



Society of Antiquaries
of **Scotland**

Radar in Scotland

Ian Brown

ISBN: 978-1-908332-21-9 (hardback) • 978-1-908332-25-7 (PDF)

The text in this work is published under a Creative Commons Attribution-NonCommercial 4.0 International licence (CC BY-NC 4.0). This licence allows you to share, copy, distribute and transmit the work and to adapt the work for non-commercial purposes, providing attribution is made to the authors (but not in any way that suggests that they endorse you or your use of the work). Attribution should include the following information:

Brown, I 2026 *Radar in Scotland*. Edinburgh: Society of Antiquaries of Scotland.
<https://doi.org/10.9750/9781908332257>

Important: The illustrations and figures in this work are not covered by the terms of the Creative Commons licence. Permissions must be obtained from third-party copyright holders to reproduce any of the illustrations.

OPEN  ACCESS



Every effort has been made to obtain permissions from the copyright holders of third-party material reproduced in this work. The Society of Antiquaries of Scotland would be grateful to hear of any errors or omissions.

Society of Antiquaries of Scotland is a registered Scottish charity number SC 010440. Visit our website at www.socantscot.org or find us on Bluesky [@socantscot.bsky.social](https://bsky.app/profile/socantscot.bsky.social).

Radar in Scotland 1938–46

Radar in Scotland 1938–46

Ian Brown

Society of Antiquaries of Scotland



Edinburgh

2022

Published in 2022 in Great Britain by the
Society of Antiquaries of Scotland

Society of Antiquaries of Scotland
National Museums Scotland
Chambers Street
Edinburgh EH1 1JF
Tel: 0131 247 4115
Fax: 0131 247 4163

Email: editor@socantscot.org
Website: www.socantscot.org

The Society of Antiquaries of Scotland is a Registered Scottish Charity No. SC010440.

ISBN 978 1 90833 221 9

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

Copyright © Ian Brown, 2022

The rights of Ian Brown to be identified as the author of this work have been asserted by them
in accordance with the Copyright, Designs and Patents Act, 1988.

All rights reserved.

Jacket image: RAF radar tower at Hillhead, Fraserburgh, re-imagined
(© Sue Jane Taylor, original photograph by Ewen Weatherspoon)

Foreword copyright © Sq L Mike Dean MBE, 2022

The author and the Society of Antiquaries of Scotland gratefully acknowledge funding towards
the publication of this volume from the Marc Fitch Fund and several private donors.

Typeset by Short Run Press Ltd, Exeter, Devon

Cover design by www.studiomuse.co.uk

Printed by Short Run Press Ltd, Exeter, Devon

Contents

<i>Illustrations</i>	vii
<i>Glossary</i>	xiii
<i>Note about measurements</i>	xxi
<i>Foreword</i>	xxiii
<i>Acknowledgements</i>	xxvi

PART I

Introduction	3
<i>Chapter 1</i> Radar in Scotland 1938–46	7
<i>Chapter 2</i> The Control and Reporting System in Scotland	21
<i>Chapter 3</i> Architecture of radar	28

PART II

Histories of the radar stations, radio navigational aid stations and research establishments in Scotland 1938–46	53
<i>Archival sources</i>	261
<i>Bibliography</i>	264
<i>Index</i>	267

Illustrations

PART I

1. Map of radar stations in Scotland, September 1939	10
2. Map of radar stations in Scotland, August 1940	11
3. Map of radar stations in Scotland, August 1942	16
4. Map of radar stations in Scotland, March 1945	17
5. Map of radar stations in Scotland, March 1946	18
6. Map of Northern Gee Chain stations	19
7. Aerial view of Raigmore, with Inverness Filter Room under construction in the clearing in the trees, taken on 9 May 1942	24
8. Boy's Hostel, Lerwick, used as Lerwick Fighter Sector Headquarters and between January 1941 and August 1945 for Lerwick SFR	24
9. A 70 foot transportable tower made by Merryweather, with a receiver trailer behind	29
10. A Type A Transmitter Block, from above, taken in 1945	30
11. A typical East Coast type Final CH station, with the four 350 foot steel transmitter towers and the four 240 foot wooden receiver towers	31
12. A Type A1 Transmitter Block from above, taken in 1947	32
13. Warden's Quarters	33
14. A typical West Coast type Final CH station, with the two 240 foot receiver towers and the four 325 foot transmitter masts	33
15. Type C Transmitter Block at Saligo, taken in 1996	34
16. A typical Remote Reserve site, with two 120 foot towers and the technical buildings hidden under camouflage netting	35
17. A typical East Coast CH Stand-by Set House	36
18. A Crossley electric generator inside a Power House	36
19. A Mobile Radio Unit	37
20. Drawing showing the layout of a twin-gantry, hand-turned CHL station	38
21. A single-gantry CHL with a Yagi transmitter aerial mounted on top of the receiver array	39
22. A typical 1941 Type CHL with a brick-built combined T & R Block and rotating aerial array on a 20 foot gantry	40

23. A CD/CHL station	40
24. Drawing showing the layout of a Mobile GCI station	41
25. Drawing showing the layout of an Intermediate Mobile GCI station	41
26. An Intermediate Transportable GCI station	42
27. A Final GCI station, with the Happidrome Operations Room under camouflage netting and the Type 7 aerial array	42
28. Type 15 GCI convoy technical vehicles	43
29. A Type 13 Mk I radar	43
30. A Type 13 Mk II radar, demounted and operating at a Final GCI station	44
31. A Type 14 Mk III radar at a Final GCI station	45
32. A Type 30 (Naval Type 273) Perspex lantern mounted on a ship, but identical to the lantern used at Naval CDU stations	46
33. A Type 31 radar as usually deployed, in its transportable wooden cabin	47
34. A Type 54 radar	47
35. A Type 50 radar	48
36. A Type 51 radar	48
37. A Type 52 radar	48
38. An IFF Mk III 105 foot guyed mast with cubicle	49
39. An IFF Mk III tower with cubicle	49
40. A pole-mounted aerial system for IFF Mk III at CHL stations	49

PART II

41. Vertical aerial photograph of the original twin-gantry CDU site at Anstruther, taken on 19 June 1941	54
42. Anstruther (Drumrack) site plan	56
43. Oblique aerial photo of Brenish, showing the two 120 foot towers, taken on 18 September 1942	63
44. Brenish, showing the 120 foot towers, taken in 1943	63
45. The IFF Mk III mast and building at Brenish on care and maintenance in 1946	64
46. Broad Bay, with the two 240 foot towers, taken on 18 September 1942	66
47. Burifa Hill site plan	68
48. Two of the 240 foot transmitter and receiver towers at Burifa Hill	70
49. Scene from a pantomime staged at Burifa Hill during 1942/3	71
50. 15128 GCI convoy in north-west Europe, 1945	73
51. Clett 1941 Type CHL, with a wooden hut variant on the standard combined T & R Block	75
52. Clett Domestic Site, with Symbister House overlooking the site	75
53. Clett site plan	76
54. Sketch plan of the Receiver Hut at Cockburnspath	78
55. Sketch of the internal layout of the Receiver Hut at Cockburnspath	79
56. Cockburnspath 1941 Type CHL	80

57. Flight Lieutenant B G Morgan and Flight Lieutenant Evans in front of the combined T & R Block at Cocklaw, September 1944	83
58. Cocklaw 1941 Type CHL, photographed in March 1946	84
59. Cromarty site plan	88
60. Crustan from the air, taken on 4 May 1943	90
61. Crustan Football Team, known as the Crusts, photographed in 1944	90
62. Removed from this edition	92
63. Deerness 1941 Type CHL	93
64. Deerness 1941 Type CHL with the Type 51 radar minus its paraboloid aerial	94
65. Dirleton GCI, photographed on 21 February 1950	95
66. Dirleton GCI Type 7 radar, photographed on 21 February 1950	96
67. Douglas Wood in 1939 with the Final CH transmitter towers almost complete	100
68. Alex Hunter on the 200 foot platform of one of the transmitter towers at Douglas Wood	101
69. Graf Zeppelin LZ 130, photographed by an aircraft from RAF Dyce on 3 August 1939	102
70. Image of Len Dobson from the special identity document he was issued with to gain entry to the technical buildings at Douglas Wood	103
71. One of the 350 foot transmitter towers at Douglas Wood, with the two 325 foot guyed transmitter masts which replaced the two removed towers	104
72. Douglas Wood site plan	106
73. The four steel 350 foot transmitter towers at Drone Hill, photographed in January 1942	111
74. Drone Hill Receiver Site, photographed in January 1942 from one of the transmitter towers	112
75. Leonard 'Tex' Woodhall, a member of the US Civilian Technical Corps, at the control desk of one of the transmitters inside the Transmitter Block at Drone Hill in January 1942	113
76. Transmitter Hut of the CDU station at Dunnet Head, photographed in June 1965	119
77. Dunnet Head site plan	120
78. 404 Gun Operations Room, Aikenhead House	123
79. Eorodale Domestic Site, taken on 18 September 1942	124
80. T1154 W/T transmitter used at Eorodale for communications	125
81. R1084 W/T receiver used at Eorodale for communications	125
82. Erecting the aerial frame, all done by block and tackle, planks and manpower, at Fair Isle North Transmitter Hut, early 1940	127
83. Fair Isle North Receiver Hut under construction, early 1940	127
84. Fair Isle North (AES 2) showing the results of gale damage in January 1940	128
85. Supermarine Spitfire Mk III X4501 being dismantled in 1941	129
86. Forth GCI, with the aerial array, Operations Block, and IFF tower and cubicle, taken on 31 August 1950	133
87. 403 Gun Operations Room, Craigiehall	134
88. Vertical aerial photograph of Fullarton taken on 1 August 1945, showing the Happidrome	135
89. Habost, photographed from the air on 18 September 1942, with the T & R Block and aerial arrays	141
90. Hesta Geo GCI station	143

91. <i>GB 49 806 Smiddyseat Funkstation</i> , as Hillhead was known to German Air Force Intelligence	145
92. The four 325 foot transmitter masts at Hillhead	146
93. One of the four transmitter masts at Hillhead, with the guy lines just visible	147
94. Hillhead CH station, with the four receiver towers and the transmitter masts	148
95. Hillhead Receiver Site, photographed from one of the transmitter masts in 1944	149
96. One of the receiver towers at Hillhead, showing the receiver dipole aerials mounted on supports from the tower	149
97. Hillhead Receiver Block with a receiver tower behind, taken from underneath one of the receiver towers	149
98. Guard room and Air Ministry policeman at the entrance to Hillhead	149
99. The CHL gantry and aerial array at Islivig, taken in 1946 when the station was on care and maintenance	151
100. The transmitter masts and receiver towers of Kilkenneth just visible below the nose of a Handley Page Halifax of No 518 Squadron taking off from Tiree	154
101. Kincaig CA No 1 Mk II Fire Control radar, with the paraboloid aerials visible on the roof of the T & R Block	158
102. Lamberton Moor Type 52 radar, photographed in August 1945	159
103. Lamberton Moor, photographed from the gantry of the Type 52 radar in August 1945	160
104. Gerry Funston in front of the Type 52 radar at Lamberton Moor, August 1945	160
105. Loth from the air, taken on 29 March 1941, with one tower built and a second just started	162
106. Loth site plan	164
107. General view of Mangersta, taken in 1956	167
108. Mangersta, taken in 1956, showing the main technical building	167
109. Petty Officer Mary Cochrane, the Wren described by Rolf Griffiths	168
110. Navidale site plan	170
111. The four transmitter towers at Netherbutton, taken in 1950	175
112. Netherbutton, with the four 350 foot transmitter towers and the four 240 foot receiver towers	176
113. ‘The Six Zephyrs’ (Jessie Dolan, Dorothy Cross, Doreen Doyle, Barbara Thornes, Jane McKechnie, Sibell Clay) performing in the Wings over Orkney show in 1943	178
114. North Cairn Christmas menu 1943, signed by Tony Hancock	181
115. North Cairn from the air on 25 May 1948, showing the two 350 foot transmitter towers and the two 240 foot receiver towers, with the IFF mast just visible	182
116. The last remaining transmitter tower at North Cairn about to be demolished	182
117. The last remaining transmitter tower at North Cairn about to be demolished	183
118. Noss Hill, showing the two 350 foot transmitter towers, the two 240 foot receiver towers and the stump of the 240 foot tower which snapped in a storm on 19 February 1943	185
119. Port Mor Domestic Site bell tents, taken in the summer of 1941	190
120. Roseheartly from the air, taken on 4 May 1942	193
121. Roseheartly 1941 Type CHL in 1943	194
122. Roseheartly Type 54, 1943	195

123. St Cyrus 1941 Type CHL, with the combined T & R Block and 20 foot aerial gantry, taken on 16 February 1942	198
124. Sketch plan of St Quivox, showing the layout of the technical vehicles and the proximity of the perimeter of RAF Ayr	200
125. Saligo from the air, with the two 240 foot receiver towers and the four 325 foot transmitter masts	205
126. Saligo, 1945	205
127. Leading Aircraftman L K Williams cleaning the feeder insulators on one of the 240 foot receiver towers at Saligo in 1945	206
128. Leading Aircraftman L K Williams tuning and setting up impulses on an indicator unit of the Type 100 equipment	207
129. Sango, with the 325 foot transmitter masts and 240 foot receiver towers of the CH station and the CHL station	209
130. Sango site plan	210
131. Saxavord combined T & R Block with the stand-by CHL Block in the background, taken in 1948	215
132. Looking west from the technical buildings at Saxavord with the 203 steps down to the road, taken in 1948	215
133. The combined T & R Block, taken in 1983, showing the location of the circular lantern for the Naval Type 273 paraboloids	216
134. Schoolhill site plan	218
135. Schoolhill Transmitter Block and base of tower, taken from the 50 foot platform of the adjacent tower in 1951	220
136. Schoolhill Transmitter Site, taken from the Receiver Site in 1951	221
137. Andrew Laurenson at the top of one of the 350 foot steel transmitter towers at Skaw in 1947	225
138. One of the transmitter towers being demolished at Skaw in 1947	226
139. Skaw Stand-by Set House, the back-up power station for the site, taken in 1947	227
140. South Ronaldsay 1941 Type CHL	229
141. South Ronaldsay site plan	230
142. South Ronaldsay Naval Type 277S radar (AMES Type 50)	232
143. Stanger CA No 1 Mk 3 Fire Control radar	234
144. Sumburgh, late 1939, showing the twin-gantry CDU with the receiver and transmitter	236
145. Sumburgh, mid-1941, showing the twin-gantry CDU station beside Sumburgh Lighthouse converted to single T/R aerial array	237
146. Ron Atkins practising with a Lewis gun next to the Receiver Hut and mast at Tannach in March 1941	240
147. <i>Würzburg</i> at Tantallon, March/April 1944	242
148. Reconstructed <i>Freya</i> radar aerial mounted on a standard RAF trailer at Tantallon	244
149. AMES Type 11 radar with part of the rear of the display cabin	244
150. The Law, photographed in late 1945, with the T & R Block just visible in the trees	247
151. The signal sent to No 203 MRU instructing it to close down	250

152. Westburn CD/CHL T & R Block with the aerial array and gantry removed, taken in June 1948 as work started to convert the building into a house	252
153. Whale Head from the Domestic Site, showing the two 350 foot transmitter towers, the two 240 foot receiver towers and the 105 foot IFF mast	255
154. The top of one of the 350 foot transmitter towers at Whale Head	256
155. Looking up one of the 350 foot transmitter towers at Whale Head	257
156. Whale Head site plan	258

Glossary

Admiralty Experimental Station (AES)

The cover name given to Naval radar stations.

Admiralty Signals Establishment (ASE)

The formation developing radar equipment primarily for the Royal Navy.

Advance CH (ACH)

Advance Chain Home. The first of three stages of Chain Home development, ACH consisted of stations with the equipment in huts and aerials on 70, 87, 90 or 105 foot masts.

Airborne Interception (AI)

Radar carried in aircraft used, often in conjunction with GCI, to close in on a target aircraft, usually at night.

Air Ministry Experimental Station (AMES)

The cover name given to RAF radar stations and also used for the designation of individual radar types.

Air Ministry Research Establishment (AMRE)

The formation developing radar equipment primarily for the Royal Air Force. Renamed from Bawdsey Research Station in September 1939 when moved to Dundee.

Air to Surface Vessel (ASV)

Airborne radar for the detection of shipping.

Anti-Aircraft Command (AA Command)

The British Army formation responsible for anti-aircraft guns.

ASB

Airborne radar for airborne interception, detection of surface vessels and bombing purposes. The equipment developed by the US Naval Research Laboratory.

Admiralty Signals Establishment Extension (ASEE)

An outstation of ASE.

Bawdsey Research Station

Located in Suffolk, the formation developing radar equipment primarily for the Royal Air Force. Renamed AMRE when moved from Bawdsey to Dundee in September 1939.

Buried Reserve

Back-up equipment for Chain Home stations, housed in underground buildings, which would go on the air if the main station was put out of action. Aerials were mounted on 120 foot wooden towers.

Canmore

The online database of the National Monuments Record of Scotland.

Carpet

This is a set for jamming German *Würzburg* radars operating around the 50 cm wavelength.

Cathode ray tube (CRT)

An electronic valve in which a beam of high-energy electrons is focused onto a fluorescent screen to produce a visible spot of light. With charged deflection equipment this produces a visual indication of an image or other signal.

Centimetric

Any radar operating on a wavelength of 1 to 10 centimetres. For the equipment referred to in this book, this means 10 cm radars. These had a very narrow beam of radio energy and therefore could pinpoint a target much more accurately than radars with longer wavelengths, such as the 1½ metres of CHL.

Chain Home (CH)

The principal long-range early warning radar used in the UK between 1936 and 1958.

Chain Home Beam (CHB)

These stations used GCI equipment in the early warning role, passing aircraft movements into the reporting organisation, rather than controlling fighters directly.

Chain Home Extra Low (CHEL)

An Air Ministry term for early warning radars operating on the 10 cm wavelength and able to detect very low-flying aircraft and surface vessels.

Chain Home Low (CHL)

A radar, operating on a wavelength of 1½ metres, developed by Air Ministry scientists from a set designed by the Army Cell at Bawdsey Research Station to plot ships. The RAF set up CHL stations to plot aircraft and in particular to provide better coverage against low-flying aircraft than Chain Home stations could provide. CHL also performed well on aircraft at medium and high altitudes and against surface vessels. CHL used aerial arrays which were rotated to 'sweep' over the area around the station. The short wavelength compared to CH gave much better definition, although not as good as that of centimetric radars.

Coast Artillery (CA)

The branch of the Royal Artillery responsible for anti-ship guns and gun batteries, and the equipment operated by it.

Coast Defence (CD)

Any of a variety of radars used for plotting shipping. CD radars were also capable of detecting aircraft and were mostly used for both roles.

Coast Defence/Chain Home Low (CD/CHL)

A radar operating on a wavelength of 1½ metres, similar to Chain Home Low, but to a War Office design and manned by all three services, or combinations of them. Used to plot aircraft and surface vessels.

Coast Defence U-boat (CDU)

Naval version of CHL originally designed to plot U-boats attempting to break out of the North Sea on the surface.

Commander-in-Chief (C-in-C)

The officer holding overall command of a major military formation.

Commanding Officer (CO)

The officer in command of a military unit or station.

Common Aerial Working

As the name suggests, this is using the same aerial for both transmitting and receiving, switching to receiving in between the transmitter pulses.

Educational & Vocational Training (EVT)

Courses for service personnel to help them obtain civilian work after release from the forces.

Final CH

Final Chain Home. The last of three stages of Chain Home development, consisting of stations with protected brick or concrete T & R Blocks and aerials mounted on 350 foot steel towers or 325 foot steel masts for transmitting and on 240 foot wooden towers for receiving.

Gee

A radio navigational aid which relied on the time difference from a series of pulses produced by ground stations to enable a navigator in an aircraft to calculate his position. This was not accurate enough to allow blind-bombing (dropping bombs without being able to see the target, through cloud for example) but was the first radio set to make accurate navigation over enemy territory possible.

General Post Office (GPO)

The organisation responsible during the Second World War for both postal deliveries and the telephone network in the UK.

Gibson Box

A transportable wooden cabin designed for railway transport and used to house the CD No 1 Mk VI/ AMES Type 31/ Naval Type 271 radar set.

Ground Control of Interception (GCI)

A radar station used to control fighters directly, rather than passing information to an operations room from where the fighters were directed.

Gun-laying Modified (GM)

A modified anti-aircraft gun-laying radar for use as an early warning radar.

Historical Radar Archive (HRA)

An independent archive established in 1990 to record and preserve the history of radar.

Home Chain

The chain of radar stations surrounding the UK. Not the same as Chain Home which was only one of the many different types of radar that made up the Home Chain.

Hopkins turning gear

Hand-turned mechanism of gears used to rotate CHL aerial array, an improvement on earlier hand-turning equipment which utilised a bicycle chain drive connecting the aerial array to an upturned bicycle frame with the pedals replaced by handles.

HQFC

Headquarters Fighter Command.

Identification Friend or Foe (IFF)

A system which made it possible to identify friendly aircraft. A transponder in an aircraft would send out a signal when it received a signal from a ground station. The aircraft's signal would then be received on the ground and identify it as friendly.

In Command (i/c)

The designated individual in command of a unit or station, eg NCO i/c.

Intermediate CH (ICH)

Intermediate Chain Home. The second of three stages in Chain Home development, with the equipment in huts and aerials on 240 foot wooden towers.

Line of shoot

In a Chain Home station, this was the direction in which the radio energy was strongest, although radio energy would be radiated 60° either side of the line of shoot. Chain Home Low stations were also allocated a line of shoot. Although CHL aerials rotated, their line of shoot was the direction the aerials would be pointed when they had to be lashed to the ground in high winds.

Mandrel

This set was designed to jam German radars operating at around 2½ metres, such as *Freya*, *Jagdschloss* and *Wassermann*.

Mast

A structure for carrying aerials that is not self-supporting and therefore has to be guyed for support. See tower.

Mobile Base (MB)

The name given to a series of transmitters sometimes used for mobile units but also at fixed stations.

Mobile Radio Unit (MRU)

The name given to a particular type of mobile radar unit with separate transmitter and receiver vehicles and aerials mounted on 70 foot or 105 foot masts.

Moonshine

Equipment which amplified and repeated the signal returned to the German *Freya* radar, making a single aircraft appear to be a large formation.

Motor Torpedo Boat (MTB)

A small, fast military boat equipped with torpedoes and intended to attack and sink larger vessels.

National Grid Reference (NGR)

A system of geographic grid references devised by the Ordnance Survey in Great Britain.

National Record of the Historic Environment (NRHE) formerly National Monuments Record of Scotland (NMRS)

The national archaeological database giving information about all known historic and pre-historic sites in Scotland, including radar stations. Accessed via <https://www.trove.scot/>

Naval Plotting Room (NPR)

The location used for the tracking of the movements of shipping and surfaced submarines.

Non-Commissioned Officer (NCO)

A person appointed from the ranks as a subordinate officer.

Northern Chain

One of several chains of ground stations for the Gee radio navigational aid. There were Southern, South Eastern, Eastern, Western, South Western, Northern, North Eastern and North Western chains, as well as several in Continental Europe following the invasion in 1944.

Oboe

A very accurate blind-bombing system, although limited in range. A bomber would follow the signal from one ground station, flying an arc which would take it over its target. The signal from a second station would intersect the first signal over the target, indicating to the bomber to release its bombload.

Operational Training Unit (OTU)

An RAF unit which gave training to aircrew to prepare them for operational service and prior to their posting to a front-line squadron.

Permanent Echo (PE)

The signal produced by islands, hills, etc., which did not move. These always appeared on a radar screen producing echoes which were there permanently.

Plan Position Indicator (PPI)

A radar display which produced a plan view of responses in the area, rather like a map. This made it possible for the bearing as well as range to be read directly from the radar screen.

Practice Interception (PI)

An interception carried out on a target aircraft by a night fighter under ground control for training purposes.

Radio countermeasures (RCM)

Something used to interfere with, or 'jam', radar sets, whether it be complex electronic equipment or strips of metal foil.

Radio Direction Finding (RDF)

One of the cover names given to British radar, until the word radar was adopted in 1943.

Radio Telephony (R/T)

Radio messages sent by speech, like a telephone, rather than by Morse code.

Receiver (R or Rx)

The equipment which receives the radio signal from the receiver aerials.

Receiver Fixed (RF)

A receiver at a fixed radar station, rather than a mobile unit.

Receiver Mobile (RM)

A receiver designed for mobile use, but sometimes used at fixed stations.

Remote Reserve

Back-up equipment for Chain Home stations, housed in surface buildings some distance from the rest of the station, which would go on the air if the main station was put out of action.

Royal Air Force (RAF)

The independent air force of the UK.

Royal Aircraft Establishment (RAE)

The unit created within the RAF to carry out evaluation of aircraft and equipment.

Royal Artillery (RA)

The formation of the British Army responsible for the use of artillery, including anti-aircraft guns.

Royal Canadian Air Force (RCAF)

The air force of Canada, which supported the operations of the RAF during the Second World War.

Royal Naval Air Station (RNAS)

An airfield or other station of the Fleet Air Arm, which was the air arm of the Royal Navy.

Service Police (SP)

The formation responsible for policing British armed forces personnel.

Skiatron

A type of cathode ray tube which could be projected onto a large screen in order that several people could observe the display.

Sub-Filter Room (SFR)

A small filter room which dealt with plots from local radar stations before passing the filtered information to the Filter Room at RAF Fighter Group Headquarters. This avoided congestion at the Group Filter Room.

T & R Block

A single building containing both transmitters and receivers.

Telecommunications Research Establishment

See Air Ministry Research Establishment

The National Archives (TNA)

Formerly the Public Record Office.

Tower

A self-supporting structure (and therefore not guyed) for carrying aerials. See also Mast.

Transmitter (T or Tx)

The equipment which send the radio signals to the transmitter aerials.

Transmitter Fixed (TF)

A hand-built transmitter produced by BRS staff for use at fixed radar stations until CH transmitters could be provided.

Transmitter Mobile (TM)

Prototype CH transmitters hand-built by the staff of the Bawdsey Research Station and used operationally on several stations into the early years of the war.

United States Army Air Forces (USAAF)

The air arm of the US Army, replaced by the US Air Force in 1947.

Valve transmitting (VT)

A transmitter valve.

Window

Tinfoil-coated paper strips which, when dropped from aircraft in large bundles, would produce large responses on the target radars. This could be used to either saturate the radar making all plotting impossible and neutralise the defences, or in carefully controlled amounts to make a small force appear much larger. The latter technique was used by small diversionary forces to attract German night fighters away from the main bomber force, and also to simulate approaching convoys and defending air cover on the night prior to the Normandy landings in June 1944.

Wireless Telegraphy (W/T)

Radio messages sent by Morse code, rather than by speech.

Women's Auxiliary Air Force (WAAF)

The women's branch of the Royal Air Force.

Women's Royal Naval Service (WRNS)

The women's branch of the Royal Navy. Members were known as Wrens.

Yagi aerial

A type of directional aerial invented in Japan in 1926, best known since the Second World War as the type of aerial used for domestic terrestrial television reception.

Note about measurements

All measurements are given in the units in use at the time. This is mostly imperial measurements, but metric for wavelengths. The conversions for the measurements are as follows:

1 inch = 2.54 centimetres

1 foot = 0.3048 metres

1 yard = 0.9144 metres

10,000 yards = 9.144 kilometres

1 mile = 1.60934 kilometres

1 mph = 1.60934 kph

Foreword

At a dinner at the British Camp Hotel in West Malvern, Mr A P Rowe described the first radar demonstration in England in 1935, in which he was the official government observer:¹

At a range of 13 miles a just perceptible indication was observed from an aircraft – hardly enough to be promising except to the very imaginative. Sir Robert Watson-Watt’s greatest contribution was to recognize the possibilities and to put himself willingly out on a limb by endorsing radar development as a sound program for air defence of Great Britain.

Scotsman Watson-Watt was very much the ‘salesman’ for the new emerging defensive weapon, securing finance for its development and the establishment of an Air Ministry Research Establishment, the famed Bawdsey Research Station. However, it would be A P Rowe who would oversee the exponential growth of the establishment and its management from 1938 until the end of World War Two and the moves from Bawdsey to Dundee, Dundee to Swanage and Swanage to Malvern.

This book does not follow the usual approach to World War Two radar history. Over recent decades we have grown used to the

carefully constructed linear timelines employed in attempts to explain the sequence of events which is then used as a framework upon which individual subjects are portrayed. At the other end of the spectrum is the rather myopic local history which concentrates almost exclusively on a single military location, frequently with a long life extending well into the post-war years and where contacts were maintained through reunions.

There have been many initiatives which have attempted to capture the personal experiences from World War Two. However, few of these projects have set out with such a comprehensive array of specific ‘target locations’ and corresponding personal stories. Some of the projects, such as the Defence of Britain (1995–2001), relied on armies of volunteers, many without having conducted any previous research, but who were given ready access to many official records, added to the archaeological records. The 2004 BBC’s People’s War project invited contributions from the wider public. In stark contrast, this is a research-led, dedicated self-imposed task carried out over many years without any sponsorship, yet which has brought together

¹ On 6 December 1944, as recounted by Dr John Trump, Director of the British Branch of the Radiation Laboratory.

information from across the globe related to almost every radar site in Scotland.

Arguably, a Gazetteer? Well, yes, but with a tremendous twist, not merely a list of locations but a geographical compendium which incorporates detailed research of historical records and encapsulates the personal experiences of those who served at the great majority of the locations. In summary, a unique blend of technical and social history which embraces the whole of Scotland.

Aside from the rapid evolution and construction of the many ground stations, radar brought a huge social change, not only to those recruited to operate and maintain the technical equipment and to the 'administrative tail' necessary to support and defend these new and most secret stations, but also to the small remote rural communities in the areas surrounding these installations. I recall once being told by a serving Royal Air Force Officer, a Macleod from Brenish in the Hebrides, that one of his most vivid boyhood memories was attending a film show put on by the RAF at the radar site, something never experienced before at that remote location. No doubt there were many similar 'firsts' in the remote coastal and island communities throughout Scotland.

A change in the perceived and actual threats posed, reactions to specific attacks often resulted in rapid deployments. Mobile units often arrived with little or no notice in locations where there was very little infrastructure. Having said that, areas had been visited previously to 'spy out the land' and find suitable locations, not simply for suitable radar vantage points but also to identify the essential local infrastructure and to provide contact information to enable action for land requisitioning, access roads, the ordering of electricity supplies and landlines. In the war years, once a specific location was identified a 'Siting Signal' was prepared,

giving the essential information against coded headings from 'A' to 'Q': Station name, Station Number, Grid Reference, Postal Address, Height above Sea Level, Nearest Electricity Power Supply, Nearest Telephone Line, Reporting line to ... station, Exchange line to [GPO] exchange, Parent Unit recommended, Billeting or Accommodation available at ..., Nearest Railway Station, Road Access, Water Supply, Sanitation facilities, Mean line of shoot recommended, Establishment recommended. The Siting Signal was then submitted for Air Ministry approval and subsequently to trigger actions in the Directorates of Signals, Works and Organisation. Co-ordination was often necessary with other military and civil organisations: seemingly vacant locations were being earmarked for other installations – the Aerodrome Board frequently raised objections to the erection of tall masts and towers adjacent to proposed or existing airfields. Another body that occasionally featured with objections were the War Agricultural Committees who wanted to retain the best agricultural land.

The Directorate of Communications Development (DCD) became involved in the setting up of the static permanent stations, specifying the Technical Buildings required and if stand-by power was needed. Accommodation for the radar station personnel and guards were also serious considerations, often requiring the requisitioning of separate domestic and guard force sites.

Not every station was given a geographically obvious name. Where is Borve Castle? Well, such a castle did exist; however, in 2000, during a visit to Benbecula, I discovered 'Borve Castle' was also the name of the house immediately adjoining the old radar site.

Perhaps the most significant factor that provided a starting point for the collection of the personal stories was the 1990 initiative

to hold a World War Two Air Forces Radar Reunion. The invitations to the first event, held in Coventry in 1991, included a career form, and ultimately some 2,400 career summaries were returned from a wide variety of backgrounds. The 1991 event was attended by some 760 radar folk, which total included significant numbers from Canada, Australia, New Zealand and the USA. 'Station Lists' prepared for the event, whilst of great interest to the attendees, provided a stepping-off point for the tremendous effort which has gone into the collection of the personal accounts that shed light on life at the many Scottish radar locations.

Radar only existed at some locations for relatively short periods and with small numbers in the crews, so it is quite exceptional to have been able to gather a multitude of personal accounts, many of which, such as that recorded at the Chain Home Low station at Gaitnip in the Orkneys, provide vital clues as to the nature of the station, the local conditions and dependence on limited transport and billeting in the nearby town. Later in the war, desperate shortages of trained men to meet overseas commitments would result in many station closures, and, where conditions were judged

to be suitable, WAAFs were substituted to release men for overseas service. For example, significant numbers of WAAF served at Netherbutton in the Orkneys and on the Gee Radar Navigation Aid (RNA) stations such as Windy Head Hill and Burifa.

There were several initiatives to obtain manpower skilled in electronics from overseas. The Dominions of Australia, Canada and New Zealand were requested to allow their citizens to be recruited and trained before sending them to the UK. Significant numbers were commissioned and commanded RAF units at home and overseas. In the USA we recruited radiomen and many other trades into the Civilian Technical Corps. Another major scheme evolved before the USA became involved in the war, whereby officers of US Army Signal Corps came to Britain for a six-month attachment with the RAF and the Army to receive training and experience on radar – this was the Electronics Training Group. Many of these officers served on ground radar stations throughout the UK.

Squadron Leader Mike Dean (retired), MBE
Founder of the Historical Radar Archive

Acknowledgements

This book could not have been written without the assistance and support of a considerable number of people. To everyone who has helped me in the course of my research I extend my deepest thanks and my apologies to anyone I may have inadvertently left out.

Top of any list has to be Mike Dean, MBE. It was Mike who originally established the Historical Radar Archive in 1990 to record and preserve radar history, and his vast knowledge was able to set me on the path towards compiling this book. Mike is a good friend, excellent researcher and something of a mentor to me, and without his efforts there would be very little accurately recorded information on the contribution of radar to history. I also wish to record my great debt to the late Bill Morton-Hall. It was Bill who answered my many questions in the early years of my research and who put me in contact with Mike in the first place. Bill's contribution to my research has also been enormous and he is greatly missed.

Also of great importance to my research over the years have been two researchers that by good fortune have been based in southern Scotland, and therefore within fairly close proximity. As a result, many discussions have taken place which have thrashed out lots of ideas and corrected many of the errors which might otherwise have appeared in these pages. Any remaining errors are mine, but without the help and friendship of Mike Bragg and Ian

Shaw this book would probably not have been written.

Many other researchers have been of considerable assistance over the years, both as regards radar itself but also for aspects of the applications of radar in the three services and wider military history. I particularly wish to thank the following for their great help: Martin Briscoe, Gordon Carle, John Guy, David Hanson, Mike Hughes, Andrew Jeffrey, Rodney Long, Malcolm Macdonald, Peter MacDonald, Ron Morris, Nick Morton, Harry Moyle, Douglas Sinclair, Leslie Smith, Ian Stott, Ray Sturtivant, Len Thomas and Tony Wintringham.

I found the RAF Commands website, at www.rafcommands.com, especially valuable during my research. It has an excellent forum frequented by many researchers with a detailed knowledge and a friendly and patient manner. I'd like to thank all those who have helped me via this website and, in particular, Keith Bryers, Chris Charland, Linzee Druce, Hugh Halliday, Scott McIntosh, Ross McNeill, Errol Martyn, Chris Pointon and Henk Welting.

Exceptional thanks go to the many wartime radar personnel, their families or others who have been connected with this story who have so kindly written accounts of their experiences and/or allowed me to copy their papers. It has not been possible to include within these pages all of the thousands of people I have met or corresponded with. Nonetheless, all

their contributions are held in the Historical Radar Archive for future generations and I am deeply indebted to everyone who has assisted me in this way. However, I do wish to thank the following, or their families, for allowing me to use their material in this book: Margaret Allan, Eric Anderson, Jim Atkinson, Bill Badcock, Jack Baigent, Hugh Barkla, Wylie Barrett, Frank Boyanoski, Tony Bridgewater, Eric Brittin, K G Budden, Cyril Burke, Meg Butler, Paul Carment, Murray Cass, Alison Catto, E H Cooke-Yarborough, Eric Crofts, Ron Dean, Len Dobson, Wilma Duguid, Clifford Evans, Mike Exeter, Richard Feachem, Eric Folkson, Gerry Funston, John Glen, Rolf Griffiths, Peter Harrild, Peggy Haynes, Mark Hodges, Betty Hogg, Jack Hughes, William Inglis, Sidney Jefferson, Kenneth Lampard, Doug Lee, Charles Lochrie, George Lowrie, B C Lyons, John McKee, Frank McCann, F F M McClean, Len MacMillan, Quinton MacMillan, J Marwick, Jean Montgomerie, Joy Moore, B G Morgan, Norman Murphy, Hubert Nettleton, George Oberman, Alan Patrick, Geof Peach, Doris Pearce, Bill Penley, William Pettifer, Ernie Pickles, Margaret Quinn, Keith Remington, W S Robertson, George Ross, J Shackleton, John Sharp, Bruce Stenhouse, Bob Stuart, Jesse Supper, Jerry Taylor, Al Tunis, Rennie Whitehead, Desmond Whitehouse, John Wightman and Maurice Wilkes.

I would also like to thank most sincerely the following organisations and individuals, or their families, who have allowed me to use their photographs or other images within the pages of this book: Historic Environment Scotland, Imperial War Museum, The National Archives, Orkney Library & Archive, Orkney Wireless Museum, Royal Air Force Museum, Whalsay Heritage Centre, Alan Aitken, David Arnott, Wylie Barrett, Ray Bennett, Gordon

Carle, Murray Cass, Sibell Clay, Elizabeth Cooper, Jim Corbett, Dennis Coutts, Ron Dean, Jim Dimond, Len Dobson, Richard Feachem, Kenny Foubister, Gerry Funston, C P Hillesley, Mike Hughes, Alex Hunter, Bob Jenner, Andrew Laursen, Frank McCann, J A Macdonald, Quinton MacMillan, B G Morgan, Ron Morris, Tom Murchie, Robert Newstead, Eric Parker, Ken Peacock, Len Pittendrigh, Joe Pratt, Thomas Reid, Frank Roberts, George Ross, Jim Russell, John Sharp, Bill Smith, Freddie Smith, Al Tunis, Frederick L Watters and Joe Wilkie.

Particular thanks are due to Allan Kilpatrick of Historic Environment Scotland, who created the wonderful maps and remained patient and understanding during the many revisions.

I am also greatly indebted to the following archives for allowing me to quote from documents in their care: Dundee District Archive and Record Centre and The National Archives.

Thanks are also due to the following publishers for allowing me to quote extracts from their books: Cambridge University Press (*One Story of Radar* by A P Rowe), F Hayward (*1939 and All That and Other Tales* by L W D Pittendrigh), Ian Allan (*Air Defence of Great Britain* by John R Bushby), Institute of Physics Publishing (*Radar Days* by E G Bowen), MIT Press (*Memoirs of a Computer Pioneer* by Maurice Wilkes), Peter Peregrinus Ltd (*Radar Development to 1945* edited by Russell Burns) and Putnam Aeronautical Books (*Fighter Command* by Peter Wykeham). Thanks also to the editors of the following who allowed me to quote from their periodicals: *The Courier*, *The Orkney Blast* and *The Orkney View*.

Every effort has been made to establish the copyright holder, and obtain their permission, for material used in this book. In some cases

this has not been possible. For example, on many stations one person would take a photograph and copies would be distributed to everyone on the unit. One of these copies is later given to the Historical Radar Archive, but not necessarily from the photographer. No one remembers who the photographer was. If this has happened, and you believe you hold copyright for any material reproduced herein, my sincere apologies. Please get in touch in

order that due acknowledgement may be given in a future edition.

Last, but by no means least, I want to thank my parents and my wife, Anne, all of whom have supported me throughout the years of research and writing. I hope that, seeing the final product, Anne feels this has been worth it. She has certainly been used to me disappearing to spend most of the day in front of the computer!