid under the Mutual Defence Assistance Programme. Given the limited resources available to the Air Ministry in 1950 and recent advances in American radar technology, Rotor planners briefly contemplated negotiating 'a combined development programme with a view to having similar equipment in service in the two countries by 1957'.[5] For the most part, British defence procurement in the 1950s prioritised domestic design and manufacturing with the parallel aim of securing valuable export markets to improve the country's balance of payments. American aircraft, weapons, materiel and components were acquired 'off the shelf' as interim measures prior to the introduction of British technologies. Economic pressures and a shortage of materials nonetheless increased the drift towards the American defence industry on the grounds of expediency. Faced with the stalled delivery of radar equipment from the principal Rotor contractor, Marconi, the Air Ministry ordered the American long-range AN/FPS-3 radar under the Mutual Defence Assistance Programme as 'an insurance against delays', despite Marconi's resentment and concerns within the RAF over its effectiveness.[6] Following its introduction in 1953, Fighter Command complained of equipment failures and the Air Staff acknowledged 'the trouble being experienced with these FPS-3 Radars'.[7] By contrast, the indigenously designed Type 80 radar exceeded expectations, piquing greater American interest in the British control and reporting system.

Originally codenamed 'Green Garlic', the versatile Type 80 was developed by the Ministry of Supply's Telecommunications Research Establishment at Great Malvern (Gough 1993: 115–19). Under the first iteration of the Rotor Plan, stations were equipped mainly with re-engineered Second World War radar types, known as 'Stage 1' equipment, prior to the introduction of a new generation of radar in 'Stage 2'. Successful testing of 'Green Garlic' led the Air Council to expedite its introduction as 'Stage 1A' equipment. Plans were revised for a second stage known as 'Rotor 2' to upgrade existing stations with the new equipment by 1956 (Cocroft & Thomas 2003: 87). Radar research was rationalised by the creation of the Royal Radar Establishment in 1953, a merger of the Telecommunications Research Establishment and Radar Research and Development Establishment. Work being done for the Air Ministry and the War Office at the respective establishments was combined, including the radar component of the guided weapons programme, for which the RAF assumed overall responsibility in the same year. The fruit of this research was a more comprehensive system which, owing to its high cost and sophistication, became integrated and standardised within international defence alliances, diminishing national autonomy (Agar & Hughes 2002: 246).

Operation Rotor will be examined as the last major nationally autonomous defence infrastructure project undertaken by the British state in Scotland. Firstly, it will be established why Scotland became important in strategic terms during Rotor. Scotland was treated as England's poor relation in 'Igloo', a parallel air defence scheme to modernise the Army's anti-aircraft artillery that coincided with the first stage of Rotor (Gledhill 2024). In the fast-evolving geopolitical and technological landscape of the 1950s, the Rotor programme's locus moved to Scotland and its peripheries. A tertiary stage known as 'Rotor 3' focused on the north of Scotland, the Northern and Western Isles and Northern Ireland as the weak points in the RAF's control and reporting system.

Large-scale RAF exercises probed the problems that Rotor was intended to resolve and in doing so exposed weaknesses in the Scottish control and reporting system that compromised the Air Defence of the United Kingdom itself.

Defence exercises became a defining feature of the Cold War in Europe, organised on an increasingly elaborate scale under NATO's auspices. RAF exercises will be discussed as an empirical aspect of Rotor that encouraged planners and decision-makers to alter the programme and shaped its final outcomes.

Rotor's societal implications will be considered at a time when the British state's competence and authority were being tested by the rigours of economic recovery. In the 1950s the state sited numerous defence projects in the United Kingdom's peripheries, which offered environmental advantages along with remoteness and seclusion. For example, the Royal Artillery Guided Weapons Range Hebrides was located on South Uist for testing American-made Corporal tactical nuclear missiles and training troops (MacDonald 2006). Defence infrastructure brought not just modernisation to the underdeveloped edges of the United Kingdom, but also outsiders into traditional and, in some cases, isolated rural communities. Niall Barr has written of Rotor's ambiguity, observing that the radar station built by the RAF on Unst became the Shetland island's economic lifeblood, creating jobs and other communal benefits such as electricity (Barr 2014: 609). The developmental potential of military infrastructure was not lost on local people who reacted positively or negatively depending on their perception of it. Radar infrastructure building was thus a test of the state's ability to protect the nation, and also of popular faith in the state as the guarantor of economic stability and engine of progress.

A NOTE ON SOURCES

This study draws on high-level military and civil service documents as the 'official' record of the Rotor programme left behind by those who conceived and directed it. Plans for Operation Rotor were classified 'Top Secret' and, as with any investigation of such material, there are manifold lacunae which will forever remain beyond the historian's grasp. To help fill in some of these gaps, RAF unit diaries were studied that record everyday implementation of planning as well as deviations brought about by practical realities on the ground. Although official documents, unit diaries are compiled independently from high command and can therefore provide remarkable insights into the social life of the armed forces as well as the personal opinions of those called upon to execute policy in real-world conditions. The records of the Scottish electricity boards are also a valuable and untapped source of information about classified defence projects in the Cold War, documenting requests for power supplies and complex negotiations between nationalised industries, government departments and the military.

CLOSING BRITAIN'S BACK DOOR

The RAF's control and reporting system in 1950 was based on a wartime network of coastal radar stations to report enemy aircraft and Ground Control Intercept (GCI) stations for directing fighters to engage the incoming threat. Organised in sectors, the system was under the command of an RAF Sector Commander based in the Sector Operations Centre (SOC). At its inception, Operation Rotor was to restore the RAF's control and reporting organisation up to the Moray Firth, with only a limited medium and high altitude reporting function for the Highlands and Orkney. (Shetland and the Hebrides were excluded.) Chain Home radar stations on Scotland's east coast were rehabilitated at Hillhead, Schoolhill, Douglas Wood and Drone Hill, along with sites at Sango on the north coast and Netherbutton on Orkney (see Brown 2022: 17).

Part of Operation Rotor's tactical rationale was to harden the RAF's exposed east coast control and reporting infrastructure to withstand Soviet 2,200lb 'BRAB' armour-piercing bombs dropped in patterns from 26,000 feet.[8] To this end, operations buildings were to be 'buried' in underground or semi-sunken bunkers of steel-reinforced concrete that would also give some protection against the shock wave from atomic explosions (for a full typology with illustrations see Cocroft & Thomas 2003: 88–91, 103–4). A Chain Home Extra Low (CHEL) station for

detecting low-flying aircraft was established with a single-storey underground 'R2' bunker at Cross Law in Berwickshire. At Inverbervie in Kincardineshire, a Centrimetric Early Warning (CEW) station, designed for tactical control and reporting, was constructed with a subterranean single-storey 'R1' bunker. RAF Buchan near Boddam in Aberdeenshire and RAF Anstruther at Troy Wood in Fife were set up as GCIs equipped with AN/FPS-3 radar during 1953; two-storey underground 'R3' bunkers were completed for these stations the following year. The bunkers were fabricated to standard designs but there was some regional architectural variation in the guardhouses above them. For example, those at Troy Wood and Inverbervie were stone-built in the local vernacular style (Illus 1 & 2; see also Cocroft & Thomas 2003: 92–3). In Edinburgh the wartime SOC at Barnton Quarry was re-constructed as a deep-level three-storey 'R4' bunker. By the end of 1953, the RAF's control and reporting organisation had been re-established along Scotland's east coast as far as the Moray Firth (Illus 3). The Chain Home stations provided supplemental high altitude coverage of the Highlands and Orkney.

In Rotor's first year planners began to look northwards with increasing disquiet at the ineffective radar coverage. In June 1951 Fighter Command drafted an 'Outline Plan for the Expansion of the UK C&R [Control & Reporting] System in the West, Northern Ireland, the Hebrides, Northern Scotland, the Orkneys and the Shetlands' based on Stage 1 equipment and referred to internally as 'Post-Rotor'. As late as July 1951, the Air Ministry reported with alarm only one functioning GCI outside the Main Defended Area, at Dirleton in East Lothian: 'Therefore, assuming that war would come with very little or no warning, the enemy would be able to out-flank our defences.'[9] Later that year, senior RAF officers expressed concern over the absence of protection for Scotland's north-western approaches, with Fighter Command 'faced with the impossible position of deciding to what extent they would allow Glasgow to be undefended'.[10] To close this north-western gap, new GCIs were built at Gailes in Ayrshire and at Scarinish

Illus 1 Former guardhouse for the Ground Control Intercept station at Troy Wood. (Photograph by the author)

ILLUS 2 Former guardhouse for the Centrimetric Early Warning station at Inverbervie. (Photograph by the author)

on the Hebridean island of Tiree (Illus 3).[11] However, government-imposed 'National Economy Measures' demanded savings of between £1 million and £2 million, thereby forcing the RAF to relax its requirement for semi-sunken 'R6' stations.[12] Owing to budgetary limitations, henceforth stations covering northern and western areas were to have above-ground buildings. Gailes and Scarinish were equipped with prefabricated 'R8' Seco huts.

At the same time, plans were taking shape to expand radar coverage of Britain's northern approaches beyond the limited provision in Rotor's first iteration. The Air Defence Committee had warned the Chiefs of Staff that after Rotor Stage 1, 'coverage will be weakest in the north of Scotland, Northern Ireland and along the western seaboard'.[13] Fighter Command's Exercise Ardent in 1952 revealed critical weaknesses in the control and reporting system in the north and north-western areas of the United Kingdom that still risked being outflanked by Soviet bombers flying at low altitude. The lack of low-level radar coverage and tactical control exposed the strategically vital ports of Glasgow, Belfast, Liverpool and Bristol. In February 1953 the Air Council approved the 'Extension of the Control and Reporting System Outside the Rotor Area' at a basic cost of around £2.17 million for equipment and works services in Scotland.[14] The 'Rotor 3' plan would create a 'Sector of the Isles' and a Northern Irish sub-sector alongside the existing Caledonian Sector, with a separate SOC and Combined Filter and Plotting Centre at RAF Raigmore in Inverness. To compensate for the inadequate coverage afforded by the old Chain Home stations at Netherbutton and Sango, CEW stations with above-ground 'R10' structures would be built at Saxa Vord on Unst, Aird Uig on the Isle of Lewis and Faraid Head on the north coast of Sutherland (Illus 3).[15] GCI stations would be constructed at Wick in Caithness and Killard Point in County Down, Northern Ireland. Stage 1A equipment would be installed at all the new stations. The lack of low and surface coverage would be remedied by new CHEL stations at Kilchiaran on Islay and Murlough Bay in County Antrim, each with 'R11' surface buildings and fitted with inferior Stage 1 equipment.

ILLUS 3 Rotor sites in Scotland 1952–1957. (Crown Copyright: Ordnance Survey)

Gailes would also take on a CHEL function, using mobile equipment prior to the fixed installation. The RAF's radar infrastructure would be supported by 13 new Royal Observer Corps monitoring posts in north-western Scotland and 58 in Northern Ireland, tasked with identifying and reporting low-flying enemy aircraft.

Fiscal pressure once again intervened to restrict the Rotor programme in the wake of the 1953 Radical Review. The Air Council abandoned the Sector of the Isles as uneconomic in June 1954 and scrapped plans for the new SOC at Inverness and GCI at Wick. The rest of the Scottish Rotor 3 programme was completed by July 1956, excepting the CHEL radar installation at Gailes, which was suspended indefinitely, and the three northernmost stations. Work on the CEW sites at Aird Uig and Saxa Vord was eventually finished in 1957 after technical problems with the aerial design caused delays. Saxa Vord and Faraid Head also suffered severe damage in gales, requiring the main aerial frames at Saxa Vord and Aird Uig to be strengthened.[16] Controversially, the Faraid Head station was discarded at the end of 1956, after £700,000 had been outlaid on works services. (By this point,

more than £19 million had been spent on Rotor nationally.) Justifying the abandonment of Faraid Head, Air Marshal Dermot Boyle argued that Rotor 3 had been undertaken to counter the 'mass threat' of bomber attack anticipated up to 1956, which had receded with the advent of the vastly more destructive hydrogen bomb.[17]

The arrival of thermonuclear weapons meant that many Rotor radar stations were already redundant before the programme's completion. Ironically, British technical innovation played its own part in the obsolescence of much of the Rotor infrastructure. The Type 80 Mk 3 combined early warning and fighter control functions, allowing the RAF to rationalise its radar network. Fighter Command based its '1958 Plan' on the concept of the 'comprehensive' radar station equipped with the Type 80 Mk 3. The United Kingdom would be divided into nine sub-sectors in which the comprehensive radar stations were to be largely self-contained, thus placing 'a minimum reliance on centralised control'.[18] As succour for economising ministers, the plan's authors noted that it permitted a reduction of 3,000 regular RAF posts as well as 12,000 auxiliaries. The Air Council approved the plan in June 1956, but it was swiftly overtaken by the 1957 defence reforms as well as technical developments. The French invention of the carcinotron valve raised the spectre that the Type 80 could be vulnerable to jamming. Consequently, the 'Blue Yeoman' radar (later designated the Type 85), which provided early warning as well as control for fighters and surface-to-air guided weapons, was favoured for the new computerised system (Gough 1993: 184–5). In the modified scheme, which morphed into 'Plan Ahead' in 1959, the autonomous station concept was replaced by a centrally controlled system based on a smaller number of radar stations.

In 1960 the Prime Minister, Harold Macmillan, decided that Plan Ahead must be integrated with civil air traffic control in a joint scheme. The military dimension would be codenamed 'Linesman' and its civil aviation counterpart would be known as 'Mediator'. Linesman/Mediator produced an integrated and semi-automated ground radar system (Agar & Hughes 2002: 243). In Scotland, two Rotor radar stations survived from the 1958 Plan: Buchan and Saxa Vord.[19] Buchan was initially converted into an autonomous 'Master Radar Station' in late 1957, after its strategic north-easterly position was recognised in the 1958 Plan. This highlighted how Rotor had been based on the 'incorrectly orientated' east and south-east facing control and reporting system from the Second World War.[20] Under Linesman, Buchan connected the RAF's reorientated control and reporting organisation to NATO's northern early warning system via radar stations in Iceland, the Faroe Islands and Norway (Gough 1993: 240).

At the Rotor 3 stage, the Air Defence Committee proposed an Anglo-American 'Northern Radar Screen', with a station on the Faroe Islands linking early warning stations in the Sector of the Isles to American stations in Iceland and Greenland.[21] American cooperation was not, however, to be forthcoming in the life of the Rotor programme. Two years later, Air Marshal Dermot Boyle warned that Soviet Tu-4 and Tu-16 bombers could fly across Norway and through the gap between Iceland and the Hebrides to strike the United Kingdom, following a route with 'the merits of avoiding Continental defences and of exploiting current deficiencies in our radar cover'.[22] Britain's aim should be to connect the continental and Scandinavian radar screens with its own; American 'consent' was required for a radar station on the Faroes because the United States would have to provide the equipment and personnel.[23] The Type 80 offered the possibility of closing the gap. However, the Secretary of State for Air, Nigel Birch, was informed that because Rotor's planners lived in 'the hope that the Americans would supply some radar free to Denmark no action had been taken by this country'.[24] British technical advances during Rotor nevertheless influenced the development of what would in the early 1960s become the NATO Air Defence Ground Environment, prompting American overtures. In February 1957 Major-General Homer Le Roy Sanders, Commander Allied Air Forces Northern Europe, visited Buchan 'to view at first hand the organisation and facilities of a G.C.I. station and in particular the

operational capabilities and technical aspects of the Type 80 radar equipment'.[25] Rotor's Scottish legacy was thus a northerly reorientated control and reporting organisation, subsumed within NATO's intercontinental early warning system for which Buchan provided a key node.

SYNTHETIC WAR

The control and reporting organisation re-established on Scotland's east coast during the first stage of Operation Rotor became operational in 1953. Stations were maintained at either 'operational' or 'readiness' status; the former were permanently manned by RAF Signals Units and supported by Fighter Control Units based elsewhere in Scottish cities and Belfast. Transferred from Home Command to Fighter Command in November 1950, Fighter Control Units mainly consisted of part-time personnel drawn from the Royal Auxiliary Air Force and the Women's Royal Auxiliary Air Force, along with a small contingent of regulars charged with administration and training. They also operated mobile 'convoy' stations that could be deployed on hard standings at predetermined locations in wartime. Units underwent regular 'synthetic' training using practice equipment; for 'live' training RAF aircraft were plotted, controlled and 'practice interceptions' made to simulate enemy raids in real time. RAF personnel also trained alongside the other armed forces and reactivated wartime voluntary services, the Royal Observer Corps and Home Guard. Signals Units at the Anstruther and Buchan GCI stations had 'parenting' responsibilities for the other coastal radar stations. Training was consolidated in regular exercises organised at unit, sectoral and national level. Fighter Command's annual exercises were designed to coordinate the Caledonian Sector's activities with the control and reporting organisation in other parts of the country as rehearsals for the war mobilisation scheme. During exercises radar operators monitored aircraft 'tracks' and controllers aimed to 'murder' enemy bombers using fighters scrambled from the RAF's eastern airfields. Under live conditions the 'enemy' would also test stations' preparedness by jamming radar and communications, mimicking the Soviet Air Force's combat tactics in the event of an actual attack.

The first full-scale test of the restored system came in August 1953 with Fighter Command's Exercise Momentum, which mobilised the Dirleton, Anstruther and Buchan GCIs. RAF Anstruther had only been established a month prior to Momentum, but a junior officer recorded it as 'the most successful exercise in which Caledonian Sector has participated up to now, and Anstruther had a very encouraging baptism', controlling 88 fighter formations and making 51 interceptions.[26] RAF Buchan, which was set up around the same time, also took part in Momentum from an operations room in a temporary Seco hut. Buchan's station commander was more critical, identifying fundamental weaknesses in the control and reporting system. He pointed to the absence of experienced controllers to make interceptions and the ageing Chain Home stations' poor performance. He also highlighted the dearth of operational fighter bases in the north of Scotland, remarking on the absurdity of aircraft being scrambled from RAF Leuchars in Fife to make interceptions 150 miles northwards: 'By the time the fighters had reached the interception point they had to be hurriedly returned to base owing to shortage of fuel.'[27] As fighter formations were handed between GCIs, the controllers had to contend with RAF Canberra and US Air Force B-45 jet bombers flying at high altitude. With Buchan's Type 13 height-finding radar unserviceable throughout the exercise, interception controllers at times struggled to direct fighters accurately to their fast-moving targets. Slower, propeller-driven RAF Lincolns, Valettas and Varsities were easier to 'murder', flying in small groups at medium altitude. At one point however, a C-47 transport plane en route from Stavanger in Norway to RAF Turnhouse near Edinburgh was mistakenly identified as an enemy track.

Momentum took place before the Anstruther and Buchan GCIs had been furnished with 'R3' bunkers. At Buchan, the AN/FPS-3 radar performed well during the exercise except for a period when it malfunctioned due to insufficient

mains voltage. In a farcical episode, to remedy the electricity supply problem the Unit had to call out an engineer from the North of Scotland Hydro-Electric Board. Telecommunications with the Caledonian SOC at Barnton Quarry were mostly faultless with only one line cut off during the exercise. (Landlines provided by the General Post Office for military communication ran underground to protect them from bomb damage.) Although stations were equipped with backup generators and VHF radio links, the arrangements for Momentum reveal an organisational mindset that had not fully appreciated the realities of nuclear warfare – all the starker for its coinciding with the Soviet Union's successful hydrogen bomb test that month.

The RAF trialled its air defence strategy in the skies over Scotland by day and night. In a night-time exercise conducted jointly between the Caledonian and Northern Sectors in March 1955, a bomber raid was intercepted east of Edinburgh by Meteor fighters of 151 Squadron scrambled from Leuchars under Anstruther's control. Buchan detected two 'hostile tracks' on course to attack Aberdeen but were able to direct Meteors from the same squadron to intercept them 20 miles east of the city, narrowly averting disaster.[28] In the same month, Buchan began a series of irregular exercises codenamed 'Yukon Jake', making practice interceptions of Canberras and B-45s returning from training missions in Norway. Picking up two B-45s 170 miles east-north-east of the station, controllers were able to scramble four Vampire fighters from RAF Dyce to intercept the bombers 60 miles east and flying at 34,000 feet. The second exercise reveals an operational awareness of the growing Soviet threat from the north, but also the narrow margins of the RAF's provisions for countering it.

In addition to testing stations' ability to track and intercept enemy aircraft, ground defence exercises were staged to rehearse a land invasion. In May 1954, a day-long exercise was held at Buchan during which 409 Signals Unit was to repel an assault on the station's technical site by troops from the RAF Regiment at Dyce. Buchan's defenders were to be relieved by a detachment of Gordon Highlanders from Aberdeen.[29] In his post-exercise analysis, RAF Dyce's Officer Commanding described the difficulty of attacking the objective:

> Geographically, it surmounts a circular hill with little or no cover for the last 400 yards. Furthermore, the type of radar equipment on the site allows for look-out posts some 50 feet above ground level which makes movement of any sort readily spotted. The site itself is surrounded by a wire fence which is scalable, but was adequately protected by machine-gun posts from within and made it suicidal to climb over or under during daylight.[30]

Made up of raw, tactically inexperienced recruits, the mobile column of Gordon Highlanders was ambushed at a roadblock while naively driving through the 'battle area' in unarmoured vehicles. After rejoining the fray, they were subsequently 'picked off by snipers'. By night, a good number of the 100 or so raiders were able to penetrate the technical site's defences, after a decoy was set. Once again, the Army's soldiers proved ineffective and were neutralised by 'hand grenades' (simulated by thunder flashes). It was concluded that an enemy force better trained in commando tactics could be 'completely successful' in overcoming Buchan's defences. The exercise also had a surreal quality, with the Dyce troops attempting various means of infiltration. They sought to gain entry concealed in packing cases and vehicles, and even disguised as General Post Office employees. All such ruses were unsuccessful, but it was 'recommended that a Regiment Squadron be detailed to attempt by any of these methods to enter any Grade 1 radar site at any time as a means of keeping the security personnel on their toes'.[31]

Ground defence scenarios were sometimes enacted within Fighter Command's annual exercises to synthesise the conditions of all-out war. As part of Exercise Beware in 1955, a subsidiary exercise codenamed 'Creep' was held to practise repelling enemy saboteurs. At Anstruther 'a constant vigilance was maintained by sentries on all the Station's technical sites, and no "saboteurs" were successful in gaining access to them – two were captured in an attempt to do so'.[32]

During the exercise the main operations area was guarded by the 2nd Battalion of the Fife Home Guard. Repulsing saboteurs and enemy commandos was a scenario redolent of the early years of the Second World War, when such possibilities were very real. Although similar fears recurred in the 1950s, the exercises now appear martial spectacles detached from a radically different strategic reality.

Air defence exercises of the early 1950s exposed a slow and unwieldy control and reporting system, hampered by an over-complex chain of command that could easily break down in a nuclear war. They also reflected the sheer fragility of Britain's defences in its Scottish peripheries, rendered virtually useless by the awesome power of thermonuclear weapons – a fact appreciated in upper military echelons, but which could not be communicated down the chain of command without jeopardising morale. Summing up the situation in 1955, the Joint Staff confessed to the Air Defence Committee: 'The possibility of attack with Hydrogen bombs dropped from high speed high altitude aircraft has already presented air defence with a threat it cannot meet.'[33]

RAF COMMUNITIES

Operation Rotor took place amid a revival of the mass uniformed culture and collective defence ethos of the Second World War, which accompanied the government's frantic preparations for conflict with the Soviet Union. Conscription under the 1948 National Service Act and a call-up of reservists in 1951 swelled the ranks of the RAF, which had dwindled following demobilisation. Although planned and executed under top secret conditions, national defence projects like Rotor brought large numbers of servicemen and women into regular contact with local people. In Scotland, memories of the RAF's wartime presence in its peripheries were fresh, and local communities were accustomed to service personnel, often from other parts of Britain, living and working among them.

After the establishment of RAF Anstruther in 1953, 351 Signals Unit developed its own social life, interacting with the other uniformed and civil services, but also the local communities at Anstruther and Crail, and in Fife more widely. Personnel were initially accommodated at RAF Leuchars before a domestic camp was established at Cellardyke, just outside Anstruther. Air Ministry housing was provided for married couples and families in the residential area around the camp. The new arrivals were welcomed by Anstruther Town Council, whose Treasurer estimated that local business revenue from the camp would 'leave something like £20,000 a year in the town'.[34] Local politicians cited trade from holidaymakers and the RAF as evidence contradicting recent press reports that Anstruther was 'down and out' after the collapse of its herring fishing industry.

Following an influx of personnel from Dirleton in August 1954, RAF Anstruther acquired land for football and rugby pitches at its domestic camp. Two teams were quickly formed, the first of which played midweek evening and Saturday games in the Fife Amateur Football League with some success. Through sport, servicemen encountered the student community in St Andrews, one year beating the University 7–1 at football, but upon their playing the then British university basketball champions, 'the final result, to put it mildly, resulted in a win for St. Andrews'.[35] The Unit also provided a range of educational opportunities, including instruction in foreign languages and exam preparation for the recently introduced General Certificate of Education. A rich associational subculture was spawned at the station, doubtless inspired by the diverse social mix created by National Service.[36] At the start of 1956, it was reported that 'all clubs and societies on the station are still flourishing. The Debating Society is specially active.'[37] As part of the programme of monthly trips, a group of two officers and 21 other ranks travelled to the Caird Hall in Dundee for a jazz concert under the aegis of the 'Rhythm Club'. In July that year the station sharpened its visibility in the local community by playing an active part in the revival of the 'Anster Fair' at Waid Park, during which 'The Station Pipe Band marched the procession of decorated floats from the Quay to the Fair

Ground and played a short programme during the afternoon.'[38] At the park, the station was singled out for praise by the local Provost, who remarked it was 'very gratifying that RAF Anstruther identified itself so closely with community efforts and they appreciated very highly the presence of the RAF pipe band'.[39]

Auxiliary personnel were embedded in communities, with Fighter Control Units mostly recruited locally and their activities centred on urban bases. Beyond their military training, units developed social lives with events programmes. Based at RAF Raigmore in Inverness, 3510 Fighter Control Unit's core function was to train reserve radar operators and controllers for war deployment at RAF Buchan and various mobile sites, including Keiss in Caithness.[40] Training was undertaken regularly onsite at Raigmore and using the Unit's mobile convoy equipment. Full operational training commenced at Buchan in April 1954. The Unit held regular social events, including dances with live bands. Teams competed in the local table tennis and cricket leagues, playing fellow servicemen and women from RAF Dalcross and the Cameron Barracks in Inverness. The Unit was based in the grounds of Raigmore House and, although under military discipline, at times had a club-like atmosphere. In the summer of 1953, it was proudly reported that 'A Basketball outdoor court is now in operation and much enthusiasm is already being shown in this grand game.'[41]

Generally under-resourced within the RAF, however, Fighter Control Units struggled to retain recruits willing to make the commitment. Joining the auxiliary organisations on a part-time basis had a range of attractions, particularly for women and those on a low income. Service offered the benefits of promotion and acquiring employment skills through 'trade tests' as well as an active social life and travel to summer camps around Britain and overseas in West Germany. In Dundee, 3511 Fighter Control Unit was based at Craigiebarn House with units of the Royal Observer Corps and Air Training Corps (Illus 4). Upon mobilisation for war, the Unit was to support the CEW station at Inverbervie; it undertook regular training at Anstruther and

Illus 4 Craigiebarn House, former headquarters of No. 3511 (City of Dundee) Fighter Control Unit. (Photograph by the author)

made practice interceptions on Oxford aircraft flown from No. 11 Reserve Flying School at Scone. Despite proactive recruitment efforts the Unit declined in strength during the Rotor period. Commenting on the problem, a senior officer remarked: 'Recruiting in Dundee is difficult, owing to Army competition and to low level of ability.'[42] Approvingly, he noted that a detachment had been formed at St Andrews University, consisting of women undergraduates, whom he considered 'an excellent material for radar operators'. Female recruits were urgently needed as the complement had declined from 52 aircraftwomen at the start of 1952 to only 26 in April 1955 when the university recruitment drive bore fruit. (In this timeframe auxiliary aircraftwomen outnumbered aircraftmen in the Unit.) The male contingent had likewise dwindled, a problem the Unit attempted to solve by hosting an 'At Home' open day at Craigiebarn House for pupils from Morgan Academy and placing recruitment posters on public transport in the city.[43] Faced with similar problems in Inverness, 3510 Fighter Control Unit stepped up publicity efforts in 1954, mounting a public display at a local cinema to coincide with the film *Conflict of Wings*.[44]

Although lacking in resources, the auxiliary units did succeed in attracting committed recruits and were particularly successful among women, who had more to gain from the skilled employment opportunities. As 3510 Fighter Control Unit's activity level increased, it was reported that two female fighter plotters had 'made the long trip to Stanmore Park' in Middlesex for their trade tests and been promoted to Senior Aircraftwomen.[45] The Unit was nevertheless given low priority in the allocation of equipment and eventually excluded from taking part in Fighter Command's annual air defence exercise in September 1956. By this point morale had dropped and social and educational activities had virtually ceased. When the Unit was disbanded amid wider defence cuts in February 1957, the majority of its male and female membership chose to be discharged rather than continue as RAF reservists. By the late 1950s not only had the strategic and financial picture changed, but defence technology itself was advancing along increasingly computerised and therefore less labour-intensive lines. Technical innovation reduced the need for a mass uniformed organisation with extensive infrastructure. In effect, this diminished the military's popular character and visible presence in local communities.

RADAR INFRASTRUCTURE AND DEVELOPMENT

Like all national defence projects in the post-war period, Rotor was competing for resources against other developmental needs, particularly housing and secure employment. The Distribution of Industry Act 1945 represented a sea change in government policy by establishing mechanisms for collecting more data on employment and investment that delineated Scotland as a 'region' distinct from the rest of the United Kingdom. In practice, this led to a restructuring of the Scottish economy through the promotion of new mobile light industries over traditional resource-based heavy industries (Tomlinson & Gibbs 2016: 590). Under the Act's provisions, unemployment would be tackled through the creation of regional 'development areas' wherein the Board of Trade could incentivise firms to establish new factories. By 1948, however, the Scottish share of new factory construction had slumped to under 7% of the national total (Levitt 1992: 35). In the 1950s unemployment was consistently higher in Scotland than the United Kingdom average and the Scottish economy remained overdependent on heavy industries (Peden 2005: 247–8).

Even though most Rotor sites were already in the Air Ministry's possession from the war, land was acquired for certain stations to meet new operational requirements. To solve the problem of defending the Clyde's approaches, the RAF sought to establish the Gailes GCI on land belonging to the Boots company, which planned to build a penicillin factory on the site. North Ayrshire was included in the Scottish Development Area and therefore the government considered it a priority for attracting new

factories. The RAF's plans caused disquiet even within the Air Ministry, which predicted 'the formidable opposition of no less than five Ministers' and could 'only recommend such a course if we had unassailable evidence to show that no other site was operationally acceptable'.[46] In the end, national security trumped factory jobs at Gailes, but the GCI's obsolescence in 1956 doubtless left many local people wondering why it had been built in the first place.

The Rotor programme did bring indirect modernisation to some rural areas of Scotland through the extension of electricity and other services. In its efforts to close the radar gap in Britain's north-western approaches, the RAF's plans meshed with the North of Scotland Hydro-Electric Board's rural electrification programme and provided a welcome opportunity to turn the situation to the latter's advantage. Rural electrification was uneconomic for the Board and the Secretary of State for Scotland, James Stuart, was unwilling to provide government subsidies. The Air Ministry planned to generate electricity for the new radar stations at Scarinish, Saxa Vord and Faraid Head from its own diesel power stations, connecting areas beyond the Board's reach at the time. On Tiree and Unst, the Air Ministry offered to supply the Board with up to 300 kilowatts of electricity, with a further 100 kilowatts available from the power station it proposed to build for Faraid Head (Illus 5). In the event of the Ministry no longer requiring the electricity,

Illus 5 Remnants of the Centrimetric Early Warning station on Faraid Head, 2004 (Canmore ID 257707). (Crown Copyright: Historic Environment Scotland)

the Board would have the option of purchasing the plant 'at a price to be fixed by agreement or arbitration'.[47] This deal allowed the Ministry to recoup costs if its plans changed, while maintaining goodwill in the local communities. Tom Johnston, the Board's Chairman and former Secretary of State for Scotland, visited Tiree in September 1953, where he addressed a public meeting of over 100 people which unanimously resolved that 'the Tiree District Council and the people of Tiree agree to and welcome these proposals as being fair and reasonable under the circumstances, and urge the Board to provide a supply of electricity on the Island as quickly as possible on these terms'.[48]

In 1953 the Hydro Board's new diesel power station at Gremista supplied electricity to Shetland's mainland, but none of the outlying islands was connected. The Air Ministry's scheme offered the welcome prospect of generating electricity on Unst for households and businesses. Local politicians were hopeful that a power station would catalyse the renewal of the island's mineral extraction industries, creating jobs to stem long-term depopulation.[49] Chromite was extracted at locations north of Baltasound until 1944 and a talc quarry was in operation at Queyhouse from 1945. Despite substantial exploration for chromite in the early 1950s, there was no ensuing industrial revival (Mykura 1976: 118–19). Mechanised talc quarrying endured on Unst but offered fewer job opportunities in the long run. In effect, by establishing its radar station at Saxa Vord and domestic camp and power station at Valsgarth, the RAF would become a pillar of the island economy, bringing much-needed electricity and ancillary employment.

The Air Ministry's design on the Isle of Lewis was more ambitious than the other sites, requiring the Board's help to supply up to 900 kilowatts. To provide this amount of electricity, the Board needed to expand its diesel power station in Stornoway and erect a new transmission line to Uig on the island's west coast. After negotiations, the Air Ministry agreed to make capital investments of £90,000 and £80,000 respectively in a new line from Stornoway to Uig, and also from Loch Shin to Durness to supply the CEW station at Faraid Head. Begun in 1954, the Loch Shin hydro-electric scheme was the Board's northernmost on the Scottish mainland and, upon completion in 1960, supplied electricity to Durness from Cassley power station (Payne 1988: 158–61). Increased traffic on the road from Bonar Bridge to Durness during construction of the Cassley and Faraid Head stations required additional expenditure on metal reinforcement and resurfacing, for which the Board felt the Ministry of Transport and Civil Aviation was 'letting the Air Ministry off too lightly'.[50] Although the Air Ministry's contributions to rural electrification were modest compared with the cost of the radar stations themselves, Rotor acted as a modernising force in the Highlands and Isles, driving the introduction of vitally needed infrastructure. After the RAF decided to run down the GCI station at Scarinish in 1958, the Board was able to purchase the diesel generating station at Tiree aerodrome by agreement. Diesel power remained the principal source of electricity on Tiree until the island was connected to the National Grid by submarine cable in the 1980s. Rotor's societal legacy in Scotland was thus an ambivalent one, bringing certain developmental benefits alongside lingering doubts over the state's competence as vast government expenditure was accompanied by rapid obsolescence.

CONCLUSION

Operation Rotor had profound and lasting consequences for Scotland's place within British defence doctrine. The RAF abandoned its outmoded strategic paradigm from the Second World War, reorientating Britain's air defences to face north as well as east, in recognition of the new Cold War reality. Rotor was the last significant nationally autonomous defence infrastructure project undertaken by the British state in Scotland. However, the programme's legacy was full British integration within NATO's intercontinental early warning system, in which the Buchan station was to play a pivotal role. Britain's strategic northerly reorientation combined with the parlous economic conditions to

make closer Anglo-American cooperation inevitable. As the 1950s wore on, Scotland figured increasingly in American strategic thinking as a monitoring and communications hub, and also as a base for defending the Greenland–Iceland–UK Gap and striking the Soviet Union from the north. American interest in Rotor thus foretold grander designs on a nuclear submarine base in Scottish waters in the late 1950s, an ambition born of the same strategic paradigm shift.

The Rotor period witnessed the twilight of the mass uniformed culture and collective defence ethos of the Second World War that bonded peripheral parts of Scotland to the rest of the United Kingdom. Military units like the one stationed at RAF Anstruther incubated their own subcultures but also interacted with local communities, participating in social events and stimulating economic activity. Fiscal contraction and labour-saving technological advances in radar and computing coalesced to degrade the personnel and infrastructure of the armed forces. The services' popular character waned along with their visibility in communities as a benign social presence.

The state's imposition of defence infrastructure was an ambivalent experience for many communities, particularly those that were rural and isolated. It could be a drag on resources for economic recovery or a modernising force with long-term developmental benefits. Rotor was conceived as part of a revitalised RAF control and reporting system, which could deploy fighters and guided weapons in Scotland for the Air Defence of the United Kingdom. During the late 1950s radar stations and control centres were hurriedly mothballed, along with plans for surface-to-air guided missiles to protect the skies above Scottish industrial heartlands. Abandoned buildings and camps erected at enormous cost left lingering doubts in the popular imagination over the state's competence. The dismantling of defence infrastructure, in tandem with Scotland's economic downturn in the late 1950s, undermined public confidence and fostered the sense of a withering British state that would become more pronounced in the following decades.

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NOTES

1 The National Archives of the UK (TNA): AIR 20/11154, Chiefs of Staff Committee, Defence Policy and Global Strategy, 1 May 1950, 6.
2 TNA: AIR 8/1786, Air Defence Committee, Air Defence of the United Kingdom in 1957, 1949, 9, 17.
3 TNA: PREM 11/72, 'Control and Reporting System', Report by the Inter-Departmental Working Party, 1951, 4.
4 Ibid, Appendix C, Section III G.P.O. Communications, 19, 21.
5 TNA: AIR 20/7324, Minute from Wing Commander R. W. Hase to the DD of S(P), 15 May 1950.
6 TNA: AIR 20/8192, Control and Reporting Progressing Committee Minutes, 1 November 1951, 1.
7 TNA: AIR 8/2032, Letter from Air Vice Marshal Leslie Dalton-Morris to the Vice Chief of the Air Staff, 3 January 1955.
8 TNA: AIR 20/10699, Revised Outline Plan for Operation Rotor, 1951–1953, 7.
9 TNA: DEFE 8/20, 'State of Readiness of United Kingdom Air Defences – June 1951', Note by the Air Ministry, 24 July 1951. Also known as 'Macmerry', the Second World War-era GCI at Dirleton (Canmore ID 121938) remained operational until it was replaced by the Anstruther station in 1954 with its personnel transferring to Anstruther and Buchan.
10 TNA: AIR 20/8192, Verbatim summary of meeting on 'The provision of Radar Control and Reporting cover for the protection of Glasgow and the Clyde', 24 October 1951, 4.

11 RAF 90 Group handed over the technical site at Beinn Ghott (Canmore ID 202282), north-west of Tiree's main settlement Scarinish, to Fighter Command on a 'care and maintenance' basis in November 1954. Type 80 Mk 3 radar was installed there in 1957 (see n19 below).
12 TNA: AIR 20/11318, Control and Reporting Progressing Committee, Note on Recent Points of Interest in Operation 'Rotor', 9 January 1952.
13 TNA: AIR 8/2474, Air Defence Committee, Air Defence of the United Kingdom up to 1957, April 1952, Annex II, 3.
14 TNA: AIR 8/1630, Air Council Top Secret Annex, 5 February 1953, 1.
15 The RAF camp was at Aird Uig and technical site on the Gallan Head promontory (Canmore ID 161858).
16 Storm damage posed a serious obstacle to the successful implementation of Rotor in the far north. Restoration of the Chain Home stations at Sango and Netherbutton was delayed when the 240-foot-high receiving towers were wrecked by gales in 1952.
17 TNA: AIR 8/2032, Minute from the Chief of the Air Staff to the Parliamentary Under-Secretary of State for Air, 19 January 1957.
18 TNA: AIR 8/2032, 'The 1958 Plan for the Reorganisation of the Control and Reporting System', Note by the Deputy Chief of the Air Staff Thomas Pike, 13 June 1956, 4.
19 In the original 1958 Plan the three CEW stations in the far north were to be retained along with the Buchan and Scarinish GCIs; Anstruther would become a 'satellite' control station. Before the plan was formally modified by the Air Council in January 1959, this arrangement was reduced to Aird Uig, Saxa Vord and Buchan with a new comprehensive radar station proposed at Haclait on Benbecula to replace Scarinish. The Anstruther station was closed in August 1957 and its personnel transferred to the Western Isles and Shetland. The Caledonian SOC at Barnton Quarry was run down between 1958 and 1959.
20 TNA: AIR 8/2032, 'The 1958 Plan', Note by the Deputy Chief of the Air Staff, 2.
21 TNA: DEFE 8/29, Air Defence Committee, 'Proposals for Development of Northern Radar Screen', Draft Report at Annex, 6 March 1953, 3.
22 TNA: CAB 21/3433, 'The State of the Air Defences of the United Kingdom: December 1954', Report by the Air Commander, 22 March 1955, 5.
23 Ibid, 20.
24 TNA: AIR 8/2032, Minute from E. Broadbent to the Private Secretary, Deputy Chief of the Air Staff, 11 January 1956.
25 TNA: AIR 29/2931, Operations Record Book, 409 Signals Unit, January 1956–December 1958: February 1957.
26 TNA: AIR 29/2284, Operations Record Book, 351 Signals Unit, July 1953–December 1955: August 1953.
27 TNA: AIR 29/2285, Operations Record Book, 409 Signals Unit, April 1953–December 1955: 'Exercise Momentum Narrative Report' by Squadron Leader F. R. Pusey, 26 August 1953.
28 TNA: AIR 29/2285, Operations Record Book, 409 Signals Unit, April 1953–December 1955: March 1955.
29 Army 'Knock Out' columns were on standby to reinforce the GCI stations if they came under attack. A Black Watch unit could reach Anstruther from Perth no sooner than two hours after a request was received by the 153 Highland District in Dundee.
30 TNA: AIR 29/2285, Operations Record Book, 409 Signals Unit, April 1953–December 1955: 'Report of Ground Defence Exercise at Royal Air Force Buchan on 4th and 5th May, 1954' by Squadron Leader V. A. Hester.
31 Ibid.
32 TNA: AIR 29/2284, Operations Record Book, 351 Signals Unit, July 1953–December 1955: September 1955.
33 TNA: DEFE 8/70, Future Air Defence of the United Kingdom, 30 August 1955, 2.
34 'Anstruther Burns Club: Treasurer's Defence of Burgh', *East Fife Observer*, Thursday 4 February 1954, 7.

35 TNA: AIR 29/2284, Operations Record Book, 351 Signals Unit, July 1953–December 1955: February 1955.
36 A vibrant social life existed at the nearby Joint Services School for Linguists in Crail, where national servicemen were taught Russian and other languages for intelligence work (see Elliott & Shukman 2002). Among other social interactions, RAF Anstruther played football against JSSL Crail in the Area Service League.
37 TNA: AIR 29/3032, Operations Record Book, 351 Signals Unit, January 1956–August 1957: January 1956.
38 Ibid, July 1956.
39 'Anster Fair Revival', *East Fife Observer*, Thursday 26 July 1956, 3.
40 When a separate Sector of the Isles was planned, the Unit was to be deployed at Wick GCI and the SOC and Combined Filter and Plotting Centre at Raigmore.
41 TNA: AIR 29/2184, Operations Record Book, 3510 Fighter Control Unit, January 1951–December 1955: August 1953.
42 TNA: AIR 29/2179, Operations Record Book, 3511 Fighter Control Unit, January 1956–December 1960, Appendix A – 'Report of Visit to No. 3511 City of Dundee Fighter Control Unit' by Squadron Leader H. P. Patten, 12 January 1956.
43 TNA: AIR 29/2184, Operations Record Book, 3511 Fighter Control Unit, January 1951–December 1955: June 1955.
44 Made with the cooperation of the RAF, *Conflict of Wings* (1954) gently satirises government bureaucracy as a Norfolk community resists the Air Ministry's plan to acquire an island bird sanctuary for a firing range. The film's value as a recruitment tool lay in its portraying the excitement of the jet age, with real RAF Vampires, Meteors and Swifts flown in the production. The onscreen RAF squadron is also shown in a positive light as being part of the local community and sympathetic to its cause.
45 TNA: AIR 29/2184, Operations Record Book, 3510 Fighter Control Unit, January 1951–December 1955: April 1954.
46 TNA: AIR 20/8192, 'The provision of Radar Control and Reporting cover for the protection of Glasgow and the Clyde', 3.
47 National Records of Scotland (NRS): NSE1/9, North of Scotland Hydro-Electric Board Minutes, Minute 2874, 16 September 1953, 15.
48 NRS: NSE1/10, North of Scotland Hydro-Electric Board Minutes, Minute 2889, 21 October 1953, 4.
49 NRS: NSE1/10, North of Scotland Hydro-Electric Board Minutes, Minute 3040, 20 January 1954, 16. The former MP for Orkney and Shetland, Sir Basil Neven-Spence, sat on the Electricity Consultative Council for the North of Scotland District and promoted new industries on Unst following the Air Ministry's proposal.
50 NRS: NSE1/12, North of Scotland Hydro-Electric Board Minutes, Minute 3667, 19 July 1955, 2.

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