

**RESTRICTED**

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THE SECOND WORLD WAR

1939-1945

ROYAL AIR FORCE

# SIGNALS

VOLUME I

ORGANISATION AND DEVELOPMENT

VOLUME II

TELECOMMUNICATIONS

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1958

**RESTRICTED**



**VOLUME I**  
**ORGANISATION AND DEVELOPMENT**





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## CHAPTER 1

# ORGANISATION OF THE SIGNALS BRANCH AT THE AIR MINISTRY

In the years 1919 to 1935 the responsibilities of the Signals Service of the Royal Air Force grew progressively wider as the use of wireless in the Service increased. The Signals Service was originally responsible for providing the means for signalling by wireless telegraphy, radio telephony, and visual and sound signalling. Communications were maintained between ground stations and aircraft, aircraft and aircraft, aircraft to stations operated by other services, and point-to-point ground stations for general R.A.F. communications purposes. The responsibility for the organisation of line communications also lay with the Signals Service, who directed their provision through the General Post Office (G.P.O.) at home and the local post and telegraph service or the Army Signals Service overseas. The Signals Branch at the Air Ministry then formed part of the Directorate of Organisation and Staff Duties in the Department of the Chief of Air Staff. The Head of the Signals Branch, as he was known, was responsible to the Director of Organisation and Staff Duties for the organisation and efficient working of all R.A.F. signals communications, and to assist him in carrying out these responsibilities he had a staff organisation at the Air Ministry, and at commands, groups, wings and squadrons signals officers were appointed whose duty it was to organise their unit or formation signals activities as laid down by the Air Ministry Signals Branch.<sup>1</sup>

In January 1935 the importance of the Signals Service in the operational commitments of the R.A.F. was more fully recognised when the Air Ministry Signals Branch was placed directly under the control of the Chief of the Air Staff.<sup>2</sup> An extra burden had been laid on the Signals Branch by the extension of the wireless direction finding (D/F) system. In November 1935, at the Second Annual Conference on Direction Finding, it was agreed that a D/F central control organisation should be formed in the Signals Branch at the Air Ministry. New duties were the co-ordination of D/F services, the development of fighter High Frequency Direction Finding (H.F. D/F) organisation, the development of bomber D/F organisation, D/F development, liaison with the Directorate of Technical Development and the Navigation School, and the co-ordination of civil and Service D/F in connection with the cloud flying organisation. The D/F organisation of the R.A.F. provided for the establishment at home of about 62 D/F stations. Staff of the Air Ministry Signals Branch had to advise on such questions as the siting and layout of buildings and the provision of the necessary wireless equipment and personnel. By January 1936 preliminary experimental work had begun at six stations, but progress was slow because of the pressure of

<sup>1</sup> A.M. File A.10223.

<sup>2</sup> A.M. File S.24630.

other duties.<sup>1</sup> The Chief of the Air Staff decreed that the D/F system was to be fully operative by 1 April 1939; and when in January 1936 the Head of the Signals Branch<sup>2</sup> proposed that the branch be granted the status of a Directorate, the extension of the D/F organisation was the most important factor in inspiring this request, although there were others. The general Service and civil aviation responsibilities of the branch had increased, necessitating reorganisation and the establishment of new posts. The Head of Signals dealt with the Chief of the Air Staff, the Director General of Civil Aviation and directors in the Air Ministry, as well as similar officials in other government departments. He was the senior Air Ministry representative on the Wireless Board and on the Imperial Communications Sub-Committee of the Committee for Imperial Defence. The Head of Signals had been an officer of air rank since June 1925 and this was the only Air Ministry appointment of air rank which was not a directorship. Finally, the Head of the Branch considered it necessary to strengthen the position of the Signals Branch in respect of civil aviation for the purpose of dealing with international conferences. There was some Treasury opposition to the proposal to give the post the status of director on the grounds that this would give it higher standing than equivalent posts in the Admiralty and War Office. The Air Ministry viewpoint was that their Head of Signals was responsible not only for the Service Signals organisation and problems but also for all communications questions dealing with civil aviation. On 9 April 1936 Treasury approval was given to the request that the Signals Branch be upgraded to a Directorate. At the same time increases in staff were authorised.<sup>3</sup>

### **Increase in Responsibilities**

The expansion of the R.A.F. and its communications systems continued, and further increases in the responsibilities of the Director of Signals (D. of S.) resulted. The Director was now responsible for the organisation and administration of the signals services of the R.A.F. and the British and Empire air routes, for all matters of policy governing the planning of landline schemes, for the development of wireless research to meet Service needs, for the signals layout of operations rooms, for wireless aids to navigation and blind landing, for liaison with the other Services, and for representation on international communications conferences and various sub-committees of the Committee for Imperial Defence. He also had to keep himself fully acquainted with the operational side of the signals organisation by visiting commands and attending exercises. His responsibilities now covered such a wide field that it was no longer possible for him to deal personally with all matters referred to him for decision or to attend all the conferences on which he was supposed to serve. As a result he was forced to find a deputy to whom he could delegate many of these tasks.

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<sup>1</sup> A.M. File 372310/34.

<sup>2</sup> Air Commodore J. B. Bowen.

<sup>3</sup> A.M. File S.24630. See Appendix No. 1 for details of the organisation of the Air Ministry Signals Directorate in October 1936.

The choice fell on the Head of Signals 1. On 8 July 1938 the D. of S. requested that the post of Head of Signals 1 be upgraded from wing commander to group captain and designated Deputy Director of Signals (D.D. of S.), the justification being that an officer who might have to make important decisions and attend high-level conferences on behalf of the D. of S. should be given the status of deputy director and a rank commensurate with his responsibilities. The suggestion was opposed at first by the Treasury, but on further representations by the Air Ministry the Treasury finally agreed in January 1939.<sup>1</sup>

In April 1939 the Head of Signals 3 was designated an Assistant Director. This was done to indicate the important nature of the post, which was filled at that time by a retired R.A.F. flight lieutenant who was in almost daily contact on detailed signals matters with the G.P.O. and other government departments and R.A.F. commands and units. When this retired officer was first appointed to the post in June 1935 his duties had been to draw up plans for wireless stations for air defence and intelligence purposes and to organise their establishment, but in April 1937 the responsibility for landline communications was added. With the number of new R.A.F. stations being established, many new landline needs arose. Many of the new direction-finding stations were linked by landlines. Technical problems arose in connection with the use of teleprinters and voice-frequency channel apparatus, while the need for special types of exchanges to facilitate the connection of highly-technical control equipment added to the difficulties. The increase in the number of London and provincial balloon stations also swelled the landline commitment.<sup>2</sup>

The history of the Air Ministry Signals Directorate in the years 1939 to 1945 is one of continuous growth in conjunction with the expansion of the Royal Air Force and the increasing use of signals equipment, particularly radar. The outbreak of war in September 1939 increased the work of the Signals Directorate at the Air Ministry in a number of main directions. In the first place, there were special wartime commitments, the control of broadcasting transmissions in so far as they affected operations, the organisation of a pigeon service, and the organisation of an Air Despatch Letter Service (A.D.L.S.) and a Land Despatch Rider Letter Service (D.R.L.S.). Secondly, the expansion of the R.A.F. increased the administrative detail in connection with the Air Ministry wireless stations, the signals schools and the generally increased signals organisation. No outside formation existed to cope with the administrative work. Thirdly, there was considerable additional work in connection with the organisation and signals aspect of radar; wartime needs accelerated the urgency of the demand for ground and air equipment.

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<sup>1</sup> A.M. File S.45449.

<sup>2</sup> A.M. File 854402/38.



In December 1939 the D. of S. defined the existing and future responsibilities of the Signals Directorate. The first was all matters of communications policy affecting the R.A.F. and civil aviation; second, the organisation and administration of all signals services for the R.A.F., civil and Empire air routes; third, the organisation of aircraft W/T safety and navigational services. Other responsibilities included the organisation of the Air Movement Reporting Service and ancillary Wireless Reporting Services; policy and requirements of aircraft and ground signals apparatus both for the R.A.F. and civil aviation; the technical administration of the radar service; the control of radio transmission on behalf of the Cabinet; the organisation of the National Pigeon Service; and visual signalling methods.

Radar, because of urgent wartime operational needs, proved one of the major burdens of the Signals Directorate. By the end of December 1939 the radar system had passed from the experimental stage, during which the greater part of the provision was made by the Director of Communications Development, and become a Service provision for which the D. of S. assumed responsibility. During the winter of 1939/1940 the radar organisation was built up and expanded rapidly. Work included the siting of new stations at home and overseas, the recruitment and training of suitable personnel, the determination of priorities as between conflicting claims for further equipment, liaison with commands and Air Staff directorates on the operational use of radar, and the co-ordination of technical requirements. The Deputy Directorate of Signals 1 was responsible for this. On 23 February 1940 the expanded responsibilities of the Directorate were recognised by the creation of another branch within the Directorate to undertake all matters connected with radar. This was known as Signals 4 and was responsible for radar policy at home and overseas, the organisation of radar systems at home and overseas, the technical administration of radar through a newly-formed radar group, and technical questions affecting all types of radar equipment.<sup>1</sup> The Signals Directorate was now organised into three 'signalling' sections and an R.D.F. section.<sup>2</sup>

Further reorganisation within the Air Ministry reflected the increasing importance of the branch. On 14 February 1940 a post of Principal Deputy Director of Signals (P.D.D. of S.), in the rank of group captain, was established to deputise generally for the D. of S.; it was no longer possible for the Head of Signals 1 to be an efficient deputy and still control his own department. The functions of the P.D.D. of S. were to represent the D. of S. at

<sup>1</sup> A.M. File S.57902.

At this date R.D.F. installations were:—

No. of Chain Home and Chain Home Low stations	...	...	32
No. of overseas stations (mobile and preliminary)	...	...	8
Airborne R.D.F. in an embryonic stage			

(A.H.B./IIE/65).

<sup>2</sup> See Appendix No. 2 for details of the organisation of the Signals Directorate in February 1940.

important conferences, co-ordinate the work of the various signals branches, and in particular be responsible for the work of a small planning section. This post was authorised because of the steadily increasing strain which had been thrown on the D. of S. since the outbreak of war.<sup>1</sup>

### Formation of the Signals Groups

Two further measures, urged for some time by the D. of S., lightened the burden of the Air Ministry Signals Directorate; these were the formation of two signals groups, Nos. 26 and 60, in February 1940. No. 26 Group was formed to control all R.A.F. wireless stations and signals training establishments, all movements by air inside and outside the United Kingdom, the installation of all wireless equipment and the modification of all station and aircraft wireless equipment.<sup>2</sup> No. 60 Group was formed to assume technical and administrative control of the radar chain and its subsidiary maintenance and installation units.<sup>3</sup> The formation of these two groups meant that the Air Ministry staff were relieved of the routine responsibility of domestic administration of the wireless and radar organisations, and were free to concentrate on policy matters.

The work of the Signals Service increased throughout 1940 and by July 1940 was considered so important that the appointment of an Assistant Chief of the Air Staff (Radio) (A.C.A.S.(R)) was authorised. It was agreed that the post was one for an air vice-marshal but, as the Air Ministry wanted Air Marshal Sir Philip Joubert to fill it, the Treasury permitted it to be graded as an air marshal's post during his tenure of office. The A.C.A.S.(R) was responsible for the work of the Directorate of Signals and of the Scientific Adviser on Telecommunications and was specifically charged with maintaining a close liaison with the Ministry of Aircraft production in matters connected with radio research and development. He reported direct to the Chief of the Air Staff and was concerned primarily with questions of high policy connected with radar. Air Marshal Sir Philip Joubert had been closely connected with radar questions as Adviser on Combined Operations. At the same time as the post of A.C.A.S.(R) was established, the post of Director of Signals was upgraded from air commodore to air vice-marshal and that of Principal Deputy Director of Signals from group captain to air commodore. Under the D. of S. there were three deputy directors and two assistant directors.<sup>4</sup>

In June 1940 V.C.A.S. agreed to the immediate setting up of a new section in the Directorate of Signals to deal with the organisation and application of radio countermeasures (R.C.M.) to enemy radio navigational and communication systems. The formation of the R.C.M. section was urged by the Prime Minister himself.<sup>5</sup>

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<sup>1</sup> A.M. File S.57902.

<sup>2</sup> A.M. File S.65342.

<sup>3</sup> A.M. File S.59512.

<sup>4</sup> A.M. File S.57902.

<sup>5</sup> A.H.B./IIE/243/2/4 and A.M. File S.5382.

### Creation of Second and Third Director Posts

By the spring of 1941 the growing importance of signals and radar in relation to all phases of R.A.F. operations, and particularly to air defence, necessitated a further review of the Air Ministry signals organisation. The weakness of the existing organisation was that it placed too heavy a burden on the D. of S. and the P.D.D. of S. In April 1941 it was proposed that the post of Director be upgraded to Director General and that of P.D.D. of S. to Deputy Director General without change of rank, and that two director posts of air commodore rank be added. The abolition of A.C.A.S.(R) was proposed. Approval was given to the creation of a Director General of Signals (D.G. of S.) in the rank of air vice-marshal and of two air commodore posts, Director of Signals and Director of Radio (D. of R.). The proposal to create a post of Deputy Director General was not approved, the Treasury view being that the two directors would be of sufficient status to assume much of the responsibility that would otherwise fall to the D.G. of S. The post of A.C.A.S.(R) was abolished.

Even after the creation of two directorates within D.G. of S. the burden falling upon the Director General was very great. He had to take responsibility for matters beyond the powers of the two directors and also give personal attention to the planning and organisation of Signals and the direction of radio countermeasures. These two important aspects could not be divided between the two existing directors without overloading them. On 9 June 1941, therefore, the Treasury approved an Air Ministry request for the creation of a third director post in D.G. of S. This reorganisation meant that the Directorate General consisted of the Director General and Inspector of Signals—one air vice-marshal—and three directors of the rank of air commodore. The Director of Signals was responsible for signals planning, radio countermeasures, and W.A.A.F. Signals; the new Director of Telecommunications (D. of Tels.) was responsible for telecommunications, signals security, and publications; and the Director of Radio was responsible for all radio matters including radar. Of these three the D. of S. acted as the senior director and in the absence of a post of Deputy Director General virtually assumed that position. His responsibilities were increased by the fact that in April 1941 the Director General had become Director General and Inspector of Signals (D.G.I.S.), and in order to fulfil his secondary function travelled extensively. On 12 March 1942 the load on D. of S. was lightened by the establishment of an additional group captain post within the Directorate.<sup>1</sup> In October 1942 the title of Inspector was dropped from that of D.G.I.S.<sup>2</sup>

In January 1942 a change of nomenclature in the R.A.F. Signals Service was ordered because of the confusion which had been caused especially in

<sup>1</sup> A.M. File S.57902.

<sup>2</sup> The title 'Director General and Inspector of Signals' was peculiar to Air Vice-Marshal C. W. Nutting. With the appointment of Air Vice-Marshal V. H. Tait as successor to Air Vice-Marshal Nutting the title became Director General of Signals. (A.H.B./IIE/44).



dealings with Canada and the U.S.A. by the Services' use of the term 'radio' in specific reference to Radio Detection and Direction Finding (R.D.F.). The Chiefs of Staff ruled that the term should no longer have that special meaning but should re-assume its normal wide interpretation as an inclusive term for all forms of ether propagation. R.D.F. was to be referred to as such except that in public announcements the term 'radio-location' might be used. The Director of Radio therefore became Director of R.D.F. and similar changes of nomenclature were made for radio schools and signals branches and trades.<sup>1</sup>

During 1942 the work of the Directorate of Telecommunications particularly increased. In January 1943 the section known as Tels. 3 was upgraded to a Deputy Directorate because of the increase of work. When D. of Tels was formed in June 1941 Tels. 3 had been responsible for landline and W/T point-to-point communications, but during 1942 it acquired several additional commitments. These were ground D/F stations and ground Very High Frequency (V.H.F.) stations, mobile wireless stations including co-ordination of vehicle problems for the whole of the Directorate General, problems relating to operations rooms, particularly for combined operations, co-ordination of apparatus required for special projects delegated to the Air Ministry by the Chiefs of Staff, and special telecommunications requirements for the U.S.A.A.F. and Ferry Command.<sup>2</sup>

The phenomenal development of different types of radar equipment and the continued application of the use of this new technique to all aspects of flying during 1941 and 1942 necessitated a reorganisation and expansion in D.G. of S. In the first place the application of radar technique to radio navigational aids had revolutionised that aspect of signals work. When Medium Frequency Direction Finding (M.F. D/F) and other such systems using communication principles were the main radio navigational aids, responsibility for them fell to D. of Tels. With the advent of Gee, Gee-H, Oboe and H2S,<sup>3</sup> all methods employing radar technique, the work became the concern of the Director of Radio Detection and Direction Finding (D. of R.D.F.), and in March 1943 pulse navigational aids became his responsibility also. To compensate for the removal of pulse navigational methods D. of Tels. took over responsibility for R.C.M. and anti-jamming measures. These had come under the aegis of the D. of S. but that Department was already overloaded; also, when Air Commodore O. G. W. G. Lywood had been D. of S. he had been particularly interested in that branch of signals and wanted to watch its development closely. The Directorate of Signals still had widespread responsibilities; these were for signals planning, signals

<sup>1</sup> A.H.B./IIE/44.

<sup>2</sup> A.M. File A.416087/42.

<sup>3</sup> Gee—Medium range radar aid to navigation employing ground transmitters and airborne receiver.

Gee-H—Radar blind bombing system which used 'Gee' equipment in conjunction with airborne transmitter and two ground beacons.

Oboe—Ground controlled radar system of blind bombing in which one station indicated track to be followed and another the bomb release point.

H2S—Airborne radar navigational and target location aid.

security, codes and cyphers, and signals personnel. Of these, signals planning was the most important, and the work on this side was increasing because the R.A.F. was going over to the offensive. The Director was responsible for the preparation of co-ordinated signals plans for the whole Directorate General. In addition, D. of S. was required to act as Deputy to D.G. of S.

The reorganisation of March 1943 affected the work of D. of R.D.F. to the greatest extent. Increased staff were required not only because of the transfer of pulse navigational aids from D. of Tels. but also because in general many new radar equipments were being developed and put into operational use. Not only was the number of equipments increasing but they were becoming technically more complex.<sup>1</sup> Questions of operational application and installation were more involved.

Some criticism of the Directorate of R.D.F. (D. of R.D.F.) was made in that there was a tendency for the staff to deal with executive matters which ought properly to have been the function of the signals groups and to concern themselves with matters of progressing of equipment and supplies. The suggestion of an overlap between D. of R.D.F. and No. 60 Group was refuted but it was agreed that the rapidity with which new radar devices were produced tended to centralisation of control. At that time D. of R.D.F. was under considerable pressure from the Prime Minister and Secretary of State, which made it inevitable that branches of the Directorate should do provisioning and progressing work not normally done by Air Staff branches. In March 1943, therefore, the creation of a second deputy directorate within D. of R.D.F. was authorised.<sup>2</sup> In June 1943 further staff increases were authorised because of new commitments. These were the extension of the Loran chain to India, the investigation of radar needs for the Far East theatre in preparation for post-European war operations, the acceleration of two new A.I. projects, anti-jamming devices for Fighter Command, the advent of the automatic gun laying turret (A.G.L.(T)) and Fishpond,<sup>3</sup> and requirements for the new Tactical Air Force.<sup>4</sup> On 14 July 1943 a D.G. of S. memorandum announced that the Directorate of R.D.F. was to be renamed the Directorate of Radar (D. of Radar). This was the result of an inter-Allied and inter-Service agreement that the term 'radar' should supersede other terms such as 'R.D.F.' and 'radiolocation' in reference to pulse technique and its applications.<sup>5</sup>

In November a new section was established in the Directorate General of Signals. It was known as Signals 7 and was controlled by a wing commander directly responsible to the Director General.<sup>6</sup> It had two main functions:

<sup>1</sup> A.M. File A.416088/42.

<sup>2</sup> See Appendix No. 3 for details of organisation of the Directorate General of Signals in April 1943.

<sup>3</sup> Indicator unit used in H2S fitted aircraft to give warning of the presence of other aircraft below the horizontal plane of the aircraft.

<sup>4</sup> A.M. File A.416088/42.

<sup>5</sup> A.H.B./IIE/44.

<sup>6</sup> A.H.B./IIE/44.

the co-ordination of policy and operational requirements for signals installations in aircraft, and the statistical analysis and co-ordination of action on signals equipment defect reports. Of these the first was the more important because at that date the installation position was highly complex. This was because responsibility was divided between the Air Ministry and the Ministry of Aircraft Production (M.A.P.). Difficulties arose in co-ordinating the work of installation, and effective progressing was difficult to achieve. Within the Directorate General of Signals no one had previously been made responsible for co-ordinating the policy for fitting telecommunications, radar and radio countermeasures equipment into aircraft. The evolution of the equipment was the responsibility of D. of Radar or D. of Tels. and they submitted their requirements independently. This led to difficulties with the Director of Operational Requirements (D.O.R.) and the Aircraft Equipment and Airframe Modification Committee. It had originally been intended that D. of S. and D.D. of S. should co-ordinate the work of D. of Tels. and D. of Radar and it was for this reason that the establishment of the post of D.D. of S. had been allowed, but since the date of that establishment the operational planning work had increased considerably.

The new section was responsible not merely for fitting together the proposals of D. of Tels. and D. of Radar: the whole range of signals equipment existing and under development in relation to the operational functions of individual types of aircraft had to be considered. The section was further responsible for producing aircraft radio installations and operating plans which, besides meeting the requirements of the operations staff, had regard to the signals conditions likely to be encountered, such as interference by deliberate jamming. The production possibilities of new equipment in relation to the aircraft programme also had to be considered. The new section had to control from the installation standpoint the frequent 'crash' introduction of highly important operational advances in radar technique.

The secondary function of the section was to deal with equipment defect reports. D.G. of S. had the subject reviewed by a committee, and on the basis of recommendations he brought into force in June 1944 throughout the R.A.F. a new reporting procedure designed to secure a greater number of reports and the requisite information for proper statistical analysis and technical investigation.<sup>1</sup> A function later added to Signals 7 was the formation and maintenance of a technical library to be available for reference by other branches of the Directorate General. It included all Secret Document publications relative to signals equipment, air publications, including those covering U.S. Army requirements bearing on signals matters, information and advance technical memoranda, W/T instrument lists issued by the Royal Aircraft Establishment (R.A.E.) and the Telecommunications Research Establishment (T.R.E.), Aircraft Equipment and Airframe Modification Committee papers, aircraft Appendices 'A' (Radio Schedules) and amendments, and 'Consisting of' schedules for all Airborne Radio Installations (A.R.Is.).<sup>2</sup>

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<sup>1</sup> A.M. File A.416086/42.

<sup>2</sup> A.H.B./IIE/44.

## Expansion and Reorganisation

During 1943 the work of the Directorate General of Signals continued and became more complex, mainly because the R.A.F. was going over to the offensive. In August 1943 the Directorate of Telecommunications was expanded. The advent of the U.S.A.A.F. to the United Kingdom increased the work of the Directorate because the Americans made great use of the telephone and their landline requirements were heavy. Also the concentration of Fighter Command sectors and groups meant reorganising the appropriate landline system. Finally, the Chief of Combined Operations had asked the R.A.F. to take on the design, layout and construction of the operations rooms and communications for three new major underground combined operations headquarters.<sup>1</sup>

### Formation of No. 100 Group

In October and November of that year considerable reorganisation took place in the Directorates of Signals and Telecommunications. There were several reasons for this. In the first place, by the autumn of 1943 radio countermeasures had assumed greater importance. When this aspect of signals work was transferred from D. of S. to D. of Tels. in March 1943 it had been concerned mainly with defence against enemy night bomber attacks. This remained important but it became increasingly obvious that if R.A.F. night bombing was to be effective something had to be done to overcome the enemy night fighter defence. In November 1943 a new group, No. 100, was formed in Bomber Command for R.C.M. operations. This offensive application of R.C.M. increased the work of the department concerned in D.G. of S. because it was responsible for equipping the squadrons with new radar devices, for maintaining their operational efficiency, and for ensuring that the emissions of the squadrons did not interfere with other R.A.F. signals activities. Close liaison with the operational staff and operational commands was required. The work was so important and secret that policy, requirements, planning and direction had to be carried out at a high level. D. of Tels. was overworked and found that he could not attend to the telecommunications side of his work, which included the large increases in overseas operational commitments, increases in home commitments for the U.S. forces, the expansion of Bomber and Coastal Commands, and the new Transport Command and the Tactical Air Force. In October 1943 a new deputy directorate under a group captain, known as D.D. Tels. 2, was formed so that D. of Tels. was relieved of all direct R.C.M. responsibilities except for major policy and direction appropriate to his level.<sup>2</sup>

A second reason determining the reorganisation was the emergence of civil aviation as a factor to be considered from the aspect of the signals service. Earlier in the war civil aviation activity had been latent, but by the autumn of 1943 it was beginning to require attention from a higher level as a result of

<sup>1</sup> A.M. File A.416087/42.

<sup>2</sup> A.M. File A.416086/42.



the provisions of a White Paper issued in connection with the setting up of communications for B.O.A.C. and the formation of Transport Command.<sup>1</sup> The resulting impetus to the development of civil aviation involved a large volume of signals planning work which had to be considered in conjunction with the requirements of Transport Command. Signals planning was a function which properly belonged to D. of S. and so in November 1943 the Assistant Directorate of Tels. 2, the section concerned with civil aviation, was transferred from D. of Tels. to D. of S. and was upgraded to Deputy Directorate of Signals (Civil Aviation). A new branch was formed under this Deputy Directorate known as Signals Plans (Civil Aviation), whose function it was to deal with the planning of telecommunications and radar requirements for civil aviation.<sup>2</sup>

The policy-making and planning aspect of D. of S. had now assumed such importance that D.G. of S. wanted D. of S. to be free of lesser responsibilities and devote himself to major overall planning in conjunction with the air and operations staff, commands, D. of Radar, D. of Tels., Director General of Personal Services (D.G.P.S.), Director of Organisation (Establishments) (D.O. Est.), and Director of Manning (D. of M.). When D.D. of S. had been appointed the functions of the post were the co-ordination and general direction of signals planning and also control of Signals 4, 5 and 6. By September 1943 the progressive increase in offensive commitments meant that D.D. of S. had to devote more time to planning work.<sup>3</sup> A new deputy directorate was therefore approved to control and co-ordinate the work of Signals 4, 5 and 6; this was known as D.D. of Signals (General). The original post of D.D. of S. was renamed D.D. of Signals (Plans), the responsibilities being the control of signals plans and co-ordination of the work of Signals 3 and 7.<sup>4</sup>

By the summer of 1944 the changing war situation altered the functions of the signals staff at the Air Ministry, especially in the signals plans branch. Up to that date the war situation had been such that the section worked on a short-term *ad hoc* basis, meeting urgent requirements as they arose and keeping pace with developments which events forced upon them. The section continued to deal with the signals planning of operational projects put forward by the Air Staff and the Combined Operations Staff and with Expeditionary Force and field requirements. But there were other aspects of signals planning. First, there was the need for standardisation both of signals equipment and organisation. These had developed piecemeal under the stress of urgent wartime needs and now needed to conform to a more general overall plan. It had been impossible, under the pressure of expansion and the need for rapid adjustments of dispositions to meet enemy moves, to prevent commands from building up individual communications systems and developing their own particular radar equip-

<sup>1</sup> A.M. File A.416086/42.

<sup>2</sup> A.H.B./IIE/44.

<sup>3</sup> A.M. File A.416086/42.

<sup>4</sup> A.H.B./IIE/44.

ments. The tendency had been for each command to give precedence to its own particular requirements of the moment, and there had been many deviations from the general pattern laid down as policy for the country or area. Standardisation was necessary to ensure overall efficiency and economy. Second, as it became obvious by the summer of 1944 that the Allies would soon win the war, long-term signals planning for future peacetime developments was required. The need for a start to be made in planning for post-war conditions was confirmed by the appointment of a Standing Committee of the Air Council and a planning executive. Post-war signals planning concerned such matters as the lines of future technical development and the operational application of airborne and ground communications, radar and radio navigational aids. Staff increases were therefore authorised for D. of S.<sup>1</sup>

### Traffic Control

The changing nature of the war from defence to assault during 1944 also necessitated reorganisation within D. of Tels. In November 1944 the Traffic Control branch was upgraded to the status of a deputy directorate at the cost of the relegation of D.D. of Tels. (Airborne Signals) to an assistant directorate. The new Deputy Directorate was responsible for telecommunications ground policy. The Traffic Control branch warranted such upgrading because it was responsible for the policy and organisation for handling and routing the whole of the R.A.F. signals traffic and traffic for other government departments passing over the R.A.F. main point-to-point signalling system. The importance of this service was continually increasing. Over the main circuits between the United Kingdom and overseas commands there had been a 20 per cent increase in traffic between March and August 1944 and as the number and scope of theatres of operations grew so did the responsibilities of the branch. D. of Tels. had managed without a Traffic Deputy Director up to that date because little traffic planning had been required except for large-scale operations such as Overlord, when special arrangements were made. In the United Kingdom, where operations had mainly been centred, the major portion of traffic went on lines. For any operations channel a direct line was required but administrative channels merely required multiplying when the traffic reached a prescribed level. There was, therefore, no cyphering, little alternative routing and little advanced planning to be done by the R.A.F., although there was some to be done by the G.P.O. The problem of meeting the needs of an operational plan was largely one of engineering. Also, in overseas theatres such as Egypt, little traffic planning was required because communications to the Middle East and Mediterranean were relatively easy and the Air Ministry had not been concerned except with the main wireless links. However, when the war in the Far East began to spread and grow more intensive the problem of communications assumed major importance. On long overseas routes there could be no question of

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<sup>1</sup> A.M. File A.416087/42.

providing another line quickly, and long-term planning had to be done even in advance of the main operational plan. Several factors had to be considered in this long-term planning: the volume of traffic had to be estimated, the number of personnel required for traffic and cypher staffs had to be forecast so that the necessary training could be provided for, the most suitable traffic procedure had to be chosen, and the proportion of book to machine cyphers had to be decided. Air Ministry opinion in November 1944 was that telecommunications planning was likely to become even more complicated in the future when secret teleprinting on the main links was introduced.

Further changes in the Air Ministry Directorate General of Signals took place in December 1944. The section which was responsible for pigeons (Tels 1(c)), was transferred from D. of Tels to the Department of the Permanent Under-Secretary and renamed the Air Ministry Pigeon Section. This was done because the R.A.F. had ceased using pigeons for communication and air/sea rescue purposes and the work of the branch was mainly confined to the supervision of the National Pigeon Service, a purely civilian body; such work was not appropriate to the Department of the Chief of the Air Staff. Also in December the branch responsible for Air Formation Signals (A.F.S.), D.D. of Tels. 5, was transferred from D. of Tels. to D. of S. and known as D.D. of S. (A.F.S.). This was done in order to link D.D. of S. (A.F.S.) more closely with signals policy and planning as those aspects of the work were likely to predominate. A new branch, known as Signals 8, was formed combining Radar (Navigation) with Flying Control 2. Its functions were to recommend policy and to plan and co-ordinate requirements for radio aids to navigation and for radio aids required for flying control and airfield approach at home and overseas.<sup>1</sup>

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<sup>1</sup> A.H.B./IIE/44.

## CHAPTER 2

### ORGANISATION OF No. 26 GROUP

#### Formation

In the autumn of 1939 it gradually became clear that two signals problems were in urgent need of solution. First, the need for proper control and administration of the Air Ministry W/T stations and of the W/T and D/F stations engaged on special work, and second, the proper technical control and administration of the schools devoted to various types of signals training. At that time the Director of Signals (D. of S.) at the Air Ministry exercised operational and administrative control of the three main Air Ministry W/T stations and the four other W/T and D/F stations engaged on special work, and had to complete all arrangements for the formation of extra units for special work, together with signals arrangements for meteorological requirements. This control by D. of S. covered such matters as stores, works, and personnel, routine matters attention to which was detrimental to the proper function of the Directorate of Signals, which should have been concerned with the framing of signals policy. The outbreak of war meant that the work of the W/T stations was likely to increase. In a minute to A.C.A.S. on 10 October 1939 D. of S. stated that he considered it essential to place the stations under the control of a special formation which would itself come under him. He did not think it would be practicable to place the scattered W/T stations independently under one of the existing commands. He believed that some central co-ordinating authority was necessary for the operational and administrative control of the stations if the work produced by them was to be of the highest efficiency. The work involved, if given to a command, would throw an undue load on the command signals staff concerned, for services which they would neither be interested in nor understand. The signals training units came under either Training or Reserve Command for control and administration; neither the Director of Training nor the Director of Signals was satisfied with the results obtained at that time. Three thousand men and women had to be trained in all branches of radar and the ordinary Training Command staff had no knowledge of requirements nor the necessary technical experience. The normal signals staff at Training and Reserve Command Headquarters were not in a position to know the latest operational requirements as well as did Air Ministry staff and were therefore not in a position to advise the schools adequately and quickly of modifications to training requirements. The Directorate of Signals was fully conversant with future operational signals requirements and was therefore in a position to pass on those requirements to the schools. If this was to be done successfully it had to be done through some central and responsible organisation. The D. of S. considered that a special signals group should be formed to provide for the necessary operational and administrative control of both the special W/T station



organisation and the schools. Both the Assistant Chief of the Air Staff and the Director of Training supported the recommendation.

A conference was held on 16 January 1940 to discuss the proposed charter and control of the new signals group. Considerable argument ensued on the question of the control of the group but finally it was agreed that the technical control should be vested in the Air Ministry (Directorate of Signals) on matters appertaining to the implementation of training policy.<sup>1</sup> No. 26 Group was formed on 12 February 1940 within No. 21 Group at Cranwell to control all R.A.F. wireless stations and signals training establishments, all movements by air in and outside the United Kingdom, the installation of all station wireless equipment and the modification of all station and aircraft wireless equipment.<sup>2</sup> The new group was included in Training Command for purposes of administration, but partly because of the fluid state of technical development with which only D. of S. could be in really close and continuous touch and partly because of the inter-command nature of the work of units within the group, No. 26 Group was given some powers beyond those of a normal group. It was authorised to deal directly with the Air Ministry in certain technical matters and it was made responsible for the specialist equipment supply and maintenance of its various units.

The units included in No. 26 Group at its formation were the R.A.F. Central Teleprinter Exchange and R.A.F. Inter-Command W/T Receiving Station at Leighton Buzzard, the communications staffs of Whitehall, the Western Area, Harrogate, the North-Eastern suburbs, and the 'Z' communications staff, the Air Ministry W/T stations at Cheadle, Greenford, Dagnall, Bodmin and four small stations, emergency W/T fitting parties, the Signals Technical Development Party, the R.A.F. Code and Cypher School, the Electrical and Wireless Schools, the Special Wireless School at Yatesbury, the Women's Signal School at Stanmore and the W.A.A.F. Signals Training Schools. Of these the signals training schools had been administered by No. 21 Group, which was badly overburdened, and many of the others had come, as a result of rapid expansion and lack of staff at commands, directly under the control of D. of S.<sup>3</sup>

When No. 26 Group was formed the headquarters was divided into three wings, operational, training, and equipment and technical. The operations wing was subdivided into three sections, home, overseas, and W.A.A.F. The functions of the home section of operations wing were: one, interpretation of Air Ministry signals policy as affecting home commands and the general efficiency of the home signals organisation; two, the co-ordination of recommendations from home commands on signals matters; three, the inspection of signals establishments; four, signals control and administration of Air Ministry W/T stations and special W/T and D/F stations; five, the control of high power W/T stations at home and co-ordination of their use

<sup>1</sup> A.M. File S.65342.

<sup>2</sup> A.M. File S.2220.

<sup>3</sup> A.M. File S.59549/I.

by home commands; six, the detailed administration of home D/F stations as applicable to W.A.A.F. signals trades; two, liaison with the Director of the and the monitoring of frequencies in use; eight, the examination of signals routine reports; nine, responsibility for the D.R.L.S. organisation; ten, liaison with the G.P.O. on the upkeep of an approved landline organisation. The functions of the overseas section were arrangements for communications in connection with reinforcing and overseas flights and the routine administration of the inter-command point to point organisation. The functions of the W.A.A.F. section were: one, interpretation of Air Ministry signals policy as ordered by the Air Ministry; seven, dealing with interference problems W.A.A.F.; three, inspections; four, recommendations in respect of W.A.A.F. signals duties. The functions of the training section were fivefold. First, the administration of and liaison with signals schools. Second, the co-ordination and examination of training syllabi. Third, submission to the Air Ministry of syllabi to meet changing operational requirements. Fourth, the classification of trainees for special and normal signals employment. Fifth, responsibility for selection boards for commissions and special duties. The R.A.F. Code and Cypher School also came under the training section. This was responsible for code and cypher training for the R.A.F., the distribution of secret and confidential signals books, the servicing of mechanical cyphering machines, and the preparation and editing of signals publications. The equipment section was responsible for the general efficiency of signals apparatus and recommendations for new designs and improvements, for co-ordination and conduct of Service trials of new equipment, for the design of mobile equipment, and for D.R.L.S. equipment questions. The technical section had four functions: one, liaison and co-ordination in connection with interference suppression questions; two, the co-ordination of design of signals buildings and works services in general; three, the co-ordination of siting plans; and four, co-operation with the R.A.E. in connection with the other three functions.<sup>1</sup>

On 27 March 1940 Headquarters No. 26 Group moved to Langley Hall, Langley, Buckinghamshire. During April it gradually took over the responsibilities assigned to it by its charter and some necessary reorganisation was carried out. Odd signals units scattered over the country were arranged as far as possible into geographical and functional groups, each administered by a central unit, raised to the status of a station which was fully self-accounting. It was found that the emergency W/T fitting parties<sup>2</sup> could not be incorporated into the system because they were scattered too widely over the United Kingdom. The officer-in-charge of the fitting parties therefore was attached to Headquarters No. 26 Group and the parties administered direct from there. The communications organisation for the movement of aircraft overseas was improved by the issue of comprehensive signals instructions.<sup>3</sup>

<sup>1</sup> A.M. File S.59549/I.

<sup>2</sup> At that date they numbered 16 and had been transferred from No. 43 Group to No. 26 Group on 15 April 1940. No. 26 Group O.R.B. April 1940.

<sup>3</sup> No. 26 Group O.R.B. April 1940.

In April 1940 the Air Ministry informed all commands that if any R.A.F. unit required urgent technical assistance in connection with air or ground radio equipment, it was to request help direct from Headquarters No. 26 Group indicating the scope of assistance required. No. 26 Group was then to arrange, according to the demands received, for assistance to be rendered as soon as possible by either W/T Emergency Fitting Parties or the Radio Department, R.A.E.<sup>1</sup>

### Expansion

The responsibilities of No. 26 Group increased during the first few months of its existence. A certain measure of relief was afforded on 19 June 1940 when at a meeting held by the Secretary of State it was agreed that signals training questions should pass through Technical Training Command and not direct between the Director of Signals and No. 26 Group. Some routine responsibility was thus spared No. 26 Group training staff. On 22 June 1940 Headquarters Technical Training Command informed the Air Ministry that No. 26 Group required a measure of reorganisation and an increase in establishment. The immediate reason for this was the impending delegation to No. 26 Group of additional responsibility in the matter of functional control of signals units other than training units in an attempt to relieve D. of S. of detail.

First was the installation of major modifications or additions to the W/T layout of aircraft at operational units, training units, and aircraft storage units. This entailed arranging for the equipment required, for fitting parties to do the work, and for liaison with commands as to the order of priority of carrying out the work. Second there was liaison with the R.A.E. for the preparation and provision of servicing schedules for all new types of radio equipment. In the case of equipment not designed by the R.A.E. the liaison was necessarily with the firm who designed and manufactured the equipment. Third, the provision to all units in the United Kingdom of technical advice and assistance (in liaison with the R.A.E.) on all matters concerning air and ground radio installations. Fourth, the installation of radio and associated equipment in ground stations for operational and other commands. Fifth, the organisation of training and subsequent distribution of mobile units of various kinds concentrated at signals depots. Sixth, R.A.F. Traffic Control section of the Air Ministry was transferred in June 1940 from the Air Ministry to Headquarters No. 26 Group.<sup>2</sup>

In addition to compiling, maintaining and issuing such publications as the R.A.F. Teleprinter Routeing Directory, the Responsibility Schedule and the Defence Teleprinter Network Operators' Instructions, the section controlled teleprinter traffic throughout the R.A.F. and was responsible for its routeing. Traffic returns were received weekly from all units where teleprinters were installed and these formed the basis upon which allocations,

<sup>1</sup> A.H.B./IIK/54/13/53.

<sup>2</sup> A.M. File S.59549/I.

cessations or diversions of lines were arranged. Station codes and 'Answer Back' signals were arranged and operating difficulties were investigated by the section, which also maintained contact with the Admiralty and War Office signals sections on traffic questions affecting the three Services.<sup>1</sup> On 12 June the Air Ministry delegated to No. 26 Group responsibility for a wireless organisation known as the 'Beetle' scheme. This was intended to provide a means of passing information about imminent attempts at invasion to defence formations of all three Services. It provided for a link by W/T between commands of the Army and R.A.F. and Area Combined Headquarters and for medium power radio telephony transmitters at Army commands in England, Scotland, and Northern Ireland, and at a naval command in the Orkneys. It further provided for the distribution of portable broadcast receivers to units of the Navy, Army and R.A.F. Preliminary work had been carried out by the Directorate of Signals at the Air Ministry and on 17 June 1940 work was transferred to No. 26 Group.<sup>2</sup>

By this time 33 units were being administered by No. 26 Group; five of these were training units and 28 were operational, counting the 16 emergency W/T fitting parties as one unit. The group was also responsible for the large emergency point-to-point organisation. Certain measures were therefore suggested to ease the work and responsibilities of No. 26 Group. Technical Training Command felt that the organisation of the group should be altered to bring it into line with normal group organisation and the channels of communication within a command. It was suggested that No. 26 Group should no longer deal direct with D. of S. on questions of signals training policy and the functional control of signals units. If this were done in the normal manner through command, Headquarters No. 26 Group would be relieved of certain detailed responsibilities. The Air Ministry viewpoint, as expressed by the Assistant Chief of the Air Staff (Radio), was that No. 26 Group differed from normal training groups in that, additional to its responsibilities for training establishments, it had an entirely new role of functional control of a large number of signals units which were mainly operational. It also provided communications for R.A.F. commands at home and overseas. Certain changes were, however, made to ease the burden on No. 26 Group. The Air Ministry approved the establishment of an additional section under a Signals group captain at Group headquarters to be responsible for the supervision of the functional signals units. This meant that the Senior Air Staff Officer was free to concentrate on the supervision of the signals training establishments.

The question of upgrading the post of A.O.C. No. 26 Group from air commodore to air vice-marshal was also considered at this time. Headquarters Technical Training Command was in favour of the proposal. In the first place, the responsibilities of the A.O.C. had increased considerably

<sup>1</sup> No. 26 Group O.R.B. April 1940, August 1940 and September 1941. This section was returned to Air Ministry control in August 1940 but again transferred to Headquarters No. 26 Group on 1 September 1941.

<sup>2</sup> No. 26 Group O.R.B. April 1940.



since the creation of the group. Secondly, the fact that Cranwell, which had been added to the Group on 7 July 1940, was commanded by an air commodore was in itself a good reason for upgrading the post of the group commander. Thirdly, the A.O.C. No. 26 Group had a dual responsibility for training units and signals operational units in addition to co-ordination and planning on behalf of the Director of Signals Air Ministry. The proposal was discussed at Air Ministry level at a conference on 2 August 1940, together with aspects of the reorganisation of No. 26 Group. The question of upgrading the post of the A.O.C. was referred to the Director of Organisation, who decided that the request could not be granted at that date but would be reconsidered after three months had elapsed.<sup>1</sup> In September 1940 additional responsibilities were added to No. 26 Group. No. 80 Wing was formed within it at Aldenham Lodge, Radlett, Hertfordshire to control R.C.M. activity; it consisted of a number of receiving and transmitting stations and other centres scattered throughout the United Kingdom. No. 1 Signals Depot was moved from White Waltham to West Drayton and several lodger units established there.<sup>2</sup>

#### **Dissatisfaction with Group Organisation**

Neither Technical Training Command nor No. 26 Group was satisfied with the organisation of the group as it was during the summer and autumn of 1940. No. 26 Group felt that the signals service suffered because it had to rely on a busy command headquarters for so many training facilities. Headquarters Technical Training Command dealt with urgent questions of syllabi, accommodation, equipment and establishments, in co-operation with No. 26 Group and the signals staff at the Air Ministry. Headquarters No. 26 Group considered that much time and trouble would be saved if all functions were centred on signals requirements alone. In November 1940 they put forward a proposal for a signals service Headquarters dealing direct with the Air Ministry on one hand and units on the other. It was felt that this was justified by the urgent necessity for great speed in everything that concerned signals matters. It was recommended that two wings be formed, Signals Training and Signals Operational, which would come directly under a signals command which in turn would come directly under the Air Ministry for all purposes. The advantage of that would be a direct and simple organisation which would give speed in handling all matters.

The functions of the group fell into three separate and distinct categories. First, there were the operational units, such as No. 80 Wing, the various outstations of Cheadle and Leighton Buzzard, and D.R.L.S. Second, there were the units required for the signals servicing and repair organisation as a whole. Third, there were the signals training units. This was contrary to the normal R.A.F. system, which was organised on a functional basis. The A.O.C. was required to divide his attention between these three aspects, and

<sup>1</sup> A.M. File S.59549/I.

<sup>2</sup> No. 26 Group O.R.B. September 1940.

it was felt that with future expansion he would not be able to devote sufficient time to any one of these without neglecting the others. Headquarters Technical Training Command agreed that reorganisation was necessary, but opposed the formation of a signals command independent of any other command because it would segregate into one vertical organisation various functions which, specialist though they were, were ancillary to the operational activities of the R.A.F. It was feared that such a formation would ultimately result in the user aspect being subordinate to that of the technical aspect and might lead to operational requirements being dictated by technical considerations. This contingency had so far been avoided because R.A.F. signals officers had, for a great deal of their Service careers, been in the General Duties branch, and had therefore been able to study and consider the operational aspect of signals matters in addition to the technical. By the end of 1940, however, signals officers were being commissioned direct into the Technical branch and there was more than ever a reason to avoid segregating them into a separate organisation.

There were also disadvantages in segregating signals training into a signals command and thereby divorcing it entirely from the organisation which was responsible for training technical personnel in all other trades. It was felt that greater efficiency would not be gained if signals training were placed under the control of signals officers only. The general control should be vested in officers who had no technical bias while the detailed preparation of syllabi and contacts with operational groups could be maintained by signals officers on the staff of Technical Training Command. Headquarters Technical Training Command considered that all signals training should be removed from the control of No. 26 Group to that of the command, while the former remained in charge of its operational units and units of the signals repair and servicing organisation.

On 5 February 1941 a conference was held to discuss the organisation of No. 26 Group at which the Director General of Organisation stated that two broad courses of action arose out of the divergent views. The first was to withdraw the signals training units from Technical Training Command and place them under some other command. The alternative was to withdraw training units from No. 26 Group and to place them either in No. 20 or No. 24 Group or to form another group in Technical Training Command to control all signals training units. At this conference various opinions were expressed by the Assistant Chief of the Air Staff (Radio), the Inspector General, the Director of Signals, the Air Officer Commanding-in-Chief Technical Training Command, the Air Officer Commanding No. 26 Group, the Air Member for Training, the Director General of Organisation, and the Air Member for Personnel. The Air Member for Supply and Organisation summed up the conference by saying that it appeared that the existing machinery needed revising without the creation of an entirely new form of organisation. He undertook to try and suggest an alternative to a signals

command which would meet the points that had been made and provide an improvement on the existing situation.<sup>1</sup>

#### Formation of No. 27 (Training) Group

On 28 March 1941 the Air Ministry informed Headquarters Technical Training Command that a decision had been reached on the future of No. 26 Group. All signals training units were to be removed from No. 26 Group and placed in a new group, to be known as No. 27 (Training) Group, to be controlled in all respects by Headquarters Technical Training Command. No. 26 Group, less the training units, was to remain under the operational control of the Air Ministry (D. of S.) and would continue to be administered by Technical Training Command. Certain units of Nos. 20 and 24 Groups were to be added to No. 27 Group. The Air Officer Commanding No. 27 Group was to be an air commodore in the General Duties or Signals branch. On 2 April 1941 Headquarters Technical Training Command submitted proposals for the re-allocation of units in the command.<sup>2</sup>

Although in July 1941 No. 26 Group lost its control of training units the responsibilities of the group were not much lessened, and in directions other than training they increased during the year. On 2 June 1941 No. 81 (Signals) Wing was formed at Worcester. The new wing consisted of No. 1 Western Area Signals Office, Worcester, No. 2 Western Area Signals Office, Gloucester, No. 3 Western Area Signals Office, Tetbury, No. 4 Western Area Signals Office, Strand, No. 5 Western Area Signals Office, Stonehenge, the W/T Station at Hartlebury, the W/T Station at Bodmin and the Signals Section, Birdlip. The organisation was still considered unsatisfactory. It was claimed that greater powers were needed if the group was to fulfil its obligations. On 21 July 1941 D.G.I.S. stated that No. 26 Group was unable to fulfil the functions for which it was intended. In the first place, works representation as already given to No. 60 Group was required at No. 26 Group. Technical Training Command was accused of obtaining only a low degree of priority for the requirements of No. 26 Group and as the group controlled signals units of high operational importance they required correspondingly high priority in such matters as works and stores. Other difficulties arose because Technical Training Command had little or no knowledge of and no direct interest in the work of No. 26 Group. Questions which were normally dealt with by commands were in the case of No. 26 Group referred by the command to the group for their opinion. Further, it was essential that No. 26 Group should deal direct with the Directorate General of Equipment (D.G.E.) departments with regard to technical stores. D.G.I.S. gave three possible suggestions for No. 26 Group. The group could be made an outside department of D.G. of S. dealing directly with the Air Ministry. It could be given similar facilities as were enjoyed by No. 60 Group and could be placed under one of the operational commands, possibly

<sup>1</sup> A.M. File S.65873.

<sup>2</sup> A.M. File S.65873.

Bomber Command. Or, finally (the suggestion that D.G.I.S. himself favoured), it could be given the powers of a command headquarters.

A conference was held by D. of Tels. on 15 August 1941 at which it was agreed that there should be an increase of establishment and considerable reorganisation within the Air Staff branch at Headquarters No. 26 Group.<sup>1</sup> This branch was to include a planning section, an operations section, an engineers section, and a liaison officer from M.A.P. permanently attached to the headquarters. Under the administrative staff at No. 26 Group provision was to be made for a works liaison officer to be permanently attached. An increase in the staff of the equipment section was agreed so as to enable them to undertake additional work necessitated by the reorganisation, particularly for the engineers' section.<sup>2</sup>

#### **Transfer of No. 26 Group to Bomber Command**

In November 1941 the question of transferring No. 26 Group from Technical Training Command to Bomber Command was discussed. The activities of the group were not entirely restricted to Bomber Command, but with the increase in bombing operations and the development of the many wireless aids which were being provided the group was largely concerned in providing for the new and urgent needs of that command. Such items as the installation of blind approach equipment at new and existing airfields, the provision of ground D/F services, installation and retrospective action in aircraft such as the TR.1154/55 (Marconi) communication and D/F set, and the proposed installation of Gee, were all projects in which Bomber Command were interested and for which it would rely to a large extent on the activities of No. 26 Group. The group performed no useful service for Technical Training Command and therefore command headquarters were not as interested in it as a command which the group served directly. Another factor to be taken into consideration was that No. 80 Wing, the R.C.M. organisation in the United Kingdom, came under No. 26 Group for administration and No. 109 Squadron belonged to this wing. The squadron was equipped with bomber aircraft (Wellingtons) and was engaged in operations over enemy territory which were closely linked with Bomber Command operations. At that time the squadron felt very much the lack of operational and administrative advice and control, which Bomber Command alone could give. Thirdly, many of the group's operational requirements were extremely urgent, needing priorities in such matters as works services, equipment, and personnel as were accorded to operational commands. A conference was held by the Director General of Organisation (D.G.O.) at the Air Ministry on 26 January 1940 at which it was agreed that the transfer should be effected.<sup>3</sup>

On 10 February 1942 No. 26 Group was transferred from Technical

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<sup>1</sup> A.M. File S.59549/I.

<sup>2</sup> A.M. File CS.12212.

<sup>3</sup> A.M. File S.2220.



Training Command to Bomber Command for administrative purposes, but remained under the direct operational and technical control of D.G.I.S. At the same time the A.O.C. No. 26 Group was given powers up to £2,500 in relation to works services and command powers of requisitioning and was entitled to deal direct with the Air Ministry in cases where Air Ministry authority for action was necessary. In September 1942 the status of No. 26 Group was further enhanced. In August 1942 D.G.I.S. had recommended that the post of A.O.C. be upgraded from the rank of air commodore to that of air vice-marshal. Headquarters Bomber Command took no action in support of the recommendation and when consulted said that as it knew so little of the work of the group it had no strong feelings in the matter. The question was, however, discussed by the R.A.F. Establishments Committee in conjunction with D. of Tels. and D. of R.D.F. It was agreed that, as the group had a pre-operational and a post-operational responsibility upon which the fighting efficiency of the operational groups was largely dependent, the proposed upgrading should be recommended. This recommendation was supported by the Chief of the Air Staff on 15 October 1942 and approved by the Secretary of State on 24 October 1942.<sup>1</sup>

#### Further Expansion

Between August 1942 and June 1943 the activities of No. 26 Group expanded rapidly.<sup>2</sup> In 1943 No. 26 Group took on additional functions. It was responsible for the formation, equipping, operating, training and preparation for overseas operations of all mobile signals units. This involved taking over Royal Air Force Chigwell on 1 April 1943, where there were Personnel Despatch Centre (P.D.C.) facilities for 4,000. It undertook the equipping, final field training and preparation for overseas of all mobile radar units. All arrangements for the preparation and training of the signals personnel of overseas forces including P.D.C. action were in the care of the group. In connection with these commitments 250 officers and 8,300 other ranks passed through Chigwell between September 1942 and June 1943 and were formed into units and despatched overseas by the group. There was a heavy increase in the responsibilities of No. 26 Group in other directions. In 1943 it became responsible for the Signals Development Unit, Hinton in-the-Hedges, consisting of the Beam Approach Development Unit, No. 1551 Beam Approach Calibration Flight, the Operational Development Flight, and No. 1478 Flight consisting of five flying W/T stations. The group also undertook the administrative and technical aircraft responsibility for No. 105 (Combined Operations) Wing and its training stations, and No. 516 Squadron. Also in 1943 the group took on the responsibility for the servicing and repair of all M.F. beacons and radio track guides. In late 1942 No. 26 Group had to undertake a considerable amount of development work, to do which an additional department was formed at Headquarters No. 26 Group consisting of civilian technical personnel drawn from the R.A.E., the Air

<sup>1</sup> A.M. File S.59512/IV.

<sup>2</sup> See Appendix No. 4 for comparison of No. 26 Group in February 1942 and June 1943.

Ministry and civilian sources.<sup>1</sup> In June 1943 No. 26 Group was accorded command status in respect of servicing of aircraft within the group, allotment of aircraft belonging to the group and aircraft establishment of the group. This was done because the administration, servicing and flying discipline of certain units in No. 26 Group was considered unsatisfactory. The proposal that it should have command status for flying discipline was agreed to only in part.

By July 1943 the A.O.C. No. 26 Group had been granted further special powers and responsibilities in recognition of the fact that the group provided a signals service which was available to the R.A.F. as a whole. The group was, however, responsible to Headquarters Bomber Command for general administration and supervision of all matters within the group. No. 26 Group dealt direct with the Air Ministry on equipment works services, requisitioning, establishments, training, education, and welfare. The operational and technical control was vested in the D.G. of S. No. 26 Group dealt with Headquarters Bomber Command for accounting matters, medical questions, W.A.A.F. administration, general administration and personnel.

#### **Nos. 1 and 2 Signals Depots**

No. 1 Signals Depot was formed at White Waltham on 28 May 1940 in No. 26 Group for planning, erecting and equipping new transmitting and receiving stations.<sup>2</sup> It moved to West Drayton in September 1940.<sup>3</sup> In September 1941 No. 2 Signals Depot, which consisted of an amalgamation of the central emergency fitting parties operating in the northern part of the United Kingdom, was formed at Cowglen near Glasgow.<sup>4</sup> It moved to Fazakerley near Liverpool in May 1943.<sup>5</sup> The two signals depots were responsible for the fitting up of W/T stations for all commands over an area extending from Jan Meyen in the north to Lagos and the Azores. The setting up of the inter-command point-to-point network was one of the most important commitments. It involved transmitting stations at Dagnall, Greatworth and Weyhill and receiving stations at Stoke Hammond, Chick-sands and Leighton Buzzard. In the peak year of 1944 1,472 transmitters and receivers were installed at widely separated ground stations, 1,495 aerials were erected and 656 installations were overhauled, modified or repaired. Among the tasks completed by the fitting parties from the Signals Depots were the erection of a first class transmitting station in Iceland, a radio range off the Scottish coast designed to bring U.S.A.A.F. aircraft across the Atlantic, a meteorological station on the island of Jan Meyen and in the autumn of 1943 the vital radio link in the Azores. Aircraft and marine craft fitting were also included in the tasks of the No. 26 Group

<sup>1</sup> A.M. File S.59549/IV.

<sup>2</sup> No. 26 Group O.R.B. May 1940.

<sup>3</sup> No. 26 Group O.R.B. September 1940.

<sup>4</sup> No. 26 Group O.R.B. September 1941.

<sup>5</sup> No. 26 Group O.R.B. May 1943.

Signals Depots. V.H.F. R/T fitting in fighter aircraft and W/T fitting in bomber aircraft were the responsibility of No. 26 Group.<sup>1</sup>

### **Battle Training School**

One lesson learnt from the 1939-1940 campaign in France was the need for mobile and self-contained signals and radar units as an integral part of an expeditionary force. At the beginning of the war selection and training of personnel in the use of specialist vehicles and instruction in the use of appropriate weapons of assault and defence were undertaken at White Waltham. By April 1943 commitments had grown to such an extent that the entire unit moved to Chigwell, using White Waltham as a satellite. The P.D.C. was formed in May 1943 within the framework of the Battle Training School to supervise the preparation and formation of the various units under training. From April 1943 to D-Day the main output from Chigwell was to A.E.A.F. formations, the peak effort being in the second quarter of 1944 immediately before the landings in Normandy. In addition Chigwell undertook the formation and training of hundreds of other units for special operations all over the world. Over 70,000 personnel passed through White Waltham and Chigwell and of these 52,000 were trained and kitted for such theatres of war as India, Iceland, Norway, North Africa, Sicily, Italy, Russia, Yalta, Azores, Middle East, Western Europe and many countries in the Far East. After 1 April 1943, 900 units were fully equipped and over 3,200 specialist signals vehicles, 1,180 specialist radar vehicles and 2,600 load vehicles were sent out.<sup>2</sup>

### **Signals Development Unit and Signals Flying Unit**

When the charter of responsibility was issued in January 1942, the responsibilities of the group in connection with radio and radar aids to navigation were confined to the siting of new D/F stations and the ground and air calibration of all new D/F and beam approach stations. Responsibilities were later extended to cover the installation, servicing and regular calibration of nearly all types of radio navigational aids, and in the case of G.C.A., the formation and training of crews to operate the equipment.<sup>3</sup>

The Signals Development Unit (S.D.U.) was formed at Hinton-in-the-Hedges in April 1943 in No. 26 Group. It was responsible for the development, installation, calibration, testing and servicing beyond local capacity of radio aids to navigation. These responsibilities were previously carried out by sections of No. 1 Signals Depot at West Drayton, No. 2 Signals Depot at Cowglen and by No. 1551 (Signals Calibration) Flight and Operational Development Party Detachment. The functions of the S.D.U. were:—

- (a) To develop flying technique in the use of radio aids to navigation.

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<sup>1</sup> A.H.B./IIE/151/75.

<sup>2</sup> A.H.B./IIE/151/75.

<sup>3</sup> A.H.B./IIE/151/75.

- (b) To develop such communications equipment and radio aids to navigation as might be delegated to it, including approach and landing systems, H.F. D/F and V.H.F. D/F but excluding M.F. D/F equipment.
- (c) To install ground equipment classed as radio aids to navigation.
- (d) To provide air and ground calibration, testing and checking facilities in respect of radio aids to navigation.
- (e) To provide servicing facilities beyond local capacity in respect of ground installations classed as radio aids to navigation.
- (f) To give technical advice on problems concerning radio aids to navigation and aircraft communications equipment.
- (g) To give advice concerning the installation of airborne communications equipment not already standardised and to undertake such testing or modification of the equipment as might be delegated to the unit.<sup>1</sup>

The Signals Flying Unit was formed at Honiley on 4 August 1944 and consisted of a signals flying wing, a servicing wing and a ground controlled approach wing. The Signals Flying Wing was composed of the Signals Development Unit transferred from Hinton-in-the-Hedges. It carried out the installation of navigational signals equipment. It was responsible for the Service trials of new equipment and for modifications and improvements to both airborne sets and ground aids to navigation. The servicing wing acted as a maintenance unit for nearly all navigational signals equipment that was supplied to the R.A.F. at home on a common user basis and to a smaller extent to commands overseas. It was responsible for servicing this once it was installed. All such equipment was regularly checked for accuracy by the calibration flight.<sup>2</sup>

### Overseas Functions

Until the summer of 1944 the overseas functions of No. 26 Group had been confined to the preparation and despatch of equipment, and the training of personnel for overseas. In July 1944 the function of No. 26 Group in giving advice and assistance in the planning, siting, engineering and operation of W/T stations in the inter-command system was extended to overseas commands. Up to that time Chief Signals Officers (C.S.O.s) overseas were left largely to their own devices in regard to the design and layout of their main communications stations. They were responsible for indenting for the necessary supplies and types of equipment, usually without a first-hand knowledge of recent improvements and without expert advice of new technique. In the United Kingdom No. 26 Group had a central engineering section specifically to cope with designs and improvements and a number of specialised fitting parties to put the results into effect. The result overseas

<sup>1</sup> A.H.B./IIE/85/4(a).

<sup>2</sup> A.H.B./IIE/151/75.

was that there was a complete lack of uniformity among the main stations so that it was never certain whether any given station was suitable technically for new equipment. In some cases construction was done on the wrong lines.<sup>1</sup> Traffic handling methods were faulty and uneconomical at certain overseas stations. The introduction of new equipment was necessary to obtain the ranges and loads for the Far Eastern war. It was more critical than the older material and required expert installation and servicing. Accordingly No. 26 Group was instructed by the Air Ministry to extend its advisory functions to overseas W/T stations, and to implement this policy decision the post of Inspector of Inter-Command Telecommunications was established at the group headquarters on 13 July 1944. In this respect the Inspectorate had four functions to fulfil. First, the technical planning and layout of inter-command wireless stations; No. 26 Group was responsible for preparing designs and layout diagrams of technical buildings and aerial arrays for overseas inter-command stations and sometimes for advising on the siting of such stations. Second, the introduction of new equipment; No. 26 Group was responsible for giving advice to C.S.O.s on the handling and servicing of new telecommunications equipment. Third, traffic handling methods; No. 26 Group was made responsible for advising C.S.O.s overseas on new traffic handling methods and for advising on means of improving speed and efficiency of existing procedure at overseas stations. Fourth, advice to the Air Ministry; No. 26 Group was required to keep the Air Ministry (D.G. of S) informed on the capacity, technical efficiency and technical layout of overseas inter-command stations and to forward recommendations for their improvement.<sup>2</sup>

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<sup>1</sup> For example the rhombic arrays at Delhi were found to be of the wrong design. This was discovered only after months of bad communication. (A.M. File CS.23129.)

<sup>2</sup> A.M. File CS.23129.



## CHAPTER 3

### ORGANISATION OF No. 60 GROUP

#### Formation

In September 1939 the Air Officer Commanding-in-Chief, Fighter Command, informed the Air Ministry that he feared the inefficiency of the chain of radar stations placed the air defence of Great Britain in jeopardy. He therefore requested that a small committee under the chairmanship of Sir Henry Tizard should be formed to investigate the working of the radar chain and to make recommendations for its improvement. The Air Ministry acceded to this request and appointed a committee, consisting of Sir Henry Tizard, Air Marshal Sir Philip Joubert, the Director of Communications Development (D.C.D.), the Director of Signals, a representative of the Director General of Operations and a representative from Fighter Command.<sup>1</sup>

The organisation of the chain had grown up under improvised and imperfect conditions. Air Ministry Experimental Stations (A.M.E.S.) were attached to neighbouring R.A.F. stations for administration. This system was satisfactory while the number of A.M.E.S.s was small, but the rapid increase in 1939 made the cumbersome system of administration through parent stations in four different commands (Fighter, Bomber, Coastal and Training) unwieldy. There was no organised channel of administration.<sup>2</sup> As a result of the Air Council decision to make the fullest operational use of radar while the technique of its employment was still in the research and development stage the expansion of the chain was hurried and became overloaded.<sup>3</sup>

By the autumn of 1939 the radar programme had grown to such an extent that its administration was proving too great a burden for the Air Ministry Signals staff. In the United Kingdom the chain included 23 Chain Home (C.H.) stations in being, 9 Chain Home Low (C.H.L) stations in being, the Bawdsey Training Centre, the Yatesbury R.D.F. training centre, and the Base Maintenance Headquarters (B.M.H.Q.) at Carlton Lodge, Leighton Buzzard. This involved all policy, personnel and training questions, and control of 40 officers, 300 wireless electrical mechanics and 300 wireless operators. These figures were increasing and by April 1940 it was estimated that there would be 70 officers, 1,500 wireless electrical mechanics, and 1,500 wireless operators or W.A.A.F. substitutes. The number of radar stations was expected to increase to 38 C.H., 23 similar to C.H. overseas, and 40 home C.H.L. The problem of administering radar chains extended overseas. There were 12 radar stations in France, with 32 officers and 200

<sup>1</sup> A.M. File S.2286.

<sup>2</sup> A.H.B./IEB/85/1.

<sup>3</sup> A.M. File S.59512.

men controlling the radar organisation there. Questions concerning the development of extensive radar organisations overseas, including Malta, Egypt, India, Aden, Singapore and Burma, also had to be considered.<sup>1</sup> Another weak feature in the organisation of the home radar chain was the method by which the component stations were serviced. The problem which seriously concerned the A.O.C.-in-C. Fighter Command was the fact that he was responsible for operating the chain of A.M.E.S.s. but the organisation for servicing them was not under his control. The existing organisation had been set up at a time when it was extremely difficult to divorce the servicing of radar stations from the research branch which was responsible for designing and erecting them.<sup>2</sup> Technical control, and personnel and equipment for major servicing, were centralised at B.M.H.Q.; this made for slowness in vital servicing work. The radar chain was basically badly organised in important aspects of personnel and technical administration, the work being shared by various authorities, such as B.M.H.Q., commands, and the Air Ministry.<sup>3</sup>

The Committee met during October 1939 and decided that reorganisation was urgently needed, as was a change in the existing system of responsibility from the point of view of technical, operational and administrative requirements. The recommendations of the Committee were submitted to the Chief of the Air Staff and he approved the formation of a group for the purpose of putting the radar chain on a properly organised basis.

On 23 February 1940 No. 60 Group was formed with its headquarters at Oxendon Lodge, Leighton Buzzard. On the formation the units in the group were the Bawdsey Training Centre, B.M.H.Q. Leighton Buzzard, which became part of the group headquarters, No. 2 Installation Unit, Kidbrooke, and its Special Calibration Unit, R.A.F. Special Flight, Martlesham, and 37 A.M.E.S.s.<sup>4</sup> The rank of the Air Officer Commanding was air commodore. The function of the group was the assumption of technical and administrative control of the radar chain and its subsidiary servicing and installation units in accordance with operational and tactical requirements. Some of these latter had been formed and operated previously without proper establishment action. In the early stages it was intended that the group should also be responsible for supervising the introduction into the Service of all other radar equipment. The operational direction of the chain remained under the Commander-in-Chief Fighter Command, who informed No. 60 Group of the operational requirements from the radar chain. It was then the responsibility of the Senior Air Staff Officer (S.A.S.O.) and the policy staff of the group to see that the requirements were met by the organisation under their control; if they could not be met No. 60 Group was responsible for consulting with the Directorate of Communications Development as to the methods of rectifying any short-

<sup>1</sup> 60 Group File 60G/2809/E.

<sup>2</sup> A.M. File S.2286.

<sup>3</sup> A.H.B./IIE/85/1.

<sup>4</sup> A.M. File CS.2824.

comings. The Air Staff, or executive part of the A.O.C.'s staff, was composed mainly of general duties signals officers.

No. 60 Group was also responsible for liaison with all other users of radar throughout the R.A.F. Under S.A.S.O. there was a small training staff which was responsible for indicating to the Directors of Manning, Training, and Personnel, the group's requirements in officers, airmen, and W.A.A.F., for the training policy of this personnel and for ensuring that the personnel of the chain itself were maintained in a high state of efficiency. The training staff was also concerned in the preparation and amendment of the training syllabus for the initial training of all radar operating personnel. In the administrative branch were the organisation and personnel sections, the staffs of the Services, and certain specialist sections. The personnel staff were responsible for advising the Record Office on selection and posting of personnel within the radar organisation. Until the formation of No. 60 Group this had been done by D. of S. for civilian staff and by Headquarters Fighter Command for Service personnel. The group captain in charge of administration was also responsible for supervising and co-ordinating the work done by B.M.H.Q., which was at that time staffed by personnel of D.C.D., with the addition of a few Service personnel attached by the Director of Personnel. The Installation Unit at Kidbrooke, responsible for installing radar apparatus at C.H. and C.H.L. stations, was also absorbed into No. 60 Group for administration. The Chief Technical Officer (C.T.O.) also came under the administrative branch; he was in charge of a number of maintenance control and technical specialists who gave a 24-hour service to the chain. Also under the C.T.O. was a calibration section, responsible for the calibration and re-calibration of radar stations, an R.D.F. Air Section, consisting of eight special signals officers established for the purpose of instructing in the use and servicing of airborne radar apparatus, and four detached radar servicing sections, scattered throughout the United Kingdom and responsible for carrying out repairs. Wherever possible the group was established on a Service basis but because it was impossible to find sufficient serving officers with the peculiar qualifications necessary for the highly technical work and responsibilities of the group, many posts established for serving officers were annotated to the effect that they might be filled by the appropriate grade of technical officer.<sup>1</sup>

#### **Responsibility for Ground and Airborne Radar**

In April 1940 No. 60 Group took over from the Air Ministry Research Establishment (A.M.R.E.) Dundee the complete responsibility for installing and servicing the chain of ground radar stations in the United Kingdom. As a necessary adjunct to this the group was given authority to exercise the powers of local purchase previously granted to the A.M.R.E. for the provision of minor items for radar stations.<sup>2</sup> No. 60 Group formed

<sup>1</sup> A.M. File S.59512.

<sup>2</sup> A.H.B./IIE/64.



a radar unit by providing equipment, mustering and training the necessary personnel, and then despatching it to the chosen destination. The personnel were posted to the nearest R.A.F. unit for all purposes other than operations.<sup>1</sup>

In May 1940 D. of S. laid down the responsibilities of No. 60 Group in relation to airborne radar equipment (I.F.F., A.S.V., and A.I.).<sup>2</sup> No. 60 Group was to assist in the introduction of airborne radar equipment to units in the United Kingdom by providing technical advice to the command, group and station signals officers concerned. It was to provide technical officers to visit stations to advise on the training of unit servicing personnel and to advise local signals officers about the methods of air operation which had produced the best results. It was to maintain liaison with the authorities responsible for research and development and to keep units and signals staff informed of progress. In order to fulfil its responsibilities towards airborne radar, Headquarters No. 60 Group attached liaison officers in May 1940 to No. 32 Maintenance Unit, St. Athan, R.A.E., Farnborough, and A.M.R.E., Swanage. These were responsible for collecting information about the day to day fitting of aircraft with airborne radar, particularly A.I., for reporting the daily position to Headquarters No. 26 Group, and for assisting and co-operating with unit personnel to give maximum productive effort. No. 60 Group was not responsible for the supply or fitting of initial I.F.F., A.S.V., or A.I. equipment in aircraft.<sup>3</sup> At the beginning of September 1940 all responsibility for airborne radar was removed from No. 60 Group. The personnel who had carried on the work were distributed between Fighter, Bomber and Coastal Commands and carried out the same functions at their new posts.<sup>4</sup>

The first aim of the first Air Officer Commanding No. 60 Group was to simplify the cumbersome and unsatisfactory technical servicing arrangements for the radar chain. At that time servicing was carried out by four section maintenance units (S.M.U.) which dealt with all emergency repairs of a major or difficult nature. Three of them had been established in the spring of 1938 and the fourth in September 1939. The S.M.U. covering the southern area, the Isle of Wight to the Thames, was located at Hawkinge and Pevensey, that covering the eastern region, the Thames to the Wash, was at Bawdsey, that in the north-eastern area, covering the Wash to the Forth, was at Driffeld and Staxton, and that in the northern area, from the Forth to the Shetlands, was at Dundee. Early in 1940 the S.M.U.s were moved to Hawkinge, Mildenhall, Linton-on-Ouse, and Leuchars

<sup>1</sup> A.H.B./IIE/85/2.

<sup>2</sup> I.F.F.—Identification Friend or Foe. Airborne and ground Radar equipment to identify friendly aircraft.

A.S.V.—Air to Surface Vessel. Airborne Radar equipment for the detection of surface vessels.

A.I.—Air Interception. Airborne Radar equipment carried in night fighters for the detection of other aircraft.

<sup>3</sup> A.H.B./IIE/64.

<sup>4</sup> A.H.B./IIE/85/4(a).

respectively.<sup>1</sup> There were two main drawbacks to the system of servicing by four section maintenance units. First, the personnel and equipment available could not keep pace with the establishment of new A.M.E.S.s. Second, there was an uneconomical use of personnel in the north-eastern and northern sections because of the large area to be covered by each. It was dangerous operationally because it caused serious delay in repairing stations which were widely separated. As a result a great deal of detailed technical control, handling and issue of spares was centralised at B.M.H.Q. The first object when No. 60 Group was established was the decentralisation of many functions performed at this unit.<sup>2</sup>

Accordingly, on 3 April 1940 proposals for the creation of units to provide technical servicing for A.M.E.S.s were submitted to the Air Ministry and were approved. On 1 July 1940 the United Kingdom was divided into eight areas in each of which a radio maintenance unit (R.M.U.) was formed.<sup>3</sup> These units were responsible for the technical administration of the chain of A.M.E.S.s, the four S.M.U.s being disbanded and absorbed into the new units. These units were also responsible for the erection of radar stations.

The need for efficient equipment provisioning, distribution and accounting was one of the pressing problems to be faced when No. 60 Group was formed. In the early days of the radar chain it was experimental and under purely civilian control. All servicing for it was controlled from B.M.H.Q., Carlton Lodge, Leighton Buzzard, where such spares as existed were held at the immediate disposal of technical personnel. There were difficulties in the way of adequate equipment organisation. In the first place the equipment staff at B.M.H.Q. had been too busy receiving and despatching urgently needed radar equipment to keep adequate accounting records. Second, with the rapid expansion of the chain under wartime conditions the arrangements for controlling receipt and issue of spares were inadequate. Third, spares were scarce because most of the equipment was still experimental and only short-term spares provisioning had been made as recommended by D.C.D. Some of the spares were bought as required under local purchase order by B.M.H.Q. Fourth, the equipment was difficult to identify by a non-technical person because very little bore a stores reference number. Fifth, the holding of most spares at a central unit meant that the distribution of vital spares was slowed down. From

<sup>1</sup> A.M. File S.62162/I.

<sup>2</sup> A.M. File S.60142.

<sup>3</sup> The location of and areas served by the radio maintenance units were :—

Number	Base	Area
1	Wick	Shetlands to Moray Firth
2	Dyce	Moray Firth to Firth of Forth
3	Usworth	Firth of Forth to Tees
4	Church Fenton	Tees to Wash
5	Duxford	Wash to Thames
6	Biggin Hill	Thames to Isle of Wight
7	Filton	Isle of Wight to South Wales
8	Speke	North Wales to Clyde

(A.M. File CS.2824).

May to July 1940 radar equipment was supplied to A.M.E.S.s direct by Headquarters (Unit) No. 60 Group, but this was a temporary measure until some improved method was evolved.<sup>1</sup> When the R.M.U.s were formed equipment sections were included on the establishment to hold and distribute technical equipment; this facilitated identification because technical personnel were always available at the units. For all technical items bearing reference numbers R.M.U.s demanded on their appropriate universal equipment depot (U.E.D.) in the normal way. For all unreferenced spares they demanded on No. 60 Group Headquarters (Unit), where local purchase order action was taken provided no contract existed for the particular item. Headquarters No. 60 Group controlled the provision and distribution of radar stocks. B.M.H.Q. continued to hold sufficient spares to supply overseas A.M.E.S.s.<sup>2</sup>

A.M.E.S. personnel continued to be posted to neighbouring R.A.F. stations and these parent stations administered the satellite radar stations in all domestic matters. For operational purposes radar stations came directly under Headquarters Fighter Command who could issue verbally via the Filter Room direct orders regarding such matters as observing and reporting. Copies of written correspondence in connection with these matters were sent to the appropriate radio maintenance unit and Headquarters No. 60 Group. On 30 June 1940 the division of responsibilities between Headquarters No. 60 Group and parent stations was laid down. Parent stations were responsible for rations, pay, discipline and courts martial, transport (petrol, oil, servicing and accident reports), clothing, repair and washing contracts, stores (non-technical equipment), works services (maintenance only), defence, and medical matters.<sup>3</sup> Headquarters No. 60 Group was responsible for establishments, recommendations for courses, promotion, reclassification and remustering, posting and attachments, leave (officers), transport (establishment and supply of vehicles), technical stores (radar equipment), supply of typewriters, amendment of standard equipment establishment, provision and employment of R.A.F. police and Air Ministry wardens, training and initial works services. On all these matters A.M.E.S.s were to correspond direct with Headquarters No. 60 Group. Parent stations published Personnel Occurrence Reports.<sup>4</sup> On 6 October 1940 Headquarters No. 60 Group stated that the R.M.U.s were responsible to it for the technical servicing and efficiency of all radar stations. They were not directly responsible for the administration of these stations except for technical stores and medical matters, but it was hoped that eventually they would take over complete administrative control of A.M.E.S.s and act as a direct link in all matters between stations and the group headquarters.<sup>5</sup>

On 14 October 1940 the Air Ministry issued orders that R.M.U.s were

<sup>1</sup> A.H.B./IIE/85/2.

<sup>2</sup> No. 60 Group O.R.B. August 1940.

<sup>3</sup> A.M. File S.60142.

<sup>4</sup> A.M. File S.60142.

<sup>5</sup> A.H.B./IIE/85/4(a).

to be known as radio servicing sections (R.S.S.). They were to be self-accounting for equipment only, and also self-accounting for equipment only for all stations which they serviced. Parent stations of A.M.E.S.s were therefore no longer to be responsible for equipment accounting for those stations.<sup>1</sup> During 1940 No. 60 Group was gradually taking to itself more responsibility for the domestic affairs of the A.M.E.S.s and using the newly styled radio servicing sections as the intermediate chain of command. In November 1940, however, the Air Ministry issued a new order ruling that the responsibility for administration (other than technical), discipline, and welfare of personnel of all radar stations was that of the parent station and parent station's group and command. In no case was No. 60 Group to concern itself with the non-technical administration of stations. This caused some confusion because A.M.E.S.s had been informed that a scheme whereby full responsibility both for their technical and non-technical administration by R.S.S.s had been submitted to the Air Ministry for approval.<sup>2</sup> In spite of the Air Ministry ruling the trend continued within No. 60 Group for R.S.S.s to assume greater administrative responsibility and in November 1940 a formal request for reorganisation within the group was submitted to the Air Ministry.

### Reorganisation

By November 1940 it was clear that the existing organisation within No. 60 Group was unsatisfactory and required overhauling. All parties agreed on the need for improvement. Parent stations complained of the cumbersome method of administering satellite A.M.E.S.s, which were often miles away, sometimes in remote and inaccessible spots. Many radar stations were controlled by large operational units, the administrative staff of which were fully occupied with the cares of operational flying stations. The personnel of A.M.E.S.s often felt that the importance of their work was minimised and their particular needs and problems overlooked in the pressure of work at parent units.<sup>3</sup> The R.S.S.s were doing technical administration and the provision of some equipment and by November 1940 they were gradually taking over from parent stations certain administrative matters, such as medical questions. The resulting diarchy was inefficient and uneconomic. Headquarters No. 60 Group also found that the original system proved unworkable in practice, particularly as during 1940 the radar chain increased both in extent and in numbers of stations. So many formations were concerned in administrative matters—A.M.E.S.s, parent stations, R.S.S.s, Headquarters No. 60 Group, and groups and commands of parent stations—that the channels of communication were diverse and unwieldy. Serious delays would have occurred if normal procedure had been followed, so the necessary administrative work had been carried out by a short-circuit of groups and commands.

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<sup>1</sup> A.M. File S.60142.

<sup>2</sup> A.H.B./IIE/85/3.

<sup>3</sup> A.H.B./IIE/85/3.



During 1940 Headquarters No. 60 Group struggled, by liaison with the authorities concerned, to effect the co-ordination and standardisation of many administrative matters, but there were still serious defects in their internal organisation. The A.O.C. felt that because of its peculiar composition and the fact that it was a functional and not a geographical group No. 60 Group should be given greater authority over its units and in some aspects the powers of a command. There were eight main difficulties produced by the division of responsibility within the group. The first was works services. A large number of new radar stations had been opened, many of them in remote places where communication and accommodation problems were manifold. Works services had to be carried out under the supervision of various Works Area superintending engineers under orders from the Air Ministry or Headquarters Fighter Command. After the erection of a camp, works, maintenance and the provision of additional accommodation were necessary. Headquarters No. 60 Group had no power to order these works services to be carried out; all it could do was to request the various authorities concerned to provide what was required. Provision always lagged behind requirements. The second difficulty lay in personnel and discipline matters. The A.O.C. No. 60 Group had disciplinary powers over personnel of the headquarters unit only because personnel of A.M.E.S.s were on the strength of units of other groups. If personnel of an A.M.E.S. were charged with offences of a technical nature which were beyond the powers of the junior officer commanding such stations, they had to be dealt with by officers at parent units who knew nothing of the technical work of an A.M.E.S. and were not allowed to be told anything about the work because of its secret nature. This meant that the parent units, groups and commands carried responsibilities for which they had no establishment. Another difficulty in administering personnel lay in the fact that No. 60 Group had no peacetime trained senior officers commanding its stations. A.M.E.S.s and R.S.S.s were commanded and staffed almost entirely by civilian technicians in uniform. Transport proved to be a third difficulty. All transport belonging to No. 60 Group units was borne on the strength of parent units belonging to other groups. No. 60 Group therefore could do nothing to effect major repairs, replacements, and writes-off, and the utmost difficulty was experienced in maintaining in a serviceable condition such transport as was available. A fourth difficulty lay in the defence and security of A.M.E.S.s. Theoretically parent units were responsible for the defence of No. 60 Group stations, but often they were situated miles from the parent unit and it was impossible for these to exercise effective control. The A.O.C. No. 60 Group felt that a Defence Officer and a Deputy Assistant Provost Marshal should be established at Group Headquarters to supervise the defence and security arrangements. Accountancy presented a further problem. Within No. 60 Group there were large numbers of civilian technical officers, technical assistants, laboratory assistants and other civilians. Their terms of service and regulations differed from those normally met on R.A.F. stations. Queries on travelling claims and subsistence allowances could not be properly answered by accountant officers



of the parent units because they were ignorant of the No. 60 Group conditions of service. Often command accountants were also ignorant of the regulations and Headquarters No. 60 Group had no power to deal with such matters. Difficulties also arose with equipment accounting. R.S.S.s were in theory self-accounting for technical equipment for themselves and for the A.M.E.S.s in their areas, but in practice procedure differed from command to command; in some commands technical inventories were kept and in others they were abolished. Equipment proved to be a further difficulty, and equipment arrangements were the most abnormal feature of No. 60 Group. Most of it was not in the stores vocabulary, was not obtained through normal equipment channels, but direct from the manufacturers, and was not standard. Most of it was experimental and highly technical and could be identified only by technical experts. With the increase in the number of stations and the development of more technical equipment the task of the equipment branch in supply and distribution for home and overseas grew steadily. The A.O.C. No. 60 Group considered that the group equipment branch required the status of a command equipment branch so that it might have direct access to Air Ministry branches. Welfare problems presented another difficulty. The question of maintaining morale by supervision of welfare and the provision of comforts was very important in No. 60 Group, where stations were in isolated spots and the number of personnel small. Headquarters No. 60 Group could do little to ensure that adequate attention was paid to the matter except by requesting parent units to do what they could. On the question of health, sanitation, and hygiene, No. 60 Group had a chain of responsibility independent of parent units. There was a Senior Medical Officer (S.M.O.) at the Headquarters and medical officers at each R.S.S. who were responsible for these matters at A.M.E.S.s. The S.M.O., however, did not have the powers of a Principal Medical Officer (P.M.O.) at command headquarters and had to rely on higher authority supporting his proposals in order to effect adequate provision for the units. The A.M.E.S.s had no medical officers of their own and had to rely on local civilian medical practitioners.

On 18 November 1940 proposals for the improvement of administration within No. 60 Group were submitted to the Air Ministry. Among these was one that the eight radio servicing sections be raised to wing status and given full administrative powers. On 6 January 1941 a meeting, under the chairmanship of the Director General of Organisation, was held at the Air Ministry to discuss the matter. The Director of Signals, the A.O.C. No. 60 Group, the Director General of Works, and representatives of Air Ministry branches, Technical Training Command, Coastal Command, Fighter Command, Flying Training Command, Bomber Command, and No. 60 Group were present. It was agreed at the meeting that the R.S.S.s were to be enlarged and known as Signals Wings, the eight existing ones being renumbered 70 to 77 instead of 1 to 8. The R.S.S.s were to be fully self-accounting units to which the personnel of their own units and the A.M.E.S.s which they serviced should be posted. They were to be respon-

sible for pay, discipline, the issue of all equipment, technical and non-technical, the arrangement of medical attention, the co-ordination of repair of M.T., the administration of Service Institute funds, and the co-ordination of local defence with the local Army commander. Rations for each A.M.E.S. were to be drawn from the nearest source. More extensive powers were granted to No. 60 Group. A works officer was established at the headquarters. Equipment branches of No. 60 Group were empowered to deal directly with the Air Ministry on matters of technical equipment only, on matters of non-technical equipment on the opening of new stations through No. 40 Group and on non-technical equipment on other occasions through the usual channels.<sup>1</sup> The new organisation of the group came into effect on 17 February 1941. On 24 February 1941 another Signals wing, No. 78, was formed to cover the Plymouth area.<sup>2</sup>

### Expansion

The number of A.M.E.S.s in the home chain continued to increase<sup>3</sup> and with this grew the responsibilities of No. 60 Group. In May 1941, therefore, No. 60 Group asked for increased powers, more in line with those wielded by a command headquarters. The requests were for full and responsible equipment functions directly under the Air Ministry accounts staff with powers equivalent to command accountants, and works powers in respect of A.M.E.S.s. This last included the power to authorise new works services up to £1,500 for any one item, full control of works services authorised for No. 60 Group stations, power to authorise requisitioning of property and land up to an agreed annual rental value, and the power to authorise re-appropriation of buildings. No. 60 Group claimed these powers not only on the grounds that the group had expanded considerably. It was claimed that the burdens of the group were heavier than those of other groups. As far as radio was concerned No. 60 Group was the only operational training ground, the only source of supply of instructors for the training schools at home and abroad, and the only source of supply for overseas drafts. The greatest possible degree of unified control was required and it was felt that if No. 60 Group had command powers, urgent operational commitments would be executed far more quickly than if reference had first to be made to higher authority. With the increasing use and increasing importance of radar in the war effort, speed of fulfilment of the various tasks was all-important, and on 20 June 1941 the Air Officer Commanding-in-Chief, Fighter Command,<sup>4</sup> concurred in the proposal that the administration and works services of No. 60 Group should be divorced from Headquarters Fighter Command and made the entire responsibility of the group commander. In September 1941 the Air Ministry gave permission for Headquarters No. 60 Group to refer requests for requisitioning properties direct to the Air Ministry instead of to Headquarters Fighter

<sup>1</sup> A.H.B./IIE/85/1.

<sup>2</sup> A.H.B./IIE/85/4(a).

<sup>3</sup> By May 1941 the number operational was 116.

<sup>4</sup> Air Marshal W. Sholto Douglas.

Command as previously. No. 60 Group was also given authority to re-appropriate buildings, but this power was not extended to requisitioned properties. The group was, however, not given full command accounting powers because on the information supplied by Fighter Command few accounting problems were dealt with by them for No. 60 Group. On 27 September 1941 the Air Officer Commanding-in-Chief Fighter Command gave authority for the Air Officer Commanding No. 60 Group to deal with Part II works services up to £2,500 for the chain of radar stations, Headquarters No. 60 Group and the signals wings.<sup>1</sup> In September 1941 a new wing (No. 79) was formed to be responsible for the A.M.E.S.s in Northern Ireland, which at that date were 11 in number.<sup>2</sup>

The work and responsibilities of No. 60 Group continued to expand during 1942. By the middle of September 1942 the personnel strength of No. 60 Group was 785 R.A.F. officers, 315 W.A.A.F. officers, 90 U.S.A. officers, approximately 12,000 airmen and 5,000 W.A.A.F., W.R.N.S., and A.T.S., together with about 300 civilians making a total of over 18,000. By that date the Air Officer Commanding No. 60 Group was responsible for the servicing and operational efficiency of his stations, for the installation of new stations and for the administration of signals wings, and stations within the group. The centralised filtering at Headquarters Fighter Command, Stanmore, had given way to the establishment of seven group filter rooms. As a result close liaison between fighter operational stations and Headquarters Fighter Command was essential and greatly increased communication facilities were provided to keep a large number of additional Army and Navy centres supplied with information obtained by radar methods. No. 60 Group was charged with the responsibility for the operation and servicing of all radar reporting stations at home, irrespective of whether such stations were intended for naval, Army or R.A.F. purposes. These additional commitments involved the taking over or commissioning of approximately 100 naval and army stations and operating them primarily for naval or army purposes.

Another aspect of No. 60 Group's responsibilities was the continual increase in the size and technical complexity of its stations. With the introduction of T.E.B. Mark III, I.F.F. ground installation, C.M.H. Mark II, Consols, and reserve channels, the technical effort required for the installation and servicing of a station was several times greater than that required for a station on the formation of the group. A further new commitment was the responsibility for the operation and servicing of Type 7,000 stations (Gee) which provided navigational assistance for Bomber Command. As a consequence of the increase of the work and responsibilities of No. 60 Group the Air Officer Commanding-in-Chief Fighter Command requested on 11 September 1942 that the post of Air Officer Commanding be upgraded from the rank of air commodore to that of air vice-marshal. D.G.I.S. had

<sup>1</sup> A.H.B./IIE/85/1.

<sup>2</sup> No. 60 Group O.R.B. September 1941.

recommended this upgrading the previous month.<sup>1</sup> On 3 October 1942, therefore, the proposal was considered by the R.A.F. Establishments Committee in consultation with D. of Tels. and D. of R.D.F. It was agreed that, as No. 60 Group had a pre-operational and post-operational responsibility upon which the fighting efficiency of the operational groups was largely dependent the proposed upgrading should be recommended. This recommendation was supported by the Chief of the Air Staff on 15 October and approved by the Secretary of State on 24 October 1942.<sup>2</sup>

### Reorganisation of Signals Wings

In February 1943 a review of the organisation and establishment of No. 60 Group Signals Wings was carried out to ascertain how far it was possible to reorganise the group geographically on the basis of one signals wing to one Fighter Command group area. The object of the review was to ensure the maximum possible economy of manpower consistent with maintenance of satisfactory operational and technical efficiency. It was considered possible in England and Wales to make the signals wing area coincide with that of each Fighter Command group. It was recommended that in Scotland one wing should be responsible for the area of the two northern sectors of No. 14 Group and another should cover the southern sector and the radar stations in Northern Ireland. The proposals were submitted by Headquarters No. 60 Group to the Air Ministry and on 25 March 1943 approval was given for the alteration. There was some delay in the reorganisation because the Fighter group boundaries were not finally determined, but on 19 April 1943 instructions were issued that the ten signals wings were to be reformed into six wings, the boundaries of which corresponded with the reorganised operational groups in Fighter Command. Nos. 71, 74, 76 and 79 Signals Wings were disbanded and the new wings were:—

- (a) No. 70 Wing situated at Bunchrew Manor, Inverness. To operate in No. 14 Group excluding the Turnhouse sector.
- (b) No. 72 Wing situated at Dollar, Clackmannanshire. To control radar stations of R.A.F. Northern Ireland and the Turnhouse sector of No. 14 Group.
- (c) No. 73 Wing at Easthorpe Hall, Malton, Yorkshire. To control radar stations in No. 12 Group.
- (d) No. 75 Wing at Keston, Kent. To control radar stations in No. 11 Group.
- (e) No. 77 Wing at Woolton, Liverpool. To control radar stations in No. 9 Group.
- (f) No. 78 Wing at Holme Park, Ashburton, Newton Abbott, Devon. To control radar stations in No. 10 Group.

This reorganisation took effect on 1 July 1943. Meanwhile, on 1 May 1943.

<sup>1</sup> A.M. File S.59512/III.

<sup>2</sup> A.M. File S.59512/IV.



another signals wing was formed in No. 60 Group. The function of this '9,000', from a technical, operational and servicing aspect. These stations were administered for all other purposes by the appropriate signals wing. No. 84, was to control radar stations Types '100', '7,000' and 'This wing did not have a very long life because on 1 September 1944 it was disbanded and re-established as a section of No. 60 Group Headquarters annotated No. 60 Group Radar Navigational Aids Section Cambridge.<sup>1</sup>

On 15 May 1944 further reorganisation of the signals wings was carried out. The existing six wings were reformed into five wings to effect essential economies in manpower. No. 70 Wing controlled A.M.E.S.s in No. 13 Group and R.A.F. Northern Ireland, No. 73 Wing controlled A.M.E.S.s in Nos. 9 and 12 Groups, No. 75 Wing remained in control of A.M.E.S.s in No. 11 Group, and No. 78 in control of those in No. 10 Group. The A.M.E.S.s of No. 72 Wing were transferred to No. 70 Wing, and the Headquarters of No. 72 Wing was reformed at Headquarters No. 60 Group as a new commitment for special service. A.M.E.S.s of No. 77 Wing were transferred to No. 73 Wing.<sup>2</sup>

#### Calibration of Radar Stations

In the early days of the radar chain, before the establishment of No. 60 Group, calibration arrangements were on a small scale and by the spring of 1940 were quite inadequate. One detached flight at Martlesham from the Special Duty Flight at St. Athan provided aircraft for height and performance calibration, in addition to special interception training at Bawdsey. Also three autogyros and two pilots were available for A.M.R.F., Dundee, and use was also made of balloons for D/F calibration. This was insufficient and Fighter Command provided aircraft from time to time for performance tests, but the arrangement was not satisfactory as it diverted aircraft from their operational duties, required special arrangement and involved the use of pilots who did not always understand fully what was required. On the formation of No. 60 Group a survey was made of the facilities and machinery for the administration, technical servicing and calibration of existing and projected A.M.E.S.s. As a result it was discovered that few A.M.E.S.s were being accurately calibrated. Therefore, in April 1940 when the A.O.C. No. 60 Group proposed the formation of servicing units he suggested that the units should include personnel and aircraft for calibration.<sup>3</sup> This proposal was embodied in the establishment of the R.M.U.s and when these units became signals wings provision for calibration was continued. Each of the ten wings had a flight consisting of Blenheim Mark IV, Tiger Moth Mark II, and Hornet Moth aircraft. By means of these each officer commanding a wing was responsible for calibrating for height the radar stations under his command. In addition, there was No. 1448 Flight at Halton consisting of Rota aircraft which was directed

<sup>1</sup> A.M. File S.60142.

<sup>2</sup> A.M. File S.60142.

<sup>3</sup> A.M. File S.62162/I.



by Headquarters No. 60 Group; these aircraft were allotted by group headquarters as necessary for azimuth calibration. Ground controlled interception (G.C.I.) stations were, in general, calibrated by sector aircraft.

This organisation worked efficiently but was extravagant in personnel and aircraft. During the summer of 1942 investigations were made in order to try and economise by reorganising the arrangements for calibration. On 3 September 1942 suggestions were put forward by No. 60 Group. It was proposed that the wing flights of Nos. 74, 75, 76 and 78 Wings be replaced by a squadron of Spitfire aircraft, centrally located in the area south of Oxford. The Hornet Moth aircraft from these disbanded flights were to be transferred to the establishment of a Rota-Moth squadron replacing No. 1448 Flight at Halton. The proposal was supported by Headquarters Fighter Command but rejected by the Air Ministry. For another year the question of economising on the calibration flights of No. 60 Group was debated. Among suggestions was one that four calibration flights should be amalgamated in No. 116 Squadron, whose function it was to calibrate Army radar stations under Fighter Command. This was considered technically impracticable by the Air Ministry and No. 60 Group. A proposal that the calibration duties of No. 116 Squadron should be taken over by the No. 60 Group calibration flights was opposed by Headquarters Fighter Command in January 1943. Finally, in June 1943, it was decided that Nos. 70 to 79 Signals Wings Calibration Flights and No. 1448 Flight should be disbanded. All the aircraft, equipment and personnel thrown up on the disbanding of these eleven flights were utilised in the formation of three calibration and one Rota squadron in No. 60 Group. These squadrons were No. 526 (Calibration) Squadron, based at Inverness and administered by No. 70 Wing, No 527 (Calibration) Squadron based at Catterick and administered by No. 73 Wing, No. 528 (Calibration) Squadron based at Filton and administered by No. 78 Wing, and No. 529 (Rota) Squadron based at Halton and administered by No. 75 Wing. Each squadron was self-contained for servicing.<sup>1</sup>

## CHAPTER 4

# RESEARCH, DEVELOPMENT AND PRODUCTION

### Pre-War Organisation

In the inter-war years radio research and development work was the responsibility of the Assistant Director of Research and Development (Instruments) (A.D.R.D.(Inst.)) in the Department of the Air Member for Research and Development (A.M.R.D.). As an integral member of the Air Staff, D. of S. participated in the formulation of policy by indicating what communication facilities existed, could be provided, or appeared incapable of attainment, for embodiment in the executive machinery on which the policy depended. D. of S. tried to lay down a reasonably long-range plan based on operational requirements to assist the process of design and development. To do this, consultation with the department of the A.M.R.D. and visits to the Wireless and Electrical departments of the R.A.E. were necessary. Between September 1929 and November 1935 D. of S. had almost full control of radio research and development because officers were appointed to the post of A.D.R.D.(Inst.) who had little or no knowledge of radio. A.D.R.D.(Inst.) was part of a Joint Directorate of Research and Development which was responsible to the A.M.R.D. through the Director of Technical Development (D.T.D.) and the Director of Scientific Research (D.S.R.). The D.S.R. was the Air Ministry representative on the Radio Research Board, which was a unit of the Department of Scientific and Industrial Research. The Air Ministry relied for basic research work in radio matters on the Radio Research Board Department, the National Physical Laboratory, and certain universities. The research team at the Royal Aircraft Establishment was too small (never more than four) to permit basic radio research except on problems peculiar to the R.A.F., such as wireless-controlled aircraft.<sup>1</sup>

In October 1935 the Secretary of State for Air expressed concern about the organisation of radio research and development work in the R.A.F. He felt that the Signals Directorate should be reorganised to fit in with the general pattern of Air Ministry organisation. At that date it had a dual function, being responsible not only for executive action in the operations field but also for development work in connection with wireless apparatus. In other spheres the A.M.R.D. was responsible for research and development and the Air Staff for operational use of equipment developed. The Secretary of State felt that the function of the Signals Directorate should be operational and that wireless research and development should be a function of the A.M.R.D. He also felt that there was insufficient arrangement for an interchange of information on the subject of research and development between the three Services and the outside world. The A.M.R.D. said the

<sup>1</sup> A.M. File S.39518.

control of D. of S. over research and development had decreased during 1936. Because of the highly specialised nature of signals equipment it was necessary for the Director to have some say in research and development matters as well as his responsibility for stating operational requirements. He considered that co-operation and interchange of information with the other Services and with outside bodies was adequately maintained. The W/T Board had technical sub-committees on which all three Services were represented. There were annual visits to the experimental establishments of the three Services. The Civil Aviation Branch of the Directorate of Signals kept in touch with developments in the United Kingdom and foreign countries by means of personal contact and attendance at international conferences. The Department of the A.M.R.D. contained civilian wireless experts who were also in touch with home and overseas civil developments. Periodically a selected officer attended the wireless course at the *Ecole Supérieure* in Paris. The A.M.R.D. did, however, suggest an improvement in the organisation for radio research and development by removing from A.D.R.D.(Inst.) all responsibility in connection with those instruments which had no connection with radio work. He suggested that the process should be gradual and when completed the title of the post should become Assistant Director of Research and Development for Radio Work. D. of S. agreed with the suggestion. On 3 November 1936 the Chief of the Air Staff recommended that the proposed change be carried out and on 1 December 1936 the Secretary of State concurred.<sup>1</sup>

During 1937 basic radio research became the responsibility of the D.S.R. The previous reliance on outside sources had been unsatisfactory because many objective requirements were peculiar to aviation in general and the R.A.F. in particular. In 1937 the D.S.R. tried to improve matters by strengthening the research team in the Radio Department at the R.A.E. and by framing a new programme in which the chief requirements were improved radio communications and direction finding methods.<sup>2</sup>

Besides the work at the R.A.E. there was a separate large research programme at Bawdsey for which Mr. R. A. Watson Watt was directly responsible.<sup>3</sup> The Bawdsey Research Station existed for the conduct of research and development work on the detection and location of aircraft and on the communication of the resulting intelligence to the operational user in the form most suitable for the user's requirements. The primary function of the station was the working out of the R.D.F. system in its different embodiments with accessory apparatus in the chain from observing station to controller's situation board. Problems relating to other systems of detection and location came within the scope of the establishment.<sup>4</sup> There

<sup>1</sup> A.M. File S.39518.

<sup>2</sup> A.M. File S.42987.

<sup>3</sup> In July 1936 Mr. Watson Watt was appointed to the staff of the D.S.R. at the Air Ministry to be in charge of radio detection and location work (including the transmission of results) in connection with all schemes of defence, and to conduct research and technical development thereon as was required. (A.M. File S.37745.)

<sup>4</sup> A.M. File S.41057.

was considerable inter-Service co-operation in matters of R.D.F. research and development. There was a scientific liaison officer stationed at Bawdsey who visited the Admiralty Signal School at frequent intervals. Quarterly meetings were held at the Signal School to discuss progress in that establishment, which were attended by the scientific liaison officers and other officers employed on similar work at the two establishments to discuss difficulties and ideas.<sup>1</sup> In February 1936 the Air Ministry gave permission for a War Office team to work at Bawdsey in conjunction with the Air Ministry experimental team. The War Office team concentrated on work for military purposes but their leader kept in touch with the development of the work of the station as a whole in order to appreciate the possibility of military applications. The team functioned as an integral part of the Bawdsey research organisation.<sup>2</sup>

### **Directorate of Communications Development**

Little was done during 1936 and 1937 to relieve A.D.R.D.(Inst.) of his heavy responsibilities in regard to research and development on instrument work. At the end of 1937 he was still concerned not only with radio transmission and reception, including direction-finding, but also with numerous classes of flying instruments, including automatic controls and photographic equipment. The whole organisation for air defence depended on a complex chain of communications, and by the end of 1937 it was clear that the existing system of communications was likely to break down in the earliest stages of a possible war and that an improved system was urgently needed. This in turn necessitated a properly organised system of research and development in communications. Not only did the air defence system require improved communications; there were corresponding needs in bomber guidance, in civil aviation traffic control and guidance, in inter-command and other point-to-point services, and in meteorological communications. In November 1937 Mr. R. A. Watson Watt proposed that a Directorate of Investigation on Communications should be formed within the Department of the A.M.R.D. The duties of this Directorate would be to provide for research and development in communications equipment and method. He suggested that the post of Director should be filled by an experienced civilian. If this were done D. of S. would be free to concentrate the policy-forming side of his work, which Mr. Watson Watt considered had tended to be subordinated to the research and development side. The D.S.R. supported the creation of a new Directorate to supervise research and development of communications.

A meeting was held by the A.M.R.D. on 6 January 1938 to discuss the organisation in his Department of research and development work on communications. It was agreed that the evolution of an effective communications system contained research and development problems of such variety and complexity that if they were to be successfully tackled direction by an

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<sup>1</sup> A.M. File S.37506.

<sup>2</sup> A.M. File S.39518.

officer with necessary, specialised qualifications was required. It was agreed that D. of S. should continue to lay down operational requirements and also be prepared at all times to consider for Service use the results of independent work. It was agreed that whatever changes in the organisation of the Department of the A.M.R.D. were decided upon it would be necessary to ensure that D.T.D. should co-ordinate the development of all apparatus destined for installation in aircraft. It would also be necessary for the D.S.R. to exercise a general supervision over all work on the research side and to remain the single official channel of communication with outside bodies on research matters. After further discussion at Air Ministry level it was agreed that a new section be formed, to be known as the Directorate of Communications Development. The head of this Directorate was to have the status of Director but would be paid a lower salary than a Director because he was to be to some extent subordinate to the D.T.D., and the D.S.R. was to remain the chief adviser to the Air Council on research matters. The formation of the new Directorate complicated the organisation of the Department of the A.M.R.D. because previously research and development had been under two separate directors, D.T.D. and D.S.R. Now the new Director was to be responsible for both research and development in connection with communications and direction-finding equipment. This departure from established practice was felt by the Air Ministry to be the best arrangement to secure progress with the highly specialised problems requiring solution. The new Directorate was not to take over instruments. Mr. Watson Watt was proposed for the post. His Directorate was also responsible for the production of R.D.F. equipment; this could not be manufactured by means of large-scale contracts because it was still experimental and changing all the time. Production of other signals equipment was the responsibility of the Director of Production in the Department of the Air Member for Supply and Organisation. The installation and servicing of R.D.F. stations also came within the scope of the new Directorate. In February 1938 the approval of both the Chief of the Air Staff and the Secretary of State was obtained. On 4 May 1938 Treasury approval was given to the creation of the new post because of the strong view expressed by the Air Council on the urgent need for it. The Treasury felt that a proper and adequate course would have been to appoint Mr. Watson Watt to the post of Deputy Director of Scientific Research sanctioned in August 1937. However, the post was authorised on the basis that the title and post were to be personal to Mr. Watson Watt. In May 1938, therefore, he took up the duties of Director of Communications Development.<sup>1</sup>

#### **Inter-Service Relations on R.D.F. research and development**

In July 1938 the Air Council considered the question of formulating an agreed inter-departmental policy on R.D.F. research because its application was being extended to cover a wide range of use in the Navy, Army and R.A.F. In August 1938 it was agreed that all basic research be centralised

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<sup>1</sup> A.M. File S.42987.



at Bawdsey Research Station and the closest liaison be maintained between Bawdsey and the Admiralty and War Office research and development establishments concerned with R.D.F. The Air Ministry was responsible for recruiting and training the personnel required to operate large fixed R.D.F. stations, mobile R.D.F. stations used by the R.A.F. and Army, and R.D.F. apparatus used in R.A.F. aircraft. The War Office was responsible for providing and training personnel necessary to man R.D.F. apparatus used in conjunction with anti-aircraft guns and for the detection of ships from the shore. The Admiralty was responsible for recruiting and training personnel required for R.D.F. equipment used in aircraft of the Fleet Air Arm. The Air Ministry was made responsible for basic research on R.D.F. The only proviso was that the development of valves and certain associated circuit work was entrusted to the Admiralty Signal School at Portsmouth.<sup>1</sup>

The Air Ministry was always insistent on the need for really close co-operation and co-ordination of R.D.F. research and development and in the summer of 1939 opposed Admiralty and War Office proposals that development work be carried out at a separate establishment for each Service. The D.C.D., Air Ministry said that completely unified control and execution in research, development and production<sup>2</sup> in R.D.F. for the three Services was necessary. This would ensure the most effective use of the very limited supply of experimental staff, simplicity and maintenance of approved priorities in production, the earliest possible application in each field, and direction with full knowledge of available technique, available material, relative urgencies and relative promise. In spite of Air Ministry opposition the War Office moved their team from Bawdsey to the Air Defence Experimental Establishment at Christchurch in August 1939,<sup>3</sup> and the Admiralty proposed that a special naval R.D.F. establishment be formed at Eastney. Their view was that the work at Eastney was on a very small scale and did not affect the main programme of R.D.F. research and development. The Air Ministry opposed the idea on the grounds that R.D.F. research would suffer if there was competition between the Services for the restricted source of supply of persons competent to do the scientific work in this field.

The need for speed in R.D.F. research and development was greatly increased by the outbreak of war. A conference was held on 13 September 1939 at which representatives of the Admiralty, Ministry of Supply, and Air Ministry were present. Recommendations were made for the furthering of progress in R.D.F. research, development, and production. It was agreed that staff, other than individuals on the National Register already earmarked by Directors of Scientific Research, were to be selected by the D.S.R., Admiralty, who would make provisional recommendations to the Directors

<sup>1</sup> A.M. File S.45641.

<sup>2</sup> At a Treasury Inter-Service Committee meeting in August 1938 it was agreed by representatives of the Treasury, Admiralty, War Office and Air Ministry that contracts for R.D.F. requirements for all three Services should be placed by the Air Ministry.

<sup>3</sup> One of the reasons for this move was the War Office fear that Bawdsey would be too vulnerable to enemy attack in the event of war.

of Scientific Research of other departments and D.C.D., Air Ministry for the allocation of such staff between departments. The Air Ministry was to conduct all research on R.D.F., mainly at the A.M.R.E. Dundee. A detailed programme of research was to be prepared and revised quarterly, or more frequently if necessary, by the D.C.D. in conjunction with the D.S.R. at the Admiralty and with the Ministry of Supply. Research on valves for R.D.F. remained the responsibility of the Admiralty. Development work on behalf of each Service was to be carried out at such establishments as were decided upon by the department concerned. The D.C.D. Air Ministry was to be responsible personally for maintaining co-operation between the various establishments contributing to work on R.D.F. Responsibility for production of R.D.F. equipment remained with the Air Ministry. The other two departments urged that a separate Directorate be formed within the Air Ministry to cover the production of signals equipment. Responsibility for releasing equipment for production at the appropriate stage of development was to rest with the 'user' department who would act in the matter after consultation with the D.C.D. The general co-ordination of R.D.F. policy and its execution was supervised by the Inter-Services Committee on R.D.F. under the chairmanship of the Assistant Chief of the Air Staff.<sup>1</sup>

#### **Reorganisation of Directorate of Communications Development**

A few months after the outbreak of war in September 1939 it was found necessary to expand and reorganise the research, development, and production organisation for signals equipment. The rapid development in the last few years of peace and the vastly increased use of wireless and R.D.F. equipment following the declaration of war made this essential. On 29 November 1939 Air Marshal Sir Philip Joubert recommended that an Inspector of R.A.F. Telecommunications be appointed. There was an urgent need for the appointment of an individual to ensure that the best technical advice was available to the Service in matters of W/T, R/T and R.D.F. It was also essential that the experience obtained in the field by the actual users of the equipment should be made available to those responsible for research and development and that the Director of Production should be rapidly informed of any requirements which were not being fulfilled by the material placed at the disposal of the Service. The Air Staff needed the best scientific advice possible in the matter of signals from an individual who was free from the responsibilities of research, design and/or production. Such a person would be invaluable also for advising Dominion and colonial governments on all signals matters, with particular reference to R.D.F. The proposal was discussed at a meeting presided over by the Deputy Chief of the Air Staff, at which the Assistant Chief of the Air Staff, the Director of Communications Development, the Director of Signals and Air Marshal Sir Philip Joubert were present. It was agreed that the appointment proposed by Sir Philip Joubert should be made and should be called Scientific Adviser on Telecommunications (S.A.T.), Air Ministry. It was also agreed that the S.A.T.

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<sup>1</sup> A.M. File S.45641.

should advise not only the Air Staff but also the Department of the Air Member for Development and Production (A.M.D.P.), but should be attached to the Air Staff (A.C.A.S.). It was proposed that Mr. Watson Watt be appointed and in January 1940 the Secretary of State approved this recommendation.<sup>1</sup>

The terms of reference of the Scientific Adviser on Telecommunications were : —

- (a) Advice to the Air Staff (A.C.A.S.) on the electrical telecommunications services of the R.A.F. and Air Ministry and on the communication and presentation of the information conveyed by the Services, and recommendations on such improvements as were desirable and practicable.
- (b) Advice to the Air Staff on the operational application and technical limitations of R.D.F. equipment.
- (c) Recommendations to the Air Staff on such improvements in operations room technique as might be desirable and practicable.
- (d) Advice to the Air Staff and the A.M.D.P. on the technical possibilities of new projects involving telecommunications.
- (e) Recommendations to the A.M.D.P. on such research and development projects as would ensure better meeting of Air Staff requirements.
- (f) Advice on proposals for the application of R.D.F. to the needs of Allied and Dominion governments.
- (g) Study and report on telecommunications services of foreign governments with special reference to their bearing on R.A.F. requirements.
- (h) He was to sit as a member of the Inter-Allied Telecommunications Board and the Air Ministry Communication Policy Committee and of such other boards and committees as were from time to time considered desirable.
- (j) Advice to government departments on the application of R.D.F. to civil needs with special reference to civil aviation requirements.
- (k) Attendance at certain international conferences on telecommunications as an Air Ministry representative.<sup>2</sup>

The post of S.A.T. was re-established at the Ministry of Aircraft Production when that ministry was formed in May 1940, but the post continued to include scientific advice on telecommunications to the Air Staff among its responsibilities and Mr. Watson Watt spent much time at the Air Ministry.

This appointment of a Scientific Adviser on Telecommunications was part of a general reorganisation in the Directorate of Communications Develop-

<sup>1</sup> A.M. File S.2773.

<sup>2</sup> A.M. File S.2773.

ment arising out of wartime expansion. In the first three months of the war the very rapid growth of the various applications of R.D.F. in all defence departments necessitated a comprehensive review of the position. The outbreak of war and consequent expansion of the chain meant that some reorganisation was essential. The responsibilities of the D.C.D. had increased greatly because of the rapid development and advanced implementation of the R.D.F. warning system. In addition to his normal responsibility for the development of ordinary aircraft communications requirements and R.D.F. equipment, he was almost entirely responsible for the production of R.D.F. equipment. This last involved a vast programme of fitting, erection, and major servicing of the stations. He was also responsible for R.D.F. research. In January 1940 a committee under the chairmanship of Sir Henry Tizard, formed to investigate the working of the R.D.F. chain,<sup>1</sup> proposed a reorganisation in the Department of the A.M.D.P. This provided for the co-ordination of development and research as far as communications were concerned under a Director of Communications Development and Research and the formation of a new Directorate of Communications Production to be responsible for all communications equipment production, including R.D.F. This section was to have a small final-stage experimental development section to ensure that equipment was developed which was suitable for mass production.<sup>2</sup> The Admiralty and Ministry of Supply had for some time urged that a separate directorate be formed within the Air Ministry to deal with the production of signals equipment.<sup>3</sup> At the beginning of January 1940 the Secretary of State approved the reorganisation of the D.C.D. into two new directorates, the Directorate of Research and Development of Communications (D.R.D.C.) and the Directorate of Communications Equipment Production (D.C.E.P.).<sup>4</sup> The name was changed to the Directorate of Radio Production (D.R.P.) in February 1940, when the Directorate was formed within the Air Ministry. Two liaison assistant directors were appointed, one from the Navy and one from the Ministry of Supply. The Directorate was organised into three main branches, responsible respectively for technical design including valve production, communications production, and R.D.F. production. Under wartime urgency production followed so closely on research that it was essential for it to be linked very closely with development. Therefore, a line of demarcation between the functions of the D.C.D. and the D.R.P. was necessary. At the stage that development was transferred from an experimental establishment to industry the control passed from the D.C.D. to the D.R.P. When development was entrusted in the first instance to radio firms the responsibility for maintaining contact between the firms and the appropriate experimental establishments in any of the three Services rested with the D.R.P. All technical queries and changes in design which arose during production also were dealt with by the D.R.P.<sup>5</sup> The committee

<sup>1</sup> See Chapter 5 of this volume for details of the formation and composition of this committee.

<sup>2</sup> A.M. File S.2773.

<sup>3</sup> M.A.P. File SB.2244.

<sup>4</sup> A.M. File S.2773.

<sup>5</sup> M.A.P. File SB.3213.



also recommended that a group be formed to relieve the D.C.D. of the responsibility of siting, erecting and servicing R.D.F. stations. This resulted in the formation of No. 60 Group in February 1940.

The change in the organisation of the Directorate of Communications Development did not affect inter-Service relations in research and development. The Air Ministry retained overriding control of R.D.F. research and development but this control was subject to the inclusion in the staff of D.R.D.C. of a representative of the Admiralty and Ministry of Supply.<sup>1</sup> It was agreed in January 1940 that it should be left to the discretion of the Air Ministry to entrust any particular item of research work to any one of the other departments if it was considered an advantage to do so. The responsibility for co-ordination and control in such cases remained with the Air Ministry. Meanwhile each Department continued to proceed on its own course in regard to research, development and production of signals equipment. The arrangement for R.D.F. was in force until the formation of the Ministry of Aircraft Production on 17 May 1940, when the Directorate of Research and Development of Communications and Directorate of Radio Production were transferred to the new ministry.<sup>2</sup>

#### **Operational Research Sections at Command Headquarters**

In October 1940 the Assistant Chief of the Air Staff (Radio) (A.C.A.S. (R)) expressed his alarm at the lack of contact between commands and those members of the M.A.P. staff who were responsible for signals research, development and production. At Fighter Command Headquarters the Stanmore Research Section had been formed but this was pre-occupied with statistical and analytical work and was not able to function on the planning and advising side. A.C.A.S. (R) therefore proposed the establishment of new posts at Fighter, Bomber and Coastal Command Headquarters. He felt that these posts should be filled by men capable of appreciating and anticipating telecommunications development and hence requirements in the commands and also of advising on the best utilisation of existing telecommunications equipment. His proposal was agreed by the Air Ministry and Ministry of Aircraft Production, and in January 1941 the Air Ministry informed the three operational commands of their intention to create three new posts of operational research officer on the staff of the S.A.T., one for attachment to each of the commands.<sup>3</sup> This was agreed. In February 1941 the functions of the S.A.T. were re-stated and those of the Operational Research Officers set out. The S.A.T. had four functions :—

- (a) To act as Scientific Adviser on Telecommunications to the Ministry of Aircraft Production and the Controller of Telecommunications Equipment.

<sup>1</sup> The Ministry of Supply acted for the War Office in matters of research, development and production.

<sup>2</sup> M.A.P. File SB.42427.

<sup>3</sup> The head of the existing Stanmore Research Section was to be Operational Research Officer at Headquarters Fighter Command.



- (b) To act as Scientific Adviser on Telecommunications to the Secretary of State for Air and the Air Staff normally through A.C.A.S.(R).
- (c) To recommend to the Controller of Telecommunications Equipment his research programme and to report on the progress of research.
- (d) To act as the head of the Operational Research Division for A.C.A.S.(R) controlling and co-ordinating the work of Operational Research Officers at operational commands and of scientific research and analysis staff at the Air Ministry and Headquarters Fighter Command.

Operational Research Officers had the duty of appreciating and anticipating operational needs for telecommunications developments (including W/T, R/T, D/F, R.D.F., radio aids to navigation and pilotage, and operations room equipment), of advising on the best use to be made of existing telecommunications equipment, and of planning the principles of future applications. Their views and proposals were to be examined by the S.A.T., who would recommend to the A.C.A.S.(R). They were available for consultation by A.Os.C.-in-C. and air staff officers at commands and groups and could without reference to the S.A.T. carry out for A.Os.C.-in-C. such scientific enquiries and analyses as could be undertaken without overburdening their staffs. They could tender scientific advice directly on matters of local importance or matters not involving major issues of policy. Operational Research Officers had to keep the S.A.T. informed of such local activities to ensure that confusion was not produced by conflicting advice. They were to obtain the permission of A.Os.C.-in-C. to visit groups, stations and squadrons for free discussion with all who could assist in the planning of telecommunications policy and suggesting means for full utilisation of telecommunications and technique.<sup>1</sup>

During 1941 the command operational research sections were transferred from the direction of the S.A.T. to that of the air staff at command headquarters because it was realised that the nature and scope of the activities of these sections were primarily a matter for the decision of commanders-in-chief. In October 1941 it was decided that the existing scheme should be widened gradually from telecommunications to all such R.A.F. and enemy activities as were amenable to scientific analysis. There was a need for some central direction. In October 1941, therefore, it was decided to appoint to the Air Staff, directly under the Deputy Chief of the Air Staff, an officer charged with the co-ordination and correlation of the work of the operational research sections. This was done in order to ensure that there was no duplication of effort. The main task of the section established under this officer was that of correlating all operational research of the commands, the Intelligence and Technical staffs of the Air Ministry, and the appropriate directorates of the Ministry of Aircraft Production.<sup>2</sup>

<sup>1</sup> A.M. File C.6879/40.

<sup>2</sup> A.H.B./ID8/244.

### Research and Development after formation of M.A.P.

In November 1941 the Director General and Inspector of Signals (D.G.I.S.) instituted a new procedure for initiating research and development work. The urgency of war requirements did not permit a continuance of the pre-war system of determining a development programme at an annual conference. It was therefore necessary to ask the Controller of Telecommunications Equipment (C.T.E.) at the Ministry of Aircraft Production to undertake development work as requirements arose. On 17 November 1941 the D.G.I.S. stated that a new procedure was to be followed in order that directorates might inaugurate the demands but at the same time avoid conflicting or inadequately considered instructions regarding supply and development, and in order that all demands might still be gathered into a definite and co-ordinated programme. All requirements for new development arising had to be examined and approved by the responsible director. Requests or authorisations for new development were addressed to the C.T.E. and were signed by the D.G.I.S. or on his behalf by the responsible director. The D. of S. was responsible for recording demands and keeping an up-to-date co-ordinated development programme: in order that this might be achieved and to avoid overlapping or conflicting requests all demands to the C.T.E. were passed through him. When a new item of development work had been accepted by the M.A.P. under this procedure, discussion on detail or progress could be delegated by directors to the heads of sections, who could establish direct contact with the relative section of the D.C.D. If any major alteration to the original item became necessary the procedure was as for new development work. In the case of equipment requirements the Director General of Equipment was informed of these and in turn informed the M.A.P. as necessary.<sup>1</sup>

In September 1942 approval was given for the appointment in the Air Ministry of a Controller of Communications (C. of C.). It was decided that the Director General of Signals should report to C. of C. who in turn reported to the Chief of Air Staff. Sir Robert Renwick was appointed to fill this post and also that of Controller of Communications Equipment in the Ministry of Aircraft Production. Sir Robert Watson Watt continued to hold the post of Scientific Adviser on Telecommunications in the Air Ministry and that of Vice-Controller of Communications Equipment in the Ministry of Aircraft Production. The duties of C. of C. were defined as:—

- (a) Implementation of C.A.S. policy in regard to the development, production and installation of radio and communications equipment.
- (b) Technical planning of development, production and installation of airborne and ground radio and communications equipment.

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<sup>1</sup> A.H.B./IIE/243/2/4.

- (c) Liaison with M.A.P. on research, development, production and installation questions.<sup>1</sup>

#### **Production after formation of M.A.P.**

When the Ministry of Aircraft Production was formed in May 1940 the Directorate of Radio Production was transferred to the new ministry and by agreement between the parties concerned all production of signals equipment was undertaken by it. In fact the M.A.P. placed contracts and undertook production progressing on behalf of the Ministry of Supply and the Air Ministry, but the Admiralty continued to place their own contracts and do their own production progressing, using capacity allocated by the Ministry of Aircraft Production. The shortage of valves was acute in all Services and production did not keep pace with demand. The production of all valves (Service requirements for communications and R.D.F., and requirements for the G.P.O. and domestic purposes) was controlled by the Inter-Service Valve Production Committee (I.S.V.P.C.) of which the Director of Radio Production was chairman and on which the Admiralty, Ministry of Supply and Board of Trade were represented. Each department notified its demands to the committee, which allocated the requisite capacity. Each department then placed its own contracts, but the production progressing on behalf of all departments was undertaken by the M.A.P., as were all projects for expansion of capacity. In effect the entire valve industry was under the control of the M.A.P., subject to the allocation of capacity by the committee. All principal components for all Services and all purposes were controlled by the Inter-Services (Communications) Components Committee (I.S.C.C.) of which the D.R.P. was chairman and on which the Admiralty, Ministry of Supply, Board of Trade, and General Post Office were represented.<sup>2</sup> This committee was formed in September 1941 because of the urgent need for co-ordinating and planning the production of components and special materials required to meet the signals communications and radio requirements of the various government departments and to control the output of the firms engaged in production. A sub-committee was formed under the I.S.C.C. to be responsible for the allocation of orders. A new deputy directorate was formed within the D.R.P. to implement the decisions of the main committee and sub-committee.<sup>3</sup> Inter-Service radio policy was co-ordinated by the Radio Policy Sub-Committee. Any technical matters concerning R.D.F. which required investigation were referred to the R.D.F. Technical Committee, of which the Controller of Telecommunications Equipment was chairman and on which the Admiralty and Ministry of Supply were represented, together with the Director of Communications Development and the Director of Radio Production.<sup>4</sup>

In June 1942 the Night Air Defence Committee asked the Minister of Production to report whether any change was called for in the machinery

<sup>1</sup> A.M. File A.435668/42.

<sup>2</sup> M.A.P. File SB.42427.

<sup>3</sup> M.A.P. File SB.3213.

<sup>4</sup> M.A.P. File SB.42427.

for determining the priority for radio production or in the arrangements for production of radio equipment. The Minister said he considered there was a need for some alteration in the existing arrangements. He also felt that there should be a body which could speak for the United Kingdom in relations with the U.S.A. in radio matters. He therefore suggested the establishment of a Radio Board to be the supreme co-ordinating body in regard to inter-Service radio policy, research, development and production. This was authorised in October 1942.<sup>1</sup>

In March 1943 the Deputy Directorate of Progressing Communications Equipment was set up in the M.A.P. to plan, initiate provisioning action for, and progress the production under contract of, all R.A.F. ground and airborne radio and communications equipment. The deputy directorate was also responsible for progressing all R.A.F. ground and airborne radio and communications installations and was also responsible for progressing naval radio and communications equipment and installation thereof in aircraft and marine craft.<sup>2</sup>

By March 1943 it was clear that the overall radio production capacity of the country was insufficient to meet the stated requirements of the Navy, Army and Air Force. Co-ordination of production for the three Services was therefore necessary in order to allot the capacity available to the most urgent needs, to eliminate duplication and to ensure maximum production from the available resources. There was some co-ordination on certain aspects of radio production, but it was on a low level and not always able readily to implement agreements reached. There was a Priority Panel under the Radio Board which gave decisions on whether priority was to be allotted to the production of any particular radio equipment. The Minister of Aircraft Production felt that the Radio Board lacked an executive arm to give effect to its policy decisions. Its decisions and recommendations went to the three separate executive branches at the Admiralty, Ministry of Supply and Ministry of Aircraft Production. There was no single instrument of administrative decision and no executive to supervise the planning and progressing of decisions reached. It was not desirable that the responsibility for the three executive branches should be disturbed, but it was necessary to weld them together for more unified action at a level immediately below the Radio Board and its two main committees. Owing to the very large increases in the radio requirements for the Services there was not capacity available to meet the requirements in full. The Radio Board was therefore anxious to ensure that there was full executive control over the demands placed on industry. Demands for main radio equipments were normally placed by each Service department on the appropriate production ministry. If the equipment was common to more than one Service department the 'greatest user' placed demands to cover all requirements. Some difficulty had been experienced in getting other users to place their demands through

<sup>1</sup> M.A.P. File SB.42427. See Chapter 5 of this volume for details of the Radio Board.

<sup>2</sup> A.H.B./IIK/54/13/53. See Appendix No. 6 for terms of reference.



the 'parent' Service, generally owing to lack of appreciation that the equipment in question was in common use. It was, however, mainly in the field of valves and radio components which might be common to a number of different equipments and in which productive capacity was especially inadequate that serious duplication and confusion arose. A measure of control was established by the Inter-Service Valve Production Committee and the Inter-Service Radio Components Committee,<sup>1</sup> but these committees were not in a position to ensure that the correct executive action was taken on their decisions. The Minister of Aircraft Production tentatively proposed the creation of a central Radio Department, but this was opposed by both the Air Ministry and Admiralty on the grounds that the existing arrangements worked fairly well and any change in them would cause dislocation of important work which would be difficult to make up. The Admiralty further considered that the formation of another department would result in loss of contact between producer and user. A solution was found in the suggestion of the Parliamentary Secretary to the Ministry of Aircraft Production that a Radio Production Executive should be established. It was agreed at a meeting of ministers on 4 May 1943 that such a body should be formed and that it should consist of the chief radio production executives of the three supply departments. Meetings between these three executives were already frequently held and the creation of the Radio Production Executive placed them on a formal footing. The composition of the Executive was the Controller of Telecommunications Equipment at the Ministry of Aircraft Production, the Director General of Mechanical Equipment at the Ministry of Supply and the Deputy Director of the Signal Department at the Admiralty. The Radio Production Executive formed part of the organisation of the Radio Board, reporting to the Production and Planning Radio Committee, and a number of the existing sub-committees concerned with production problems came under the Executive. The method of provisioning then changed so that each department requiring radio equipment furnished full details of estimated requirements to the Radio Production Executive, who co-ordinated the estimates and planned the output of the radio industry and any necessary extension. The Executive was also responsible for determining priorities.<sup>2</sup>

The Radio Production Executive remained the central radio production authority for the rest of the war, but it was no longer necessary when peace returned. At a meeting of the permanent secretaries of the departments concerned on 27 August 1945 it was agreed that the Radio Production Executive and its activities in the production field should close down. Arrangements were made for it to do so from 30 September 1945, such parts of the subordinate organisation as were still required being held by the M.A.P. and reporting to the Operations and Technical Radio Committee or to the Radio Board.<sup>3</sup>

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<sup>1</sup> These were subordinate committees of the Radio Board.

<sup>2</sup> A.H.B./ID/5/96.

<sup>3</sup> Radio Board Memorandum. Radio (45) 39.



### Signals Equipment Provisioning

On 15 December 1943 the Director General of Signals held a conference to discuss radar and telecommunications equipment provisioning procedure. The need for urgency in provisioning radio equipment was emphasised. D.G. of S. felt that too much time was taken up in the Air Ministry provisioning procedure; this was very important from the operational standpoint as it often resulted in delaying the equipping of service units with valuable operational signals devices. For speed in provisioning it was essential that the D.G. of S. requirement should be clearly and fully stated. For the purpose of provisioning procedure radio equipment was divided into two categories:—

- (a) Normal projects not involving covering Treasury Inter-Service Committee (T.I.S.C.) approval, such as additional provision of a standard equipment already in R.A.F. use.
- (b) Entirely new projects requiring T.I.S.C. approval such as new equipment developed to meet a new operational requirement.

It was agreed that for projects requiring T.I.S.C. approval no material action towards provision could be taken until the approval was obtained. When this was obtained necessary requisitioning action could be taken by the Director of Radio Production, M.A.P. In non-T.I.S.C. projects the greater part of the preparatory work for the placing of a contract could be put in hand before financial approval from F.4, Air Ministry, was sought. It was agreed that T.I.S.C. authority should be sought by D.G. of S. asking the provisioning branch and F.4 to approach the Treasury for general approval.<sup>1</sup>

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<sup>1</sup> A.H.B./IIE/44.

## CHAPTER 5

### R.A.F. SIGNALS IN THE DEFENCE ORGANISATION

The R.A.F. Signals organisation fitted into the general signals organisation of the Empire Defence Scheme. Contact and co-operation with other departments was officially carried out by means of various committees and boards. Before the war the main body responsible for the defence of the Empire was the Committee for Imperial Defence (C.I.D.), and to this all other defence organisations were subordinate. During the war the supreme committee responsible for the conduct of the war was the War Cabinet. Immediately below this came the Chiefs of Staff Committee. The Imperial Communications Committee (I.C.C.) was the main advisory body on all matters appertaining to the signals communications of the Empire. The R.A.F. was represented on this committee.<sup>1</sup> It was set up during the 1914-1918 War and functioned between the two wars as one of the sub-committees of the C.I.D. Its terms of reference were to consider questions of policy concerning overland telegraphy, wireless telegraphy, submarine cables, and visual signalling. In 1939 the I.C.C. became a War Cabinet committee and its terms of reference remained unaltered.<sup>2</sup>

#### The W/T Board

The Wireless Telegraphy Board was another inter-Service committee on which the R.A.F. was represented. It was formed in 1918 and superseded the Joint Naval and Military Wireless Telegraphy Committee. The chief object of the Board was to ensure the smooth co-operation of the three Services in all wireless telegraphy, line telegraphy and visual signalling matters and to prevent the unnecessary duplication of work by the research and development departments of the three Service ministries.<sup>3</sup> Membership was from the Signals departments of the Admiralty, War Office and Air Ministry. The Chairman was an active Service officer of the equivalent rank of lieutenant-colonel.<sup>4</sup> He could be appointed from any one of the three Services but in fact the Navy monopolised this position until Wing Commander O. G. Lywood became chairman on 4 May 1937.<sup>5</sup> The Board was not an independent authority on its own account but was a means of expressing the combined opinion of the three Services. Its functions were purely advisory and its recommendations had to receive the approval of the ministries concerned before action could be taken upon them. The Board had an experimental sub-committee which was formed in 1920. It exchanged information about the research work in progress, with a view to mutual benefit; it recommended the allocation of new experimental or development work which might affect more than one Service; it discussed action regarding

<sup>1</sup> R.A.F. Signals Manual A.P. 1083, December 1924 and A.M. File 493038/24.

<sup>2</sup> Radio Board Memorandum, Radio (45) 39.

<sup>3</sup> See Appendix No. 7 for detailed duties of W/T Board.

<sup>4</sup> A.M. File S.3356.

<sup>5</sup> Narrator's interview with Air Vice-Marshal O. G. Lywood, R.A.F. (Retd.).

patents; it co-ordinated valve development and the use of common components; and it prepared W/T instrument and material specifications of common use to the three Services. Periodic visits were paid by members of the main committee and of the experimental sub-committee to the three experimental establishments. A special meeting was held annually to examine the year's programme of experimental work and to ensure that no unnecessary overlapping occurred.<sup>1</sup>

The outbreak of war necessitated a reorganisation of the W/T Board. Its functions then included the co-ordination of the signals requirements of the three fighting Services and the Home Office; signals communications liaison with the Allies; and technical co-ordination between the three British Services and their French counterparts. In January 1942, because of the increased scope of responsibilities of the W/T Board, the post of chairman was upgraded to the rank of full colonel or equivalent. In March 1942 the terms of reference of the Board were changed. These became:—

- (a) To co-ordinate the views of the three Services on signals communications matters generally, including submarine cable communications.
- (b) To collaborate on behalf of the three fighting Services with the Imperial Communications Committee, the General Post Office, the Home Office, the Ministry of Home Security, and other government departments.
- (c) To secure liaison with commercial wireless and communications companies.
- (d) To determine the allotment of wireless frequencies between the three fighting Services.<sup>2</sup>

#### **Subordinate overseas bodies to the W/T Board**

The main executive function of the W/T Board was the allocation of frequencies, and in overseas war theatres this function was performed by subordinate bodies of the main W/T Board. In the Middle East a committee, at first called the W/T Board Eastern Mediterranean, Egypt and Palestine, was formed in the years before the war. It controlled the allotment of frequencies for the Navy, Army, Air Force, and Civil Service in Egypt, Palestine, and Transjordan, and was under the control of the General Headquarters Middle East. The Board primarily consisted of the Chief Signal Officer, Headquarters British Troops in Egypt, the Fleet Wireless Officer, Mediterranean Fleet, and the Chief Signals Officer, Headquarters R.A.F. Middle East. Where co-ordination was needed between military and civilian wireless services the Inspector General Egyptian State Telegraphs, the Postmaster General of Palestine, the Director of Posts and Telegraphs, Sudan, and the Chairman of Marconi's Radio Telegraph Company were co-opted. The arrangement worked very well in peacetime but in wartime it was felt

<sup>1</sup> A.M. File S.3356.

<sup>2</sup> A.M. File S.3356.

that the existing control should be extended to cover all areas under the command of the General Officer Commanding-in-Chief Middle East, in order to prevent mutual interference between the various wireless services. These additional areas were Cyprus, Kenya, Uganda, Tanganyika, Zanzibar, Northern Rhodesia, Nyasaland, British Somaliland and Aden. Accordingly, on 25 January 1940 the G.O.C.-in-C. Middle East asked that the jurisdiction of the Board should be so extended; this request was considered at a meeting of the main W/T Board on 3 May 1940. It was decided, with the approval of the Colonial Office, that the W/T Board Eastern Mediterranean should be given control over all frequency allotments, both Service and civilian, in all areas under the command of the G.O.C.-in-C., certain restrictions being specified to safeguard colonial administrations. It was also understood that all allotments of frequencies made by the W/T Board Eastern Mediterranean should be subject to confirmation by the main W/T Board in London. The name of the Eastern Mediterranean Board in May 1940, therefore, changed to the Middle East W/T Board and later that year to the Combined Signal Board, Middle East. There was also a W/T Board in Malta which worked in conjunction with the Middle East W/T Board.<sup>1</sup>

In November 1940 the War Office received a request from the G.O.C. West Africa for an allotment of frequencies and wave codes for operational use. The W/T Board agreed that the matter would best be decided on the spot in consultation with the other Services. They agreed with a War Office suggestion that the formation in West Africa of a board similar to the London W/T Board seemed to be the best method of bringing about the required inter-Service collaboration. In December 1940 the establishment of the Combined Signal Board, British West Africa, was authorised.<sup>2</sup>

#### **The Inter-Service Committee on R.D.F.**

In November 1934 a committee was formed to consider the possible application of new scientific discoveries to methods of warfare. This was the Air Ministry Committee for the Scientific Survey of Air Defence, known as the Tizard Committee. Mr. H. T. Tizard was chairman, Professor A. V. Hill, Professor P. M. S. Blackett, and Mr. H. E. Wimperis were members and Mr. A. P. Rowe, secretary. The committee considered the whole field included in its title but R.D.F. proved the most promising line of enquiry. In November 1938 the Inter-Service Committee on R.D.F. was set up under Air Vice-Marshal W. Sholto Douglas, on which the Admiralty, War Office and Air Ministry were fully represented, both on the scientific and operational sides.<sup>3</sup> At the first meeting it was proposed that the Committee should have three panels, one for each Service, which would deal with detailed work on the application of radar to individual Services. The terms of reference for the panels were, to consider and report to the Inter-Service

<sup>1</sup> A.M. File S.4654.

<sup>2</sup> A.M. File S.8323.

<sup>3</sup> Radio (45) 39. See Appendix No. 8 for the terms of reference of the Inter-Service Committee on R.D.F.

Committee on R.D.F. on matters, within the terms of reference of that body, predominantly affecting one Service. It was stated that it had been agreed by the Board of Admiralty, Army Council, and Air Staff that basic research on R.D.F. should be centred at the Bawdsey Research Station but that the development of individual Service requirements should be undertaken by the appropriate Service establishments. It was agreed that certain research problems might be passed on to the Admiralty and War Office establishments in the same way that research on valves was undertaken by the Admiralty Signal School.<sup>1</sup>

#### The R.D.F. Policy Sub-Committee

At a meeting on 6 June 1941 the Chiefs of Staff Committee approved the setting up of an R.D.F. Policy Sub-Committee as part of their organisation and as a War Cabinet Committee. This Committee, the terms of reference of which were to determine R.D.F. policy for the three Services (referring where necessary to the Chiefs of Staff), replaced the Inter-Services Committee on R.D.F. The duties included arranging priorities for the allocation of equipment, deciding what developments should be undertaken, advising the Dominions, Colonial Empire and India on R.D.F. policy, and determining a policy of interchange of R.D.F. information with foreign governments and in particular with the U.S.A. Air Chief Marshal Sir Philip Joubert was the first chairman and was succeeded by Sir Henry Tizard in September 1941. The members consisted of representatives from the Naval Staff, General Staff and Air Staff, Sir Edward Appleton, the chairman of the R.D.F. Technical and Implementing Committee,<sup>2</sup> and representatives as required from Anti-Aircraft Command, Bomber Command, Fighter Command and Coastal Command. In August 1941 permission was given for an American representative to attend meetings with the status of an all-time observer. This was done in order to foster close co-operation between the United States and the United Kingdom authorities on matters of R.D.F. policy. Firstly, as a potential large scale producer of R.D.F. equipment for Allied use, America occupied a unique position among Allied and foreign nations. Secondly, it was felt that the U.S. fighting Services, as potential users of R.D.F. equipment in the Allied cause, should be persuaded to adopt and follow the equipment designs and technique used by Britain as a result of operational experience in war theatres. Thirdly, it was considered that the American authorities should be assured that the United Kingdom Government attached great importance to American knowledge and understanding of the Government's R.D.F. policy.<sup>3</sup>

In December 1941 the Vice Chief of Naval Staff put forward a recommendation that the terms of reference of the R.D.F. Policy Sub-Committee

<sup>1</sup> Minutes of meetings of the Inter-Service Committee on R.D.F.

<sup>2</sup> The formation of this committee was recommended on 4 July 1941 by the R.D.F. Policy Sub-Committee to give effect to the instructions of the Chiefs of Staff.

<sup>3</sup> Minutes of R.D.F. Policy Sub-Committee Meeting. R.D.F. (41) 2.

<sup>4</sup> R.D.F. (41) 11 and R.D.F. (41) 3rd.



should be extended to cover more than just R.D.F. policy. There were a variety of subjects which required co-ordination at the hands of one authority and which, because they were based on wireless in one form or other, were interdependent on matters of policy. These were, R.D.F., use of W/T beams for navigation, use of W/T for accurate distance finding, measures to counter the enemy's use of the foregoing devices whether by jamming or otherwise, methods of preventing the effective use by the enemy of countermeasures, jamming of W/T communications, and priority of production of material common to W/T and R.D.F. He recommended that the title and terms of reference of the R.D.F. Policy Sub-Committee be altered by substituting 'radio' for 'R.D.F.' with a note defining radio in that connection as all forms of wireless and their antidotes. He proposed that the Radio Policy Sub-Committee should co-ordinate policy on a high plane and that co-ordination on a lower level should be effected by an R.D.F. Board, and an R.C.M. Committee to include jamming of W/T communications and R.D.F. among its responsibilities.<sup>1</sup>

#### **Radio Policy Sub-Committee and the R.D.F. Board**

On 10 February 1942 the R.D.F. Policy Sub-Committee was superseded by the Radio Policy Sub-Committee of the Chiefs of Staff Committee. This new committee covered the whole field of wireless and not only the limited field of radar.<sup>2</sup> The sub-committee was composed of two representatives of the staff of each Service Department, two representatives of the United States Staff Mission in the United Kingdom, the Controller of Telecommunications Equipment (Sir Frank Smith), the chairman of the R.D.F. Application Committee and of the Communications Committee of the Ministry of Supply (Sir Edward Appleton), and Mr. R. A. Watson Watt.<sup>3</sup> In the same month the Chiefs of Staff approved the formation of a permanent R.D.F. Board to work under the Radio Policy Sub-Committee. The Board consisted of two Service members from the branch of each of the three Service ministries responsible for the R.D.F. policy of its respective Service. The chairman was appointed from among the members. R.D.F. questions dealt with by the existing sub-committees of the Radio Policy Sub-Committee, i.e. the Low-Cover Sub-Committee and the I.F.F. Sub-Committee, were dealt with by the R.D.F. Board and the sub-committees dissolved.<sup>4</sup> The R.D.F. Board was empowered to appoint temporary *ad hoc* panels to discharge set tasks.<sup>5</sup> Certain regulations were made concerning the relations of the R.D.F. Board to other committees. It was compelled to refer for decisions to the Radio Policy Sub-Committee all questions requiring a policy decision. The R.D.F. Board had to refer to the W/T Board for their agreement all proposals for the allocation of frequencies to be used by R.D.F. equipment. Co-operation with the R.C.M.

<sup>1</sup> R.D.F. (41) 58.

<sup>2</sup> See Appendix No. 9 for the terms of reference of the Radio Policy Sub-Committee.

<sup>3</sup> A.M. File CS.13420.

<sup>4</sup> See Appendix No. 10 for terms of reference of the R.D.F. Board.

<sup>5</sup> R.P.C. (42) 5 and R.P.C. (42) 2nd.

and Jamming Board was necessary to ensure that any countermeasures proposed against enemy radio facilities would not interfere with or adversely affect British R.D.F. facilities. The R.D.F. Board corresponded with the R.D.F. Technical Committee on questions of research, development and production.<sup>1</sup> On 22 June 1943 the name of the R.D.F. Board was changed to Radar Board, in accordance with an official decision that the term 'radar' should be used instead of 'R.D.F.'

#### Lord Justice du Parcq's Enquiry

In the first two years of the war there was considerable criticism both in Parliament and in the Press about the quality and quantity of Army and R.A.F. radio equipment. It was alleged that the German Services were more efficiently equipped, particularly for communication between aircraft, tanks, and infantry. Adverse comments were made on the British lack of advance planning of radio equipment to meet Service requirements. In February 1942 the *Scharnhorst*, *Gneisenau*, and *Prinz Eugen* sailed up the English Channel from Br est to North German ports and it was known that British search and early warning radar systems, except those of the heavy guns at Dover, had been successfully jammed by the enemy. The position was considered so unsatisfactory that the Prime Minister on 2 May 1942 asked Lord Justice du Parcq to undertake an enquiry. The terms of reference were: first, whether there was full co-ordination between the three fighting Services in respect of radio-location; second, whether full advantage of technical help had been taken in effecting communication in the field between tanks and aircraft and between troops and commands; third, whether the situation with regard to the production and supply of wireless equipment to the three Services was satisfactory. Lord Justice du Parcq's report was presented to the Prime Minister on 5 August 1942. He reviewed the position and expressed the view that until recently adequate planning had been lacking, mainly owing to difficulties as to priorities, since the Radio Policy Sub-Committee had been compelled to allot the highest class of priority to about 38 different subjects of research. He said that no-one with whom he had been in contact regarded the production and supply of wireless for the Services as satisfactory. It was generally agreed that the lack of components had been, and continued to be, the greatest difficulty in the way of speedy production. A delay of about 20 weeks in delivery of components was stated to be normal and in some cases the delay had been as long as six months. He stressed the importance of having a comprehensive list of 'preferred components', for a large stock of such components, and for facilities for quick small-scale production. Lord Justice du Parcq reported that in principle all concerned were agreed that the setting up of a Radio Board on the lines then recommended by the Ministry of Production would do much towards solving the difficulties surrounding production as far as radar was concerned. He stressed the need for the representation of the supply departments on the Board and

<sup>1</sup> A.M. File CS.13420.

its main sub-committees and the importance of the chairman being independent in the sense that he should not be associated with any of the departments which might be brought into conflict. He recommended that the Minister of Production should act as chairman.<sup>1</sup>

### The Radio Board

On 28 September 1942 the War Cabinet approved the formation of the Radio Board as the supreme co-ordinating body in regard to inter-Service radio policy, research, development, and production.<sup>2</sup> Colonel the Rt. Hon. J. J. Llewellyn, then Minister of Production, became chairman in his personal capacity. The Board consisted of three representatives of the Admiralty, two representatives each of the War Office, Air Ministry, Ministry of Supply and Ministry of Aircraft Production, and one representative of the General Post Office.<sup>3</sup> The Board was responsible for ensuring that there was a single coherent policy on the development and production of radio equipment, on scientific research for that purpose, and on such questions as might be determined by the Chiefs of Staff Committee. It made recommendations or submitted matters in dispute to the War Cabinet, the Minister of Production, or where operational issues were involved, to the Chiefs of Staffs, as appropriate. The Radio Board took over the whole of the functions previously performed by the Radio Policy Sub-Committee. This committee ceased to exist, being considered as merged in the Board, and the various subordinate bodies of the committee continued as committees of the Board.<sup>4</sup> It had two main sub-committees, the Production and Planning Radio Committee (P.P.R.C.) and the Operations and Technical Radio Committee (OPTEC). The Board took over a number of existing bodies concerned with particular aspects of the radio field and many organisations to cover specific fields were established. One of the bodies taken over by the Radio Board was the Central Radio Bureau which was set up under the Ministry of Aircraft Production in July 1942, was in full operation by the end of that year and was transferred to the establishment of the Ministry of Production in January 1943. The Bureau was a supporting agency of the Radio Board, responsible in policy matters to one of the deputy chairmen. Its main function was the collection and distribution of radio information both from government and commercial organisations and the maintenance of a library. Its work extended to the Empire and U.S.A.<sup>5</sup>

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Radio (45) 39.

Radio (45) 39.

In April 1945 a representative from the Ministry of Civil Aviation was appointed to the Radio Board. Previously the radio requirements for civil aviation were brought before the Board by the representative of the Directorate General of Signals, Air Ministry, but when the Ministry of Civil Aviation was formed it was felt necessary to have separate representation of that Ministry. (A.H.B./ID/5/95).

A.M. File CS.17201.

Radio (45) 39. See Appendix No. 11 for details of the Radio Board in September 1942.

### Anglo-American Signals Co-operation

Co-operation between the U.S.A. and the British Commonwealth on signals policy matters was achieved by means of joint committees after America entered the war. British representatives on these committees were usually members of the staff of the Directorate of Signals, R.A.F. Delegation, Washington. This body had been in existence before the entry of the U.S.A. into the war but its activities had been largely advisory. Shortly after America entered the war, Anglo-American staff talks were held in Washington to consider the signals problems that might arise between the U.S.A. and Great Britain. Certain general principles, particularly applying to the British and American naval forces, were laid down. Provision was made for the setting up in Washington and London of signals committees for the examination of all problems of inter-allied concern and for settling them as far as possible. The Washington Communications Board (W.C.B.) and the London Communications Committee (L.C.C.) were set up in April 1942 by the Joint Chiefs of Staff for the purpose of co-ordinating the various activities connected with all forms of communication including radio and R.D.F. but they were not primarily connected with research and development in either subject. The committees considered and recommended communications<sup>1</sup> arrangements for joint operations of any combination of elements of the two powers and operations involving elements of those powers with other United Nations. The Committees reported in the case of London to the British Chiefs of Staff and in the case of Washington to the Joint U.S. Chiefs of Staff. The two committees were of equal standing. The major recommendations of each agency, when concerned with matters of broad policy, were subject to review by the other before submission for final approval by the Chiefs of Staff. The W.C.B. and the L.C.C. each consisted of U.S. and British representatives.<sup>2</sup>

The Washington Communications Board was replaced by the Combined Communications Board (C.C.B.) in July 1942. The establishment and organisation of this was due largely to the efforts of the Director of Signals, Air Ministry, who visited the U.S.A. in July and August 1942. The function of the C.C.B. was to co-ordinate Allied communications requirements. It took over the functions of the North Atlantic Inter-Service R.D.F. Committee which had been set up earlier in the war. The C.C.B. had several subordinate committees which were designed to foster interchange of knowledge on the research and development of communications equipment and to try and reach some measure of standardisation of equipment and procedure. Among these subordinate committees were the Combined Recognition Committee, the Combined Methods and Procedures Committee,

<sup>1</sup> The term 'communications' was used to denote techniques involving the transmission and reception of information or data by methods employing radio (wireless), wire, visual or sound means, and the location of objects by methods employing the transmission, reflection and re-radiation of oscillation in the radio frequency spectrum.

<sup>2</sup> Radio Policy Sub-Committee paper R.P.C. (42) 43.



the Combined Security Committee and the Countermeasures Committee. In the summer of 1941 the U.S. Joint Aircraft Committee appointed a sub-committee to standardise, as far as possible, the aircraft radio installations arising out of conflicting U.S. Army, U.S. Navy, and British operational requirements. At the end of 1941 this sub-committee was reconstituted and became the Joint Radio Board. This board did valuable work in co-ordinating the aircraft radio policy of the U.S.A.A.F., the U.S. Navy and the R.A.F.<sup>1</sup>

#### **The R.A.F. Delegation Washington**

The R.A.F. Delegation was the spearhead of Anglo-American co-operation in air warfare. It was set up in Washington in the summer of 1941. A Directorate of Signals was formed within it in September 1941, with an establishment of four posts, a group captain Director of Signals, a wing commander and a flight lieutenant communications, and a squadron leader radar. At that time only the three highest ranking posts were filled. At the same time a communications centre was established with a cypher office, a signals registry and a teleprinter room. The wartime activities of the R.A.F. Delegation Directorate of Signals were divided into four main categories, communications, radar, signals security and radio countermeasures. Before the entry of America into the war the principal function of the Directorate was one of liaison on radar and communications matters with the U.S. Army and Navy in order to secure the advantages of standardisation of operational practice and equipment. The entry of the U.S.A. into the war and the consequent necessity for greater operational co-ordination and collaboration greatly increased the work and responsibility of the Directorate. This, combined with the fact that the communications centre provided communications facilities for other British organisations in the U.S.A. as well as for the R.A.F. Delegation, necessitated increases in the establishment of the Directorate of Signals. In November 1942 the establishment consisted of one air commodore Director of Signals, one group captain Deputy Director of Signals, one wing commander communications, one wing commander, one squadron leader and two flight lieutenants radar, one squadron leader signals security, one squadron leader radio countermeasures, two flight lieutenant secretaries to the Combined Communications Board, and officers and airmen to man the communications centre. The Director of Signals R.A.F. Delegation was represented on the Washington Communications Board and later the Combined Communications Board and its subordinate committees. Personnel of the Directorate were concerned with matters connected with communications equipment. The requisition, procurement and distribution of American radio equipment was the function of the British Air Commission (B.A.C.) on behalf of the Ministry of Aircraft Production but the Directorate of Signals R.A.F. Delegation was responsible for presenting the operational aspects of R.A.F. requirements for this equipment in competition with the U.S. Army and the

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<sup>1</sup> A.H.B./IIF2/32(B).



U.S. Navy, and other United Nations agencies coming within the realm of Lease-Lend. To fulfil this function the Director of Signals was represented on the Joint Radio Board.

A matter on which standardisation between the U.S. Forces and the R.A.F. was needed was signalling procedure. This was done by the Methods and Procedure Committee of the C.C.B. It was obvious after the U.S.A. entered the war that if signals traffic between Services of the two nations was to be handled correctly and expeditiously common signalling procedures covering W/T, R/T, teleprinter, visual signalling and operating signals for use in combined operations were essential. In the absence of combined procedures it would be impossible to withhold from the enemy the nationality or Service making radio transmission. Also there was the risk that vital information concerning the composition and disposition of Allied forces would be disclosed. At the beginning of 1942 the situation was:—

- (a) A basic British procedure existed but all three Services differed. These differences were slight between the R.A.F. and the Navy but very pronounced between these two and the Army.
- (b) There was a basic U.S. procedure.
- (c) A limited combined procedure was in use between the British and U.S. Navies.

By September 1944 certain combined procedures had been agreed and were in force.

The Director of Signals R.A.F. Delegation was responsible for advising the U.S. Forces on radar matters. When America entered the war the U.S. Services knew practically nothing of radar technique and procedure. Before Pearl Harbour there had been no great interest in the U.S. Services in radar beyond the development of SCR.268, which was technically and operationally far behind the British equivalent. Between July and August 1941, 50 sets of A.S.V. Mark II, 100 sets of I.F.F. Mark II and 5 sets of A.S.V. Mark IV were supplied as prototypes for airborne equipment but as far as ground equipment was concerned there were nothing but casual enquiries coupled with the experiment of sending electronic training group officers of the U.S. Signals Corps to the United Kingdom to take R.D.F. courses and to study and work with British radar equipment operationally. The radar officer in the Directorate of Signals had to make the Americans understand the detailed application of radar to modern warfare, to persuade them to learn its theory and practice and to show them how to build up a complete radar system and to organise the necessary training and maintenance Services. In January 1942 Sir Robert Watson Watt and the Director of Signals R.A.F. Delegation began advising the Americans on the formation of their defence system. They gave assistance on the selection of sites. Plans and prototypes of equipment were provided by the United Kingdom and copies made in the U.S.A. All arrangements were made through the R.A.F. Delegation Signals Directorate and these tasks, combined with that of liaison with various departments concerned with

radar and air defence, proved formidable. In April 1942 the establishment for radar duties was increased from one squadron leader to one wing commander and two flight lieutenants. When American radar development became established equipment began to flow the other way. Because American productive capacity was so much greater than that of the United Kingdom the British Services came to rely on American equipment and on American production of British equipment. In this connection the R.A.F. Delegation was responsible for stating operational requirements.

In the spring of 1942 interest in R.C.M. developments was awakening and United States representatives visited the United Kingdom to study research and development at the Telecommunications Research Establishment and operational practice at No. 80 Wing. Following this visit an R.C.M. officer was established in the R.A.F. Delegation. He became the permanent R.A.F. member on the Countermeasures Committee of the C.C.B., which was formed in September 1942. In October 1942 he was recognised as the official representative in the U.S.A. of the R.C.M. Committee in London. The Americans were given valuable help in planning their R.C.M. programme and in the design of their countermeasures equipment. Assistance was reciprocal because in the later stages of the war the R.A.F. relied to a great extent on American production of 'Window' material, machines and dispensers.<sup>1</sup>

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<sup>1</sup> A.H.B./IIF2/32(B).

## CHAPTER 6

### RESPONSIBILITIES OF AIR FORMATION SIGNALS

#### Pre-War Organisation

During the period between the two world wars the provision of landline communications for the R.A.F. in the field came under review. It was clear that the co-ordination of landline provision and technical matters was best entrusted to one authority and, since the Army were the largest users of this type of communication in the field, it was confirmed that the Army should accept responsibility for the provision of similar R.A.F. landline requirements. Thus, whilst R.A.F. wireless communications remained the responsibility of the R.A.F., the Royal Corps of Signals, who provided the Army's communications, became responsible also for providing the ground communications for R.A.F. contingents with the Army in the field. Their duties in support of the R.A.F. included the building of telegraph and telephone routes and the operation of telegraph and telephone instruments and exchanges and of the despatch rider letter service.

It soon became evident that none of the normal Army Signals units in the field was really in a position to fulfil R.A.F. commitments and it was necessary to create special units which understood R.A.F. requirements and could work entirely in R.A.F. interests. Individual Wing and Squadron sections of the Supplementary Reserve, Royal Corps of Signals, were formed in 1924, and by 1931 a total of 22 independent signal sections existed. In 1935 a new organisation was brought into force to co-ordinate the work and training of these scattered sections and to simplify their administration. The units were styled R.A.F. Signals, but the Air Ministry objected to this title as being confusing and in June 1935 a new title of Air Contingent Signals was agreed (A.C.S.). In June 1937 the question was raised of a similar unit for providing equivalent services for the Advanced Air Striking Force (A.A.S.F.). The new unit, although entirely separate from the Air Contingent Signals, was organised on similar lines and the whole organisation then became known as Air Formation Signals (A.F.S.).<sup>1</sup>

#### Wartime Development

At the outbreak of war in September 1939 two Air Formation Signals units were despatched to France, one with A.C.F.F. and one with A.A.S.F., returning after the fall of France in 1940. As a result of the experience in France during that period the Air Ministry advocated a change in the organisation of Air Formation Signals. In the retreat in the summer of 1940 the landline organisation collapsed and in order to maintain communication W/T and other methods had to be used. The Air Officer Commanding-in-Chief Army Co-operation Command opposed any change

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<sup>1</sup> A.M. File 405507/35.

in organisation. He admitted that landline communication had broken down in the Air Component, but everything else with the British Expeditionary Force in that respect had failed. Headquarters Army Co-operation Command, however, in its successive moves from place to place in the retreat, was in constant telephone communication throughout the battle from 9 May until the cables were finally severed before the evacuation on 17 June, both with the Air Ministry and the Advanced Air Striking Force and its bomber and fighter units. After considerable discussion in the remaining months of 1940 it was finally decided in February 1941 that the role of Air Formation Signals should remain unaltered. Therefore their responsibilities regarding R.A.F. communications remained as:—

- (a) The provision, maintenance and manning of equipment for line circuits both telegraph and telephone down to and including squadron exchanges.
- (b) The construction and maintenance of all line circuits.
- (c) Despatch Rider Letter Service.

From experience in France, however, one valuable lesson was learned. This was that no one method of communication should be allowed to become so predominant that its breakdown would seriously jeopardise the communications organisation.<sup>1</sup>

After the withdrawal from France, the Air Ministry persuaded the War Office to keep the units in being. No. 1 Air Formation Signals was sent to Northern Ireland for use with the Air Component there for possible operations in Eire and No. 2 Air Formation Signals was allotted to the R.A.F. to provide landline communications for air defence purposes and to assist in manning teleprinter and telephone channels. In addition both units were of the greatest assistance to the G.P.O. in carrying out short distance line construction for the R.A.F., as the G.P.O. was short of staff. A large amount of local landline construction needed to be carried out, particularly in the United Kingdom in connection with the expansion of Bomber Command, and the G.P.O. were unable to complete the requirements without the assistance of Air Formation Signals. But since the primary function of this body was the provision and servicing of R.A.F. communications in the field, it was obvious that when an expeditionary force was despatched from the United Kingdom, Air Formation Signals would have to revert to its proper role.

#### **R.A.F. Construction Company**

In August 1941 the Air Council suggested that, in order to ensure that the construction of local defence programmes was completed, a unit comprising approximately a strength of two line and four construction sections should be raised quickly to take over this work from Nos. 1 and 2 Air

<sup>1</sup> A.M. File S.6334.

Formation Signals. It was agreed in February 1942 that a new unit of Air Formation Signals, known as the R.A.F. Construction Company, should be formed with a company headquarters, two line sections and four construction sections. Owing to manpower limitations the company was never manned to full establishment. The actual strength of the company varied throughout the war because the War Office found the calls for line construction sections so heavy that they frequently withdrew sections from Air Formation Signals at short notice. In 1945 the company consisted of company headquarters, one line and one construction section. In March 1945 the line section was withdrawn for employment in Western Europe. The cessation of hostilities in Europe made the retention of the services of the R.A.F. Construction Company unnecessary. From 1 August 1945 therefore it ceased to come under the operational control of the Air Ministry.<sup>1</sup>

### Further Development

Throughout the war, the Royal Corps of Signals was engaged in forming and training new signal units for despatch overseas for service with armies and air forces in the field. From the nucleus of Nos. 1 and 2 Air Formation Signals the air formation signals component grew rapidly with the build-up of the R.A.F. and the spread of the war to new theatres. By May 1942 there were seven units : No. 1 in Northern Ireland, No. 2 in England, No. 3 in the Delta Area, Middle East, No. 4 in the Western Desert, No. 5 in Syria and Cyprus, No. 6 in Iraq, and one in India. At the end of the war there were no less than twenty-five units comprising some 21,000 men.<sup>2</sup> The rough yardstick used for planning was one Air Formation Signals Unit for every fifteen R.A.F. squadrons. Subsequently, units were allocated on the basis of one unit for each major air headquarters and for each operational group, base defence group and similar air formation. A normal unit consisted of some 600 officers and other ranks. The standard unit, in addition to a headquarters, included sections for line construction, line maintenance, the staffing of R.A.F. headquarters signals offices and despatch rider services, staffing of R.A.F. headquarters signals sections down to squadron level (including airfield communications), a sector for technical maintenance, and a light aid detachment of the R.A.O.C. for the maintenance of M.T.<sup>3</sup>

Some months after Dunkirk the post of Chief Signals Officer, Air Formation Signals to the field army was abolished because of lack of work. The two units in the United Kingdom were placed under the operational direction of the Air Ministry pending their further employment with R.A.F. units overseas. Liaison between the Air Ministry and War Office on Air Formation Signals matters was carried out by an Army Liaison officer at the Air Ministry. He was a major from the Royal Corps of Signals. In November 1942 the post was upgraded to that of a full colonel in order

<sup>1</sup> A.M. File C.25696/45.

<sup>2</sup> Narrator's interview with Colonel E. L. L. Vulliamy (Royal Corps of Signals).

<sup>3</sup> A.M. File S.6335.



to secure the best possible co-ordination and use of Air Formation Signals units and an officer of that rank was appointed to fill it. The original liaison officer remained at the Air Ministry and in January 1942 a major's post was established, the function of which was to act as assistant to the colonel. The posts were on the War Office establishment and the officers were attached to the Air Ministry for duty. The tasks of the War Office liaison officer fell into three main categories. First, he acted as a liaison channel on major matters of Air Formation Signals policy between the Director of Signals, War Office, and the Director General of Signals, Air Ministry. Secondly, he acted as adviser to D.G. of S. on all questions dealing with the functions of Air Formation Signals in the field. Thirdly, he acted in the capacity of Chief Signals Officer in relation to such Air Formation Signals units as existed or were forming in the United Kingdom and which were not allocated to G.H.Q., Home Forces. The responsibilities of Air Formation Signals were restated in November 1942.<sup>1</sup> They were:—

- (a) The provision and maintenance of landline and D.R.L.S. communications between Headquarters of R.A.F. formations and their units.
- (b) The establishment and staffing of signal offices.
- (c) Assistance in installing and maintaining filter and operations room equipment.

#### Creation of Deputy Directorate at Air Ministry

From November 1942 the responsibilities of the Air Formation Signals (A.F.S.) liaison officer gradually expanded so that by the summer of the following year he was engaged not only in directing the work of the units but also in formulating R.A.F. requirements and in issuing directions to chief signals officers in the R.A.F. In June 1943 the Director General of Signals proposed that a new deputy directorate be formed within the Directorate of Telecommunications to deal with the R.A.F. side of Air Formation Signals. It was felt that the work of the Army officers in D. of

<sup>1</sup> By November 1942 Air Formation Signals Units dispositions were:—

<i>No.</i>	<i>Location</i>
1 —	North Africa.
2 —	North Africa.
3 —	Middle East (Delta Area).
4 —	Middle East (Western Desert).
5 —	Syria and Cyprus.
6 —	Iraq.
7 —	United Kingdom (Being formed).
8 —	Middle East (Being formed).
9 —	Middle East (Being formed).
<i>India</i>	
11 —	Bengal.
2 —	Ceylon (Being formed).
3 —	Bangalore (Being formed).

(A.M. File S.6335).

Tels. had outgrown that of liaison and required to be upgraded in status so that they could take on responsibility for the planning, organising and general operation of Air Formation Signals requirements in a similar manner to that in which other forms of R.A.F. communications were handled in the Air Ministry. In view of the operational importance of the proper provision of communications in the field and the size to which the Air Formation Signals commitment had grown D.G. of S. and the D. of S. War Office agreed that it was necessary to deal with it as an important and essential part of the R.A.F. communications system. It was an R.A.F. not an Army responsibility because the latter was not responsible for planning R.A.F. communications nor for their organisation and disposition. The increase in the number of Air Formation Signals units in use and projected, due to expansion of territories under British control and the fact that Britain had gone over to the offensive, made the planning, organisation and disposition of Air Formation Signals units a major consideration. D.G. of S. felt that, in the interests of close co-operation and continuous contact with, and advice which had to be given to, the War Office, it would be most advantageous for the post of deputy director to be held by an Army officer. In September 1943 therefore it was agreed that a deputy directorate in the Directorate of Telecommunications be established consisting of one group captain, one squadron leader and one flight lieutenant. There was an annotation to the effect that the group captain and squadron leader posts might be filled by Army Officers of equivalent rank. In October 1943 the Deputy Directorate of Telecommunications (5) (D.D. of Tels. (5)) came into being. The Army officers already filling the liaison posts at the Air Ministry were appointed to the group captain and squadron leader posts. In November 1943 the duties of D.D. of Tels. (5) were defined:—

- (a) To plan and co-ordinate R.A.F. requirements in Air Formation Signals units.
- (b) To inform the Director of Signals War Office of R.A.F. requirements in Air Formation Signals units.
- (c) To act as adviser to the Air Ministry and War Office Signals Directorates on all matters arising in connection with Air Formation Signals organisation and policy.
- (d) Co-ordination of Air Formation Signals questions of telecommunications equipment required by Air Formation Signals in overseas theatres.
- (e) Planning, co-ordination and direction of supply of telecommunications equipment required by Air Formation Signals in overseas theatres.
- (f) Co-ordination of services regarding equipment for operations and filter rooms in overseas theatres.
- (g) Allocation of tasks to the R.A.F. Construction Company in connection with air defence communications in the United Kingdom.

<sup>1</sup> A.M. File S.6335.

In December 1944 D.D. of Tels. (5) was transferred from D. of Tels. to D. of S. and renamed D.D. of S. (A.F.S.). This was done in order to link D.D. of S. (A.F.S.) more closely with Signals policy and planning.

In November 1943 the division of responsibility between the Army and R.A.F. on intercommunication and administrative questions affecting Air Formation Signals in the field was defined.<sup>1</sup> At the same time the channel of control was made clear. The officer commanding an Air Formation Signals unit was under the operational control and technical direction of the Chief Signals Officer, Air Formation Signals or the Chief Air Formation Signals Officer depending on the location of his unit and Air Formation Signals' dispositions generally. He was responsible to the appropriate C.S.O., Air Formation Signals or C.A.F.S.O. for the technical efficiency of his unit and for the efficient operation and maintenance of landline and despatch rider communications provided by his personnel. Arrangements were made to consult the C.S.O. Air Formation Signals or his representative in all phases of signals planning where Air Formation Signals personnel were likely to be affected. The C.S.O. Air Formation Signals or his representative were included in all R.A.F. reconnaissance parties which involved any changes in landline and despatch rider communications. At this time a standard Air Formation Signals unit was established for unit forming and training purposes. This consisted of:—

- Unit headquarters and three company headquarters.

- Two line sections.

- Two construction sections.

- Two line maintenance sections.

- Three telegraph operating sections.

- Two despatch rider sections.

- Five wing signal sections.

- One technical maintenance section.

- One light aid detachment R.E.M.E. (attached).

Conversion from standard types of Air Formation Signals units was effected as soon as operational planning reached a reasonably firm stage. From 1943 onwards there were only two types of unit, one employed with tactical air forces and the other for more static uses. The only difference between the two lay in the establishment of M.T., which was naturally greater for the more mobile units employed with tactical air forces.

In February 1944, a pamphlet was issued jointly by the War Office and the Air Ministry explaining the main features of R.A.F. communications in the field, setting out the general principles governing the allocation of responsibility for the provision of these communications, and describing the organisation and administration in the field of air formation signals. The first section dealt generally with the various R.A.F. formations and units, types of air force and staff organisation likely to be met in the field; the second section gave an outline description of the main features and

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<sup>1</sup> For details see Appendix No. 12.

characteristics of R.A.F. communications and fighter control in the field, with special reference to the landline communications provided by the Army; while other sections dealt with the establishment, general and detailed responsibilities, training, organisation, planning and employment of Air Formation Signals.

Air Formation Signals units carried out as much as possible of their collective training alongside and with units of the R.A.F. Visits were made by Air Formation Signals trainees to operations and filter rooms and radar stations to study their layout and operational functions.<sup>1</sup> This was part of the vast training programme organised before Operation Overlord.

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<sup>1</sup> A.H.B./IIK/54/13/53.

## CHAPTER 7

# ORGANISATION FOR RADIO COUNTERMEASURES

### Early Wartime Organisation

In the first year of the war responsibility for R.C.M. was undertaken by that section of the Directorate of Signals which was responsible for providing and organising R.A.F. signals navigational facilities. This was because at that time the most vital and immediate employment of radio countermeasures was in connection with the frustration of enemy radio navigational systems and by July 1940 a considerable project was on hand. This was the investigation of German beam type transmissions on 31.5 megacycles per second which were believed to be used by the enemy for navigational purposes. By the summer of 1940 some definite organisation to deal with R.C.M. was essential. Measures included not only action against enemy use of radio beams but the projected use of jamming in certain local tactical situations such as dive bomber support operations. Employment of the countermeasures weapon involved considerable organisation and a highly specialised central control. A.C.A.S.(R) therefore proposed that a new section under a wing commander be established in D.D. of S.(1) to be known as Radio Countermeasures (R.C.M.). The placing of the section in D.D. of S.(1) had the particular advantage that it enabled close co-ordination between radio navigational aids and countermeasures, both of which were expected to use similar apparatus and personnel. The formation of the new section was urged by the Prime Minister himself. Authority for the establishment was given in July 1940.<sup>1</sup> R.C.M. remained within D. of S. until March 1943 when it was transferred to D. of Tels.

### Formation of No. 80 Wing

In August 1940 following the formation of the R.C.M. section at the Air Ministry a number of small wireless stations were established to carry out the necessary work on R.C.M. Authority was given for the formation of four Type 'HM' W/T stations, one Type 'HJ' W/T station, and nine Type 'M' W/T stations which were added to the establishment of No. 1 Signals Depot. The necessary domestic services were provided by an R.C.M. administrative section and an installation and modification section was also added to No. 1 Signals Depot. As this station was under the command of No. 26 Group this was the channel of communication used. In September 1940 the Chief of the Air Staff ruled that the countermeasures organisation should be pushed forward with all possible speed. A large number of stations were in operation and it was essential to provide a control and monitor centre for the operation of the extensive system of counter wireless stations. The best method of achieving the necessary control was considered to be by the establishment of a special signals wing

<sup>1</sup> A.M. File S.5382.



for operational and monitoring radio control, technical installation, siting and servicing administration. It was realised by this time that radio countermeasures would have a more important part to play than was originally envisaged and therefore required independent control. No. 80 Wing was therefore established on 27 September 1940 within No. 26 Group but came directly under the Air Ministry for technical control. At the beginning the nucleus of the wing was a unit depending on Headquarters (Unit) Fighter Command for administrative matters but on 7 October 1940 it moved to Aldenham Lodge, Radlett, Hertfordshire, and became self-accounting for cash and stores.<sup>1</sup>

Small stations, such as these wireless stations, were usually provided with domestic services by neighbouring large R.A.F. stations but in the case of No. 80 Wing stations this was considered undesirable on security grounds. By the spring of 1941 the wireless stations had increased in number so much and were so widely scattered that No. 80 Wing Headquarters found the burden of providing technical administration, servicing and monitoring services for the outstations too heavy. In April 1941, therefore, six area headquarters were formed.<sup>2</sup> Each was staffed by an officer, one senior N.C.O. (wireless electrical mechanic) and three wireless operators. At each area headquarters 100 per cent. technical spares were held for distribution to the outstations. The officer-in-charge of each area was responsible for the administration, technical supervision, monitoring and servicing of all R.C.M. outstations in his area. The wireless operators at area headquarters maintained a nightly listening watch to monitor the various transmitters within the area.<sup>3</sup>

#### Formation of No. 100 Group

No. 100 Group (Special Duties) was formed on 23 November 1943 and in the following month Headquarters No. 80 Wing and the W/T outstations, which at that date numbered 84, were transferred from the administrative and operational control of No. 26 Group to that of No. 100 Group.<sup>4</sup> The group was under the administrative and operational control of Headquarters Bomber Command and subject to the general technical control of the Command. The reason for the formation of No. 100 Group was the switch from defensive to offensive radio countermeasures. During the first half of the war R.C.M. was concerned mainly with defence against enemy night bomber attacks. This remained important but by 1943 it was clear that if R.A.F. night bombing was to be effective the enemy night fighter defence

<sup>1</sup> A.M. File S.5382.

<sup>2</sup>	<i>Area</i>	<i>Headquarters</i>
	South Eastern	—Windlesham
	Southern	—Ashmansworth
	South Western	—Fairmile
	Eastern	—Braintree
	Midland	—Hagley
	Northern	—Marske

<sup>3</sup> No. 80 Wing O.R.B. April 1941.

<sup>4</sup> No. 100 Group O.R.B., December 1943.

had to be overcome.<sup>1</sup> No. 100 Group was primarily responsible for supporting the forces operating under Bomber Command but had in addition to meet a proportion of the requirements of other formations, including A.E.A.F. and A.D.G.B. Within No. 100 Group bomber and fighter activities were successfully blended under the same command, and American units were also absorbed into the organisation.<sup>2</sup>

#### R.C.M. Committees

At a meeting of the W/T Board on 6 July 1940 it was decided to create an inter-Service R.C.M. committee to be known as the 'X' Committee.<sup>3</sup> It was an informal committee which met under the chairmanship of D. of S., Air Ministry. The committee considered R.C.M. and allied subjects in their widest sense and served as a focus for interchange of views on experimental and operational radio countermeasures in the three Services. Its chief function was the consideration of countermeasures to be taken against known enemy beams and other radio aids. On 14 January 1942 the formation of a permanent Inter-Service Radio Countermeasures and Jamming Committee to work under the Radio Policy Sub-Committee was approved by the Chiefs of Staff Committee.<sup>4</sup> The existing R.C.M. committee formed the basis for the new one and its chairman carried on. The committee consisted of the chairman and one representative of each of the following:—

- (a) The branch of each of the three Service ministries responsible for radio countermeasures.
- (b) A.D.I. (Science).
- (c) The branches of the Ministry of Supply and Ministry of Aircraft Production concerned with radio countermeasures equipment.
- (d) Telecommunications Research Establishment.
- (e) Admiralty Signal School.

Also on the committee were Lord Cherwell, Group Captain E. B. Addison, and the secretary of the R.C.M. Committee. The committee had no executive power but achieved executive action through those of its members who represented the executive heads of the signals departments of the three Services.<sup>5</sup> When the Radio Board was formed the R.C.M. Committee became a subordinate committee of the Operations and Technical Sub-Committee of the Radio Board.

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<sup>1</sup> A.M. File A.416087/42.

<sup>2</sup> R.A.F. Signals History, Volume VII: 'Radio Counter-Measures'.

<sup>3</sup> A.M. File S.5382.

<sup>4</sup> See Appendix No. 13 for terms of reference of Inter-Service Radio Countermeasures and Jamming Committee.

<sup>5</sup> War Cabinet Papers.

## CHAPTER 8

### MANNING, TRAINING AND PERSONNEL

#### Introduction of new trades

The requirement for signals trades before the war was divided simply between operating and maintenance wireless personnel. But the increasing complexity of equipment, and the demands of the Defence Teleprinter Network, necessitated the introduction of new trades and the division of existing ones. These changes took place over a period, and the first major alteration came in 1939 with the introduction of a new trade of teleprinter operator.

During the Munich crisis of September 1938, the load placed on the point-to-point communications system for operational units of the R.A.F. was heavier than could be handled by the personnel of the units, and it was apparent that the delays that resulted might in certain circumstances have serious consequences. It was necessary at all times for the landlines at operational units to be supplemented by a wireless organisation to serve as a standby against the danger of cables being cut or failing for some reason, and the Air Council decided that it was essential that sufficient personnel should be established in peace to enable an effective 24-hour service to be maintained during an emergency. This raised problems of manpower which were discussed at a meeting held at the Air Ministry on 20 January 1939 under the chairmanship of the Air Member for Personnel.

Under the existing arrangements both landline and wireless systems were operated by wireless operators who had also been trained in the use of the teleprinter, thus avoiding unnecessary double-banking of personnel. But the retention of this policy entailed a heavy training commitment of wireless operators, and was altogether uneconomical. The Director of Signals therefore suggested a different manning policy. It was proposed that the number of wireless operators be limited to those necessary to operate aircraft and inter-command services and act as standby in the event of a failure in the landline system. The balance of personnel for purely teleprinter operating should be recruited from personnel of the clerk type. Group IV was recommended as the appropriate trade group. Teleprinter operators were to be recruited as for clerks general duties but without the arithmetical test. There was no career in the trade open to teleprinter operators because the number of N.C.O. posts would be very small. It was felt that during their employment teleprinter operators would have adequate opportunity for learning signals procedure and morse and that some of them would after a period of service prove suitable for employment in the Group II trade of wireless operator. In March 1939, Treasury approval was given for the institution of a new trade of Teleprinter Operator with pay at Group IV rates.<sup>1</sup>

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<sup>1</sup> A.M. File 861448/38.

### Training in Ground and Airborne Radar

By October 1938, 18 of the first 20 permanent radar sites had been selected and 15 had been acquired, and five permanent stations were in operation. Personnel were required for the maintenance and operation of all radar stations, for instructional purposes at Bawdsey, for sifting of information at the radar filter room and for guarding the radar stations. The first two functions were carried out by Service signals personnel, the third by aircrafthands trained as plotters, and the fourth by warders. Up to this time, Bawdsey had trained over 60 signals personnel out of the 200 urgently required and were training another 30 during October and early November; W.A.A.F. plotters were among those trained. The normal course for the wireless operator mechanic was about six weeks and for the wireless operator about four weeks.<sup>1</sup> But it was clear that provision would have to be made for the creation of new trades and for training at the signals schools.

For airborne equipment the training policy for the first year of the war was to take selected radar mechanics who had been through the Yatesbury radar course and give them specialised additional training in airborne equipment with instruction in the air at Martlesham (A.I.) and Silloth (A.S.V.). During this period the numbers involved were small and the whole question of training airborne radar mechanics and operators was embryonic.

### The Signals Schools

At the outbreak of war, there were two signals schools already in existence. They were known as Electrical and Wireless Schools, Nos. 1 and 2, and were located at Cranwell and Yatesbury respectively. Up to June 1940, these two schools dealt with practically the whole of the signals training commitment of the Royal Air Force, and had under training some 5,600 trainees. The signals trades at the outbreak of war were :—

Group I — Wireless and electrical mechanic.

Group II — Electrician, wireless operator.

Group IV — Teleprinter operator.<sup>2</sup>

In addition to the two electrical and wireless schools, two supplementary schools at Hamble and Prestwick, under contract arrangements with Air Service Training Ltd. and Scottish Aviation Ltd., trained wireless operators for the R.A.F. until late 1940, when they became redundant.

In June 1940, on the formation of No. 26 Group, the responsibility for signals training was transferred to the new Group. The training policy at this time was centred around increasing intakes to the various courses and reducing the length of some of these courses. An emergency entry of 200 airmen under training as wireless operators was sent to Cranwell and the

<sup>1</sup> A.M. File S.45641.

<sup>2</sup> A.M. File S.75175/I.

intakes of airmen from the supplementary wireless schools were increased from 100 to 200 a month. The intakes at Yatesbury were increased from 200 to 400 per week up to the end of July, and 300 per week thereafter. The length of the course was reduced from 24 weeks to 21, and subsequently to 18; this was achieved by modifying and compressing the syllabus.

Double shifts were worked on the teleprinter course at Cranwell, and the intake of teleprinter operators under training was doubled to 80 per week. At Yatesbury, an eight weeks' course was arranged for 150 airmen teleprinter operators, and on 14 June a W.A.A.F. School was opened at Worcester with 25 telephone operator trainees, on a two-week course. The radio operator's course which had been introduced at Yatesbury was reduced to two weeks and the intakes increased to 126 per fortnight by working three shifts per day; this course was later increased to three weeks.<sup>1</sup>

Further fundamental changes were planned in June and brought into force in July. A new Electrical and Wireless School, No. 3, was formed at Compton Bassett to train 200 wireless operators per week on a 21-week course with a peak of 4,000. At the same time, No. 10 (Signals) Recruit Centre opened at Blackpool, involving a complete reorganisation of wireless operator training. Recruits were now posted at the rate of 1,000 a week to Blackpool, where they did a fortnight's recruit training followed by 10 weeks' preliminary morse and science training before proceeding to Yatesbury or Compton Bassett, where they did a further 10-14 weeks' training. Aircrew wireless operators were trained at Yatesbury and ground wireless operators at Compton Bassett.<sup>2</sup> The first entries under this scheme passed their courses at Blackpool and went on to Yatesbury in December 1940.

Facilities for the training of wireless operators were also given by the G.P.O., and in July 1940 courses of 12 weeks' duration were started at twenty-two G.P.O. centres, with a total intake of over 500 airmen. The G.P.O. had already put its training facilities at the disposal of the Air Ministry for several other types of signals training, and in the early days of the war had trained some 600 W.A.A.F. teleprinter operators, and had organised short courses on landline communications for R.A.F. signals officers. The courses for R.A.F. wireless operators continued until early in 1942, by which time 2,130 airmen had been trained.

At the end of 1940, the G.P.O. started a 16 weeks' course for W.A.A.F. wireless operators, and this training was continued until September 1942, by which time 2,240 W.A.A.F. had been trained. Late in 1941, the G.P.O. started training W.A.A.F., and later R.A.F., telephone operators, and this training was continued.

In August 1940, the removal of trade training in the instrument and electrical trades from Cranwell to other stations in Technical Training Command was completed, and the title of 'Electrical and Wireless Schools'

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<sup>1</sup> A.M. File S.75175/I.

<sup>2</sup> A.M. File S.67041.



was abolished and the schools in existence became known as Nos. 1, 2 and 3 Signals Schools. A course for the training of R/T operators was begun in the same month at Cranwell, with intakes of 125 every four weeks, on a course lasting eight weeks. D/F training was begun at Compton Bassett. Because of the poor results on various courses, nearly all of them had to be increased in length as time passed.

W.A.A.F. personnel had been substituted for airmen to a small degree as telephone and teleprinter operators in the early months of the war, and in August 1940 the teleprinter school at Cranwell changed over from the training of airmen to the training of W.A.A.F.; the training of airmen teleprinter operators continued at Yatesbury.<sup>1</sup>

### **Radar and Wireless Mechanics and Radar Operators**

In order that recruits from civilian trades could take their place in units with a minimum of further training, the highly skilled trade of wireless electrical mechanic was divided into two in February 1940, and two new trades of wireless mechanic and radio (later radar) mechanic were introduced, each specialising in either ground or airborne equipment.<sup>2</sup> Later the radar mechanics came to specialise still further on apparatus used in the respective operational commands. In 1940, however, both trades were considerably below establishment, and wireless operators were doing some of the work. There was a radar school in operation at Yatesbury for the training of signals officers (R) and radar mechanics, and later a new trade of radar mechanic (air) was introduced and training undertaken. At the end of 1940 a second school was opened at Cranwell to train radar operators (R.A.F. and W.A.A.F.) and radar mechanics. W.A.A.F. radar operators had begun training at Yatesbury in June 1940; they had previously been trained at Bawdsey.<sup>3</sup>

Early in 1941 a third radar school was opened at Prestwick, to deal with the training of radar mechanics (air) and all signals officers (R) in airborne equipment. The training of radar mechanics (air) had to be transferred temporarily to Cranwell in April 1941 because of building delays, but it was transferred back as quickly as possible so as to free accommodation at Cranwell for radar mechanics (ground) training.

The supply of adequate numbers of radar mechanics was a persistent problem, the solution for which called for strong measures. One particular difficulty was the growing complexity of radar equipment. When the new trade was introduced in February 1940 it was hoped that a large proportion of requirements would be met by the enlistment of skilled engineers, but

<sup>1</sup> A.H.B./IIM/B20/1. No. 26 Group O.R.B., 1940—1944 and A.M. File S.75175/I.

<sup>2</sup> The term 'radio' was succeeded by 'R.D.F.' in 1942 and later by 'radar'. The term 'radar' is used in this chapter.

<sup>3</sup> The first W.A.A.F. plotters were on watch in the Fighter Command filter room at Stanmore on 20 September 1939, and the first radar operators were on watch at radar stations in November 1939.

by early autumn 1940 the civilian radio trade had been combed almost to exhaustion, and other methods of finding men were investigated. The first step taken was to find out how many civilian radio personnel already called up in the R.A.F. were employed on work other than radio. With the help of the radio trade, this was ascertained and as a result enough electricians were remustered to meet immediate requirements.<sup>1</sup>

The immediate training of radar mechanics was thus safeguarded, but to meet future requirements it was apparent that *ab initio* training would have to be given to large numbers of unskilled men. But already the number of personnel on wireless and radar courses had been increased to the limit of existing capacity and the length of the courses drastically cut down, so that it was apparent that the R.A.F. was quite unable to provide for such training.<sup>2</sup>

In the latter part of 1940, discussions took place with the War Office and the Radio Manufacturers' Association on the recruitment of skilled wireless mechanics, and under the direction of the Hankey Committee for the Provision of Skilled Wireless Personnel for the Services, it was decided that the Board of Education should undertake this *ab initio* training, to provide a flow of wireless and radar mechanics into signals and radio schools to meet the R.A.F. requirements in these two trades.

### The Technical Training Colleges

In the course of 1941, a training organisation involving 27 technical training colleges with a potential training population of 8,000 airmen was brought into being, courses in basic wireless theory opening in February 1941 at the first eight colleges. All trainees were placed on an *ab initio* wireless mechanic course; those who obtained 60 per cent or more at the end of the course examination were creamed off for the radar mechanic course; the remainder went on to the wireless mechanic course.<sup>3</sup>

In March 1941, the radar school at Cranwell became No. 1 Radio (later Radar) School and began instruction with the first intake of airmen and airwomen for training as radar operators (ground). The radar school at Yatesbury was numbered 'No. 2' at the same time. Target requirements for radar mechanics and radar operators at this time, up to April 1942, were 5,000 radar mechanics (ground), 2,500 radar mechanics (air), and 9,000 radar operators (of which 4,000 would be W.A.A.F.). Subsequent requirements in 1942 were 500 radar mechanics (ground) and 4,000 radar mechanics (air).<sup>4</sup>

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<sup>1</sup> A.M. File S.87799.

<sup>2</sup> A.M. File CS.14825.

<sup>3</sup> A.M. Files S.71575/1 and CS.14825.

<sup>4</sup> A.M. File S.69218.

In April 1941, wireless mechanic courses and the wireless operator to wireless operator mechanic conversion courses at Cranwell were combined, the intake to be at a rate of 125 per week on a 13 weeks' course, the previous rate of conversion having been 50 per week. In addition, it was necessary to make plans for the setting up of facilities for the further training, on an eight weeks' course, of the wireless mechanics who would come from the 17 weeks' courses at the technical colleges. This output would be small at first, but with the addition of further colleges, an output of some 325 wireless mechanics per week was expected from October 1941 onwards. The airmen under training at technical colleges was in excess of 2,000 by June 1941 and reached 4,000 in July. The additional conversion commitment at Cranwell involved accommodation for a further 1,000 trainees, and no further arrangements had been made to deal with the output from the technical colleges. The demands on signals training were growing so rapidly that the need for opening further schools was apparent.

#### Formation of New Signals Schools

A Signals Training Conference was held at the Air Ministry on 23 May 1941, at which proposals for making good the existing training deficiencies were discussed.<sup>1</sup> The total for which new accommodation was required was 5,320 (3,320 wireless mechanics and 2,000 ground wireless operators), of which 2,000 could be trained at No. 1 Signals School. The other two schools were filled to capacity in meeting requirements of air and ground wireless operators, which were both equally urgent commitments. There was thus a total of 3,320 personnel to be accommodated; but this figure was based on the assumption that a new overseas radio school at Clinton, Canada, would produce a total of 8,000 radar mechanics, whereas the Air Ministry considered it unlikely that the full figure would be realised. The facilities for *ab initio* training at the technical colleges were therefore being expanded, and it was necessary to make provision for a corresponding increase in advanced training facilities. The provision of accommodation for 4,000 trainees instead of 3,320 was required.

Provision also had to be made for extending the wireless operator (ground) course to 14 weeks from the existing period of 10 weeks, which proved to be far too short; and in order to turn out the same number from a 14 weeks' course, additional accommodation was required for a further 2,000. The total needing new accommodation thus became 6,000, which, added to station staff, made a gross total of about 7,000.<sup>2</sup>

Proposals for meeting the requirements were as follows :—

- (a) A new signals school had previously been planned to be opened at Madley to accommodate 800 wireless operators (ground) and

<sup>1</sup> A.M. File S.69218.

<sup>2</sup> A.M. Files S.69218 and S.75175/I.

1,200 wireless operators (air), 2,000 in all. Accommodation was to be built for a further 2,000 ground wireless operators at this school, making 4,000 trainees in all.

- (b) A new school was to be opened at Malvern, using blocks of Government offices for training, and billeting staff and trainees. the intention being to train wireless mechanics up to a peak of 1,000, each 10-week course to consist of 100 airmen.
- (c) Similar facilities to those at Malvern were to be provided at Bolton Technical College.
- (d) A new school was to be opened at the Science Museum at South Kensington, after completion of certain works services, accommodation for a capacity of 2,000 wireless mechanic pupils to be found in empty houses adjacent to the Museum.

#### **Formation of No. 27 Group**

Earlier in the year, it had been found that signals training, which was principally carried out by No. 26 Group, had reached such proportions that it had become unwieldy. It was therefore decided that signals training establishments should form the nucleus of a new Group, No. 27 Group, operational signals units remaining in No. 26 Group. No. 27 Training Group was formed on 26 May 1941, and included the following units :—

- No. 1 Signals School, Cranwell.
- No. 1 Radio School, Cranwell.
- No. 2 Signals School, Yatesbury.
- No. 2 Radio School, Yatesbury.
- No. 3 Signals School, Compton Bassett.
- No. 3 Radio School, Prestwick.
- R.A.F. Code and Cypher School, Oxford.
- W.A.A.F. Signals School, Worcester.
- Radio and Wireless Mechanics training at Technical Colleges.
- Radio and Wireless Mechanics training at G.P.O. Centres.
- Radio and Wireless Mechanics training at various manufacturers' works.
- London Radio School, Chiswick.

The new schools formed as a result of the proposals at the Conference of 23 May 1941 also became a part of the new Group. No. 4 Signals School, Madley, began training ground operators in November 1941 and air operators in March 1942. No. 5 Signals School, Malvern, was formed in November 1941. No. 6 Signals School, Bolton, was formed in December 1941 and became the parent unit for the Bolton Municipal Technical College and the College of Technology, Manchester; No. 7 Signals School formed at South Kensington in January 1942. This school also had a commitment for the training of morse slip readers, which was taken over from the London Radio School, Chiswick.

The strength of trainees undertaking *ab initio* training at the 27 technical colleges reached 6,000 in September 1941 and increased to a peak of 8,000 by the end of the year, by which time a weekly output of over 300 partly trained wireless and radar mechanics was the average. Nevertheless, although the radar trades were in a comparatively good position because of the priority they had been granted, the wireless mechanic trade still suffered from acute deficiencies. The substitution of W.A.A.F. for R.A.F. personnel in the signals trades proceeded. In addition to the teleprinter and telephone operator and morse slip reader trades, increasing proportions were introduced into the trades of radar operator, R/T operator, and W/T operator for ground trades.<sup>1</sup>

#### No. 31 Radio School, Clinton

The proposal to build a training school in Canada had been made in the summer of 1940, because of the shortage of trained radar personnel in England and the dangers arising from having only one radar training school, the only one in existence at that time being at Yatesbury. The radio school in Canada was proposed for the training of locally recruited officers and men and if necessary personnel from England. The site for the school was carefully chosen so that the training of radar mechanics and operators in airborne equipment could be carried out at the same place in order to effect economies in apparatus and aircraft. For A.I. operator training it was desirable that regular flying should be in progress in the neighbourhood so that target aircraft were always available; and for A.S.V. operators the training had to be near the sea or a large lake so that instruction could be given in the identification of shipping, islands, mountains, and landfalls. The plan for the school was based on experience at Yatesbury, but it was on a smaller scale and was more economically designed.

The first course began on 16 August 1941, consisting entirely of American Forces personnel. Later courses were peopled mostly by Canadians, Canada having agreed to supply 5,000 semi-trained radar mechanics over a period of three years.<sup>2</sup> By September 1944, Canadians made up one-third of the total strength in the trade. The extension of the training facilities at Clinton to U.S. personnel assisted the Americans considerably.<sup>3</sup>

By February 1942, the numbers of wireless and radar mechanics undergoing training were sufficient to allow a 50 per cent reduction in intakes into the majority of the technical colleges. The total under *ab initio* training thus fell considerably in the course of the year, and a number of these colleges ceased training as a result.

In January 1942, a specialist signals course was begun at No. 5 Signals School in order to train airmen of signals trades recommended for commissions and officer wireless operators/air gunner selected for the Technical

<sup>1</sup> A.H.B./IIE/44.

<sup>2</sup> A.M. File CS.9742.

<sup>3</sup> A.M. File S.75972.



Branch. In May 1942, however, No. 5 Signals School closed because of the drop in output of wireless mechanics from the technical colleges, and all courses at this school were absorbed by No. 7 Signals School.

#### **Wireless Operators (Air)**

Before July 1941, men were allowed to enlist for immediate training as wireless operators/air gunner, with the object of going straight through the two courses. The wireless course itself was split into two, the initial training at Blackpool being purely ground training but later training at Yatesbury including air operating. By the middle of 1941, however, two factors were militating against this policy. First, it was found that wireless operators who had completed their aircrew wireless training could not be absorbed into the gunnery schools at the rate at which they were being passed out by the signals schools; and the second factor was that an improvement in the standard of wireless training of the wireless operator/u/t air gunner was needed. It was therefore decided that all wireless operators u/t air gunner should follow their wireless training with a minimum of three months' employment on W/T duties at a unit in order to gain general signals experience.

This policy, however, had its defects, often resulting in a loss of efficiency and morale because of long waiting periods between courses. It was therefore decided in 1942 to adopt a straight-through training system for wireless operators/air gunner, to become operative in 1943.

With the advent of the two-seater long range fighter, a new type of aircrew category became necessary, and in July 1941 the observer (W/T) was introduced, and W/T training for this category began at No. 1 Signals School in the same month.

A large amount of specialist training in the use of radar equipment was carried out at O.T.U.s, and to relieve these O.T.U.s of much of this training, a scheme was introduced to amalgamate the A.S.V. course with an advanced W/T course. The advanced signals training of navigators (W) for Coastal Command was transferred from the O.T.U.s to Squires Gate. A heavy commitment in the training of Coastal Command wireless operators/air gunner in the use of A.S.V. accumulated at No. 3 Radio School, so that for a time the school was over-burdened by this commitment. To remedy this, ground training for the A.S.V. course was transferred to No. 7 Signals School, as was ground training for radar mechanics (air). The air training for both courses remained at Prestwick.

#### **Deficiencies of Personnel**

Towards the end of 1942, although the personnel situation as a whole in the signals trades had greatly improved, the general position was that requirements still exceeded outputs of trainees in most trades. The most serious deficiencies were still in the mechanic grades. The wireless operator

and radar operator position was fairly satisfactory, though the use of wireless operators/air gunner under training against ground establishments had caused some complications. The R/T operator trade was badly under strength. W.A.A.F. substitution was applied wherever practicable, and greatly helped to reduce deficiencies, particularly in the teleprinter and telephone operator trades, where substitution was on a 100 per cent basis for all Home commands. Substitution took place to a greater or less degree in nearly all ground signals trades. W.A.A.F. personnel were being trained in large numbers as wireless and radar operators, morse slip readers, and R/T operators, and in an effort to make up deficiencies in the mechanic trades, 24 selected airwomen were given wireless and radar mechanic courses, 12 to each course. They all passed out successfully and were posted to units. Reports on their service were so favourable that the Directorate General of Signals pressed for 33½ per cent substitution of these trades.<sup>1</sup> An advanced wireless operators' course was begun with the object of bringing W.A.A.F. wireless operators who had previously been trained at G.P.O. centres up to approximately the standard of R.A.F. wireless operators. Accommodation was found at No. 3 Signals School for a straight-through course for W.A.A.F. wireless operators, following which their training at G.P.O. centres was ended.

In May 1942, an air maintenance course for wireless operators u/t air gunner was begun at No. 7 Signals School with the object of getting greater benefit out of periods during which these airmen were supernumerary awaiting aircrew wing training. A course for W.A.A.F. signals officers was also begun at No. 7 Signals School. The training school for teleprinter operators moved from Yatesbury to Cranwell. Radar courses for signals officers were carried out at both Cranwell and Yatesbury. G.P.O. landline courses for signals officers, which had hitherto been given at the G.P.O., Cambridge, were transferred to Cranwell. The number of wireless mechanics under training at the technical colleges fell to 2,000 by August 1942, but increased intakes were planned later in the year to bring the peak of trainees up to 3,000 by the end of the year and later up to more than 4,000. In December, No. 3 Radio School was moved from Prestwick to Hooton Park; the ground phase of A.S.V. training, previously carried out by No. 7 Signals School, was also transferred to Hooton Park. The London Radio School at Chiswick, which had trained W.A.A.F. morse slip readers for the previous 18 months, closed early in 1943.

The policy remained to put airmen and airwomen under training in accordance with a total target figure in each trade supplied by the Director of Establishments, based on estimated requirements for 12 months or more ahead.<sup>2</sup> The proper channel of demand was through the Director of Signals, Signals Plans being responsible for preparing estimates of requirements on which the Director of Establishments' target figure was prepared and

<sup>1</sup> A.H.B./IIE/44 and A.M. File S.75175/I.

<sup>2</sup> The total of signals trades and strengths as at 1 December 1942 is given in Appendix No. 14.

amended. There remained a basic shortage of both R.A.F. and W.A.A.F. personnel available for training, and the overall establishment showed a total deficiency in all trades of 14 per cent. By April 1943, the signals trades formed 25 per cent of the technical trades in the R.A.F. and 10 per cent of the whole Force, and priority was being given to the wireless trades. Even so, the manpower situation was acute, and shortage of signals trades, especially of wireless operators, was among the most severe. In July 1943, W.A.A.F. wireless operator (ground) substitution in the Home commands was increased to 75 per cent, and a proposal was agreed in the same month to introduce W.A.A.F. substitution for the signals trades in Middle East Command. The trooping of tour expired airmen from overseas commands, however, was not considered a practical proposition. The increasing strength of Home Command made substitution impossible and, in any case, as far as signals personnel were concerned, Home Command was now manned very largely by W.A.A.F. personnel and by airmen unfit for overseas service. The result of the general inability to return tradesmen to the United Kingdom at the end of a normal term was a marked decline in efficiency overseas, tradesmen declining in some cases to a third-rate standard in the first year of their over-stay.

Experience in the 'Torch' operation in North Africa showed that airmen attached to mobile wireless units were insufficiently trained in operating under mobile conditions, and the ground wireless operator course was increased in January 1943 from 14 to 16 weeks, signals field training being included in the final fortnight of the course. The extra time was used to ensure that trainees had practical experience of mast and aerial erection, the operation of generator sets, accumulator charging, the laying of field telephone cables, and the maintenance of W/T and landline communications over distances under field conditions.

Straight-through training of wireless operators/air gunner on 24-week courses was continued at Yatesbury, the peak under training being constant at 1,200. The total under training at the technical colleges was still about 3,000 at the end of 1943, although several more colleges had ceased training. In July 1943, a new trade of R/T operator Group II was introduced. Previously R/T operators had been Group IV, regardless of the higher qualifications required on certain duties. The new trade was sanctioned in view of the skill essential for the operation and maintenance of the more complicated airborne and ground R/T sets for fighters and the wide range of duties involved. The less skilled R/T operating duties remained in Group IV. The R/T operators course remained at Cranwell, with a peak

of 500. Training for W.A.A.F. morse slip readers was carried out at Compton Bassett and Kensington.

The signals and radio schools had been renamed at the beginning of 1943 as follows :—

<i>School</i>	<i>Location</i>	<i>Renamed Radio School</i>
No. 1 Signals	Cranwell	No. 1
No. 2 Signals	Yatesbury	No. 2
No. 3 Signals	Compton Bassett	No. 3
No. 4 Signals	Madley	No. 4
College of Cypher	Oxford	No. 5
No. 6 Signals	Bolton	No. 6
No. 7 Signals	South Kensington	No. 7
No. 1 Radio	Cranwell	No. 8
No. 2 Radio	Yatesbury	No. 9
No. 4 Radio	Carew Cheriton	No. 10
R.A.F. Station	Hooton Park	No. 11

No. 9 Radio School at Yatesbury trained direct entry officers, pre-commissioning courses, a small number of radar mechanics, and airmen and airwomen radar operators. The training of wireless operators remained at Nos. 1, 2, 3 and 4 Radio Schools. In addition to the straightforward training requirements in the various trades, there was a considerable further requirement due to operational commitments for the training of qualified tradesmen and tradeswomen in new equipments, supervisory duties, instructor duties, new procedures, etc. The shortage of personnel remained acute, and the overall deficiencies, together with the numbers of tradesmen under training (R.A.F. and W.A.A.F. combined) were summarised towards the end of 1943. The deficiencies totalled over 14,000, with a similar total under training. Largest deficiencies were in the wireless/radar mechanic and wireless operator trades, but these two trades comprised the greater part of the men under training.

In August 1943, No. 10(S) Recruiting Centre was renamed No. 13 Radio School and transferred to No. 27 Group. The recruits phase of training no longer took place at Blackpool, instruction being confined to signals training. It now became an 11-week *ab initio* wireless operator's course with an intake of 200 airmen per week. No. 12 Radio School was formed at St. Athan in the same month for courses in wireless telegraphy.<sup>1</sup>

#### Personnel Economies

A meeting was held at the Air Ministry on 8 September 1943 to discuss means of effecting economies in R.A.F. and W.A.A.F. Signals personnel.<sup>2</sup>

<sup>1</sup> A.H.B./IIM/B27/1A.

<sup>2</sup> A.H.B./IIE/44.

It was reported that there was an extreme shortage of Signals personnel and that new commitments had to be met out of existing strength. The Committee had, therefore, to examine what commitments could be suspended to throw up men against new requirements. The question of the suspension of the W/T point-to-point channels was discussed, particularly the effect such suspension would have on teleprinter traffic and how many R.A.F. and W.A.A.F. would be thrown up by such suspension. Representatives from Fighter, Bomber, Coastal, Transport, Technical Training and Maintenance Commands, Headquarters of Nos. 26, 27 and 60 Groups, as well as the Air Ministry, were present. All representatives agreed that suspension of W/T point-to-point channels would not affect teleprinter traffic. No. 60 Group agreed to suspend these channels entirely; Fighter Command, in Nos. 9, 10, 11, 12, and 70 Groups and between Headquarters R.A.F. Northern Ireland and fighter stations in N.I.; Technical Training Command entirely; Transport Command entirely; Maintenance Command everywhere except in No. 40 Group; Flying Training Command entirely; Bomber Command agreed to suspend watches between groups and stations; Coastal Command entirely; and Headquarters No. 26 Group were prepared to make certain alterations. The manpower saving was totalled at some 550 airmen and 160 W.A.A.F.

The question of reducing the H.F. D/F organisation was also considered, but, with the exception of Coastal Command, the commands agreed that there was no possibility of effecting further economies in this case. Coastal Command was prepared to suspend the second D/F station at all stations with the exception of the O.T.U.s and Ballykelly and Tiree. This meant a saving of two corporals and 36 aircraftmen. These economies were intended as temporary measures to meet the serious manpower shortage, and were not meant to create a precedent for the reduction of establishments.

The training of wireless operators (air) at No. 12 Radio School St. Athan was stopped in May 1944 and trainees transferred to No. 4 Radio School Madley. A new school for ground training, No. 14 Radio School, remained at St. Athan. In August 1944, No. 7 Radio School, South Kensington was closed down following damage by flying bombs, and its courses were transferred to other radio schools already in existence and to a new school, No. 15, at Cosford, which was specially formed for the purpose and which functioned as a radar (air) training school. It was proposed to transfer wireless/radar mechanic training from the technical colleges to a radio school, probably Yatesbury, but this could not be done immediately and in September 1944 all W.A.A.F. trainees at the London technical colleges were transferred to technical colleges in the provinces. In the following month, No. 13 Radio School, Blackpool, closed, its commitment being taken over by Compton Bassett; and in December 1944, No. 5 Radio School, Oxford moved to Compton Bassett, but retained its identity. There was a relatively small number of intakes of wireless operators (air) to Nos. 2 and 4 Radio Schools at the end of 1944, and in view of the reduced commitments, No. 2 Radio School was converted for the training of ground tradesmen, the



training of aircrew at this school lapsing. Training ceased at No. 6 Radio School in April 1945. The W/T slip reader courses at Kensington were transferred to Compton Bassett. Owing to decreasing Coastal Command commitments, No. 11 Radio School at Hooton Park was closed.

### Signals Trades in the Last Year of War.

In the last year of the war the signals trades totalled twelve in all, four maintenance and eight operating.<sup>1</sup> The trades were:—

(a) <i>Maintenance</i>	<i>Group</i>
Wireless Operator Mechanic	I
Wireless Mechanic	I
Radar Mechanic (Air)	I
Radar Mechanic (Ground)	I
(b) <i>Operating</i>	
High-Speed Telegraphist	I
Wireless Operator (Morse Slip Reader)	II
Teleprinter Operator	IV
Wireless Operator	II
Wireless Operator (D/F)	II
R/T Operator	II and IV
Telephonist	III
Radar Operator	II and IV

### Watchkeeping

During the latter half of 1942, a good deal of study was given to the subject of hours and conditions of work of personnel employed on watchkeeping duties. There was some reason to suspect that the hours of work combined with the fatiguing nature of the duties had produced a state of indifferent morale and might eventually result in a definite deterioration at some units. The situation was investigated and it was found that, although there was no obvious sign of deterioration in health, there was a considerable deterioration of contentedness, always a forerunner of sickness. This was found to be due to long hours of work, the extremely fatiguing nature of the work, and the general conditions of life of watchkeeping personnel.

The manning position was such that it was imperative for the maximum economical output to be obtained from available personnel. Research showed that this was not attained by making operators work the maximum possible number of hours per day, but was directly dependent on keeping working conditions as favourable as possible. Operators had to be fresh in mind and body, and needed adequate break periods and refreshment. The object of rest periods was to cut down loss of efficiency due to monotony,

<sup>1</sup> A table of educational standards and specified qualifications for the signals trades is at Appendix No. 15.

fatigue, boredom or hunger, and careful planning of these periods was the key to good work and maximum output. Some of the duties in communications centres were particularly monotonous, but could be partially relieved by rotation.

It was important that watches were manned according to the amount of work to be done. If the watch was under strength it caused not only delays, but overstrain for the operator, eventually resulting in sickness. On the other hand, an over-staffed watch not only wasted manpower but was also conducive to carelessness and delays.

A considerable difference of opinion existed between commanding officers and the establishments authorities on the hours of work possible for a given number of people, and following an investigation, the Medical Branch supported the C.O.s, and a report was submitted to the A.O.C. No. 26 Group which recommended the amendment of establishments to make it possible to work more reasonable hours, the introduction of a new shift system which would give the required rhythm of life with reasonable passes and leave, some amelioration of the general conditions of life, more careful selection of personnel for the more difficult types of watchkeeping duties, and some action to reduce the strain on operators in some of the more exhausting jobs (operation of machines etc.). Arrangements were put in hand to obtain advice by a lighting expert on the best type of lighting for various watchkeeping rooms.

In December 1942 the watchkeeping system on a number of stations was changed so as to provide a more regular rhythm of life, and on one station to provide breaks in the watch. Experience showed that about a week was probably as long as W.A.A.F. personnel should be kept on night or evening duties. On some stations a watchkeeping system which gave a shorter period of night duty was changed to one giving a week. The change was successful and personnel settled down well. At one station a three-weekly system was tried and given a run of nine weeks, but it was unpopular with personnel and had an adverse effect on operating efficiency, so the weekly system was reintroduced.

Watchkeeping hours were still not ideal, but considerable improvement was obtained. An establishment of approximately four watchkeepers per channel was the general run, but the medical branch felt that this was still insufficient. Manpower problems prevented any further improvements.<sup>1</sup>

In April 1943, further investigation of watchkeeping systems was carried out by the Traffic Control Section of Headquarters No. 26 Group, with a view to laying down a standard system. However, due to the varying conditions which applied at different stations, differences in living and working accommodation, distances from work, varying peak periods of traffic, the employment of both airmen and W.A.A.F. personnel on the same watches,

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<sup>1</sup> A.H.B./IIM/B26/1.

messing facilities etc., it was found impracticable to establish any such standard system. The general rule followed was that wherever possible an endeavour should be made not to exceed a daily watchkeeping period of eight hours for airmen and six hours for W.A.A.F. A break period during each watch was arranged wherever practicable. Some standardisation had already been possible between adjacent stations, and the watchkeeping system at Leighton Buzzard, Cardington, and Bletchley Park was on an eight-day cycle for both teleprinter and W/T operators, each eight days being an exact replica of the preceding period. The number of personnel involved in this standardisation was approximately 870. All personnel had two breaks whilst on duty, of twenty and twenty-five minutes respectively. Changes in the type of work were made during each tour of duty wherever possible, such as changing teleprinter operators over from the switchboard to traffic duties. This system had been in force at Leighton Buzzard for over two years and was found to be the most satisfactory to meet conditions there. Details of the eight-day cycle are tabulated below:—

*Leighton Buzzard, Cardington and Bletchley Park  
Teleprinter and W/T Operators*

Watch Commencing	1st Day	2nd Day	3rd Day	4th Day	5th Day	6th Day	7th Day	8th Day
0800	A	A	D	D	C	C	B	B
1600	B	B	A	A	D	D	C	C
2300	C	C	B	B	A	A	D	D
OFF	—	D	—	C	—	B	—	A

The watchkeeping cycle varied at stations such as Dagnall, Greenford, Cheadle, Prestwick, Gloucester etc., to meet local conditions, but although there were differences of detail, the same general rules were observed.<sup>1</sup>

In August 1944, Headquarters No. 26 Group laid down certain common principles of watchkeeping in an effort to improve working hours and conditions generally:—

- (a) A regular rhythm of watches.
- (b) Hours on any particular watch to be short enough to prevent serious fatigue. Six hours on a busy watch was suggested, eight hours on a comparatively slack watch.
- (c) One or two breaks in any watch period involving continuous sitting and continuous work at high pressure.

<sup>1</sup> A.M. File CS.13275.

- (d) Avoidance of broken watches as far as possible.
- (e) Regular rest days. This could not apply under conditions of operational stress, but under these conditions intensive periods of work were followed where possible by long stand-offs.
- (f) Rotation of types of duty.
- (g) Hot meals before and after watch, with adequate hot drinks and light food during watch.
- (h) Accommodation of each watch separately.

A maximum of a 48-hour week was laid down for normal conditions, and irritating restrictions were avoided as far as possible, but control was exercised over periods intended for sleep; for instance, no pass out of camp was granted within eight hours of coming off night duty except in special cases.

### **Selection of Signals Officers**

In 1939, the question of the selection of officers for specialist technical duties was reviewed at the Air Ministry. At that time the broad principle underlying the provision of officers for technical duties was that they should be experienced in flying duties before specialisation, should be intermittently employed in specialist and non-specialist postings, and should be eligible to rise to the highest posts in the R.A.F. on an equal footing with non-specialists. This policy was that originally laid down by Lord Trenchard when C.A.S., in order to avoid the danger of developing technical branches out of touch with flying and fighting requirements and in conflict with the officers who flew and fought.

During the inter-war years the policy was increasingly modified by the introduction and growth of the commissioned warrant officer, who gained his technical knowledge and skill in the ranks. The policy was that this class should fill 80 per cent of the junior posts plus a small proportion of squadron leader posts. Permanent officers (G.D.) occupied the great majority of senior posts and sufficient junior posts to provide an adequate flow to these senior posts. Officers specialised in five branches—engineering, signals, armament, navigation, and photography.

### **Failure of Specialisation Policy**

By 1939 it was found that the specialisation system was not working smoothly.<sup>1</sup> This was due partly to the abnormal strain thrown on the R.A.F. by rapid expansion, but in part it arose from some inherent disadvantages in the principles of the scheme. There were many criticisms. First, the young officer who specialised had no need to possess any definite aptitude for or interest in his specialist subject; he specialised to gain promotion or (in the case of short-service officers) a permanent commission.

<sup>1</sup> A.H.B./IIE/243/1/3.

Secondly, the training given was not such as to produce a real expert with wide technical knowledge and practical experience; this applied particularly to engineering. Thirdly, the policy of reversion to non-specialist employment required the maintenance of a margin of specialist officers in excess of actual posts. The margin originally accepted was 50 per cent, but in the period 1935-1938 efforts were made to increase it to 100 per cent. The attempt to meet increased requirements for specialist training to allow for new jobs under expansion and to provide the increased margin imposed a very severe strain on the limited flow of permanent officers and diminished the number of experienced officers available for effective employment. Fourthly, the G.D. specialist tended to look for advancement from his work on non-specialist duties and feared that if he stayed too long or concentrated too thoroughly on his specialist duties his career would suffer. That this fear was groundless was proved by statistics of promotions in the preceding years, which showed that in proportion to their numbers specialists were equally successful with non-specialists in gaining promotion to the ranks of wing commander, group captain and air commodore; but the fear was prevalent and officers were reluctant to specialise or remain in specialist employment. Fifthly, the reversion policy increased the number of postings, with a serious disturbance to the efficiency of the Service. Sixthly, there was an expectation that university entrants with honours degrees in engineering would come forward in sufficient numbers to provide the higher grades of specialists required for research and development work.

#### **Formation of a Specialist Branch**

In the spring of 1939, the formation of a separate specialist branch for signals, engineering and armament technical officers was proposed, and during the first five months of 1939 the problems of creating a new branch were debated. A sub-committee was appointed to consider the training policy for engineer, armament and signals specialist officers. The sources of supply of higher grade technical specialists were envisaged as:—

- (a) University graduates in engineering who had completed a whole-time course at university.
- (b) Public school or technical college entrants who had gone straight from school to a good engineering works, who had obtained at least three years' good practical experience, and who had continued their technical education up to the standard of a 2nd class honours degree or an approved diploma from a technical college.
- (c) The entrant who had theoretical knowledge up to a university degree standard and had practical experience in a good engineering works.
- (d) The exceptional general duties officer who might be ex-Cranwell or short-service.
- (e) The exceptional commissioned warrant officer who should be given every opportunity of acquiring special knowledge.



- (f) Selected R.A.F. apprentices who would be sent to a university for further training.

The necessity for offering a good career to attract the right type of candidate was recognised. It was felt that officers of the new technical branch should not feel that their duties were in any way inferior to the G.D. branch and that the opportunity for flying must be provided. In the case of higher grade signals specialists the main source of supply was anticipated as being the university graduate in engineering.

A sub-committee was also appointed to consider what higher specialist posts could be filled by the proposed types of specialist officer and which should remain the responsibility of the G.D. branch. Careful consideration was given to career prospects of specialist officers. Suggested conditions of service including pay rates were drawn up, estimates were made of requirements, and on the basis of these, possible regradings and reclassifications suggested.

On 24 May 1939, a conference was held under the chairmanship of A.M.P. to consider the various aspects of the problem. Reports from the sub-committees and papers prepared by the Air Ministry Secretariat Division were considered. A further conference was held on 15 June at which it was agreed that the statement of requirements for specialist officers and the establishment changes involved implied wide policy issues which could not be settled quickly. It was therefore decided that in order to get the scheme working as soon as possible the minimum requirements should be met in the first instance. It was agreed that pay should be at the same rates as for G.D. officers and that retiring ages should be the same except for technical squadron leaders, who were to retire at 50. At the conclusion of the meeting it was agreed that a paper containing the decisions of the committee should be prepared for submission to the Air Council.

In July 1939, the Air Council decided that the existing system no longer met the needs of the modern R.A.F. because:—

- (a) It involved the withdrawal of pilots from flying duties at a stage when they were of the most use in squadrons. The fact that they were posted throughout their career between operational and specialist employment adversely affected both their operational and their specialist efficiency.
- (b) The G.D. officer trained under the existing system was not qualified to cope with the wide range of technical problems arising in connection with the new and complicated aircraft and equipment being used in 1939. The new conditions demanded a technician of a much higher standard who could concentrate on technical matters and make his career in a technical branch.
- (c) Under the old system officers were induced to specialise by the offer of accelerated promotion, or, in the case of short service officers, by making it a method of obtaining a permanent commis-

sion. This tended to produce specialists who undertook technical duties not so much because they were really interested in or had a special aptitude for technical subjects but because they wanted the benefits conferred thereby.

The Air Council therefore decided to establish a technical branch embracing engineer, armament and signals experts. The new policy was that the majority of junior posts for squadron leaders and below should be filled by commissioned warrant officers and that sufficient posts would be reserved for the new type of direct entrant to absorb them before promotion to senior rank (wing commander and above), all of which posts it was proposed should be filled by the new type of higher grade specialist. Such an arrangement would ensure adequate experience in the varying duties appropriate to the specialist subject concerned before higher responsibilities were assumed.

The scheme was not officially approved before war broke out, and the changed requirements meant that many technical officers were commissioned in the R.A.F.V.R. The peacetime scheme for the establishment of a technical branch was therefore abandoned and a wartime technical branch was established on 24 April 1940. It embraced the specialist duties of engineer, signals, armament, and electrical engineering. Rates of pay were the same as for G.D. branch except for commissioned warrant officers. Permanent officers of the G.D. branch were permitted to transfer to the new branch, but only if they were fully qualified specialists, because the new branch was exclusively composed of officers possessing the requisite technical qualifications.

### **Training**

With the outbreak of war, signals officers entering the R.A.F. were given a six months' Specialist Signals Course at Cranwell. They came from all age groups and possessed diverse qualifications and most of them were recruited direct from civilian life. The course gave them general Service training as well as specialist signals training.

In February 1940, it was decided that where training facilities were inadequate to cope with requirements, officers should be sent to units to gain specialist experience on the job. They were double-banked with signals officers already there. The intake at the beginning of the war was 32 every three months, increasing to 40 in May 1940. Non-regular officers were commissioned in the A. and S.D. Branch and remained in that branch while under training on a course or being double-banked and performing executive functions. It was decided to continue to recruit non-regular technical officers in the A. and S.D. Branch and to permit them to transfer to the Technical Branch if they proved suitable. In the event of an officer not proving entirely satisfactory technically, he was then available in the A. and S.D. Branch for employment in a sub-technical post or on other duties. In the Signals Branch, posts were labelled to make a clear distinction

between the really technical posts requiring high technical qualifications and others. Fully technical posts were only filled by qualified officers of the Technical Branch.<sup>1</sup>

In December 1940 the procedure was revised, signals officers being commissioned as acting pilot officers in the Technical Branch and receiving A. and S.D. rates of pay. If found unsuitable they were transferred to the A. and S.D. Branch, and after successfully completing a training course and a period of practical experience they were confirmed as pilot officers in the Technical Branch and received Technical Branch rates of pay. This method eliminated much administrative procedure.<sup>2</sup>

Cranwell was chosen for signals officer training because it was the only station where technical equipment and buildings fitted with the necessary apparatus were available. When in May 1940 the number of officers under training was increased, the shortage of domestic accommodation was overcome by housing them in tents.

The War Signals Course lasted six months, having been reduced from the pre-war Specialist Signals Course of fourteen months. The war course was not an *ab initio* one; it assumed certain previous training or experience in electrical subjects. Officers selected for training as signals officers in the first year of the war entered with some technical qualification in science or engineering. Officers required for radar duties graduated to a course at No. 1 Radio School, Yatesbury, which lasted eight weeks.<sup>3</sup>

Radar officers were required preferably to have a degree in physics and a first-class knowledge of modern radio, both on the theoretical and practical side. It was desirable that they should also have had experience of short-wave transmitting and receiving and of cathode-ray tube work or television. Professional experience of radio was not essential. Keen radio amateurs made excellent radar officers. Under the stress of war conditions the high standards of peacetime could not be maintained, and minimum technical requirements were laid down. These were that candidates should have a good science degree (or a good law degree and subsequent experience of patent work) and a thorough knowledge of basic alternating current theory. They were required to be absolutely sound in this, particularly in their knowledge of inductance, capacity, resistance, frequency, phasing, and acceptor and rejector circuits. In addition, they were to have a fundamental knowledge of the principles of radio transmission and reception. Provided this knowledge was thorough it was possible to superimpose the special training in eight weeks.

<sup>1</sup> As technical officers got the G.D. rate of pay, the Air Ministry had promised the Treasury that only fully qualified men should be commissioned for the Technical Branch. Not all the R.A.F.V.R. officers who passed the short Signals War Course were transferred to the Technical Branch for signals duties, but only those who were fully qualified as radio engineers and had practical experience.

<sup>2</sup> A.M. File S.82415.

<sup>3</sup> A.M. File S.82415.

The demand for signals officers, however, now exceeded the supply, and by September 1941 the R.A.F. was deficient of nearly 200 signals officers, and this did not include radar specialists or the requirements of No. 80 Wing. This represented a deficiency of 20 per cent. Of 1,000 posts in the Air Ministry, home commands, and overseas, only 800 were filled. Bomber and Fighter Commands were on the average more than up to strength, and Technical Training and Middle East Commands were worst off, both being nearly 33½ per cent under strength. The arrangements for training were for 150 officers a year at both Nos. 1 and 2 Radio Schools and 400 a year at No. 1 Signals School, but the Air Ministry could not produce sufficient men to keep these courses full.<sup>1</sup>

In January 1942, the requirement for signals officers was stated to be 310 from 1 January 1942 to 1 January 1944, of which 103 were already selected. One third of the entry were required from university entrants because this higher type were required for staff posts, R.A.E. and overseas, after a tour at stations. D. of S. felt that station signals officers should be commissioned from wireless operators/air gunner, because they had a knowledge of operations and a certain prestige when briefing crews; these posts were later abolished in Bomber Command, effecting a considerable saving.

In the early months of 1942, the deficiency in signals officers became acute. At a meeting to discuss the position on 19 March 1942, it was stated that the deficiency was due to an unforeseen increase in the February 1942 establishments. Owing to the length of training required it appeared that the deficiency could be met only by accelerating the commissioning of senior airmen who required little or no training and junior airmen for whom a course shorter than the normal six months was required. D. of S. considered that the framed establishments did not allow adequately for the expansion which he visualised during the target period. It was agreed that an increase in the number of university candidates above the existing 50 should be considered, that the small flow of direct entrants should be taken into account, and that the question of modifying the instructions regarding qualifications necessary in the case of airmen with limited Service experience would be considered. Other recommendations were that commissioning of airmen be accelerated and that as many as possible of the planned entry of 230 be commissioned as soon as possible, that all available senior airmen who did not require training be commissioned immediately, and that the question of obtaining tour-expired wireless operators/air gunner should be further investigated.

#### **W.A.A.F. Substitution**

By the middle of September 1942, the shortage of signals officers had become even more acute and it appeared likely that the deficiencies would get worse. There was now a deficiency of nearly 400 signals officers. A meeting was therefore held at the Air Ministry on 22 September 1942 to

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<sup>1</sup> A.H.B./IIM/B27/1A.

discuss questions concerning the intake of officers for all signals and radar duties.<sup>1</sup> At this meeting it was decided to introduce W.A.A.F. substitution where practicable in R.A.F. signals officer posts. Twenty W.A.A.F. officers were sent on a four months' signals course and another 40 were to be trained later.<sup>2</sup>

The training syllabus for these officers was based on the corresponding wartime course for male officers. By December 1942, some posts had already been taken over by W.A.A.F. officers. Although considerable technical knowledge was required for these posts, W.A.A.F. officers soon proved themselves satisfactory. An additional advantage lay in the fact that the ground signals services in the United Kingdom were to an appreciable extent manned by W.A.A.F. personnel and these airwomen thus came directly under the command of W.A.A.F. officers. The first course of 19 W.A.A.F. signals officers reported to their units on 11 December 1942. A new commissioned branch, with advancement to the rank of squadron officer, was formed in the W.A.A.F. The experiment proved very successful in alleviating the extreme shortage of signals officers. These W.A.A.F. signals officers were employed as unit signals officers at group and command headquarters, and at signals centres; they also filled specialised posts at headquarters. Courses of six months (W/T Operators) and eight months (non-W/T Operators) were given.

#### Further Policy Changes

In December 1942, the C.A.S. prepared a paper for the consideration of the Air Council on the staffing of signals posts in the R.A.F. He felt that a proportion of signals posts should always be filled by G.D. signals officers because without an inflow of officers with operational experience, operational requirements would not be met because they could not be fully appreciated. Pure technicians could not try equipment in the air and guide the development and the course of trials. It was proposed that 25 per cent of squadron signals officers should be recruited from junior G.D. officers. The remaining 75 per cent could be highly specialised in signals. The G.D. officers would be employed for a limited time on signals duties and then go back to flying; later, if suitable, they could return for a further signals course. D.G. of S. said the existing system of commissioning meant that he was unable to meet satisfactorily the war requirements of the R.A.F. The Air Council therefore agreed to the proposal put forward by the Secretary of State that the suggestions of the Chief of the Air Staff should be considered by a committee. This committee met on 7 January 1943. It recommended agreement with the proposal that as a matter of policy a proportion of signals posts should always be filled by G.D. signals officers. The second proposal was that an immediate start should be made in selecting and training a small number of G.D. officers for signals duties. It was decided

<sup>1</sup> A.M. File S.82415.

<sup>2</sup> A.H.B./IIE/44.



that there would be great difficulty at that time (without impairing the operational effort) in releasing G.D. officers for training in signals duties, but that a few pilots might be found from Fighter and Coastal Commands, a few radio observers might be found suitable and made available, and a few wireless operators/air gunner might be considered, provided they were capable of passing the course as for other G.D. officers. It was decided to recommend the creation of two establishments, one to be filled by G.D. signals officers and the other by signals officers of the technical branch; the latter establishment must guarantee an adequate career to signals officers in the technical branch. G.D. signals officers would be eligible for promotion to the highest posts in the G.D. branch as well as to any of the G.D. signals posts, but not to the higher posts in the technical branch. A proposal that G.D. signals officers should be eligible for transfer to the technical branch if they held or acquired the necessary qualifications was not acceptable to the committee, nor was a proposal that G.D. officers who had already transferred to the technical branch should under the new policy be given the option of reverting to the G.D. branch if they wished and were considered suitable.

The committee felt that as a long-term policy, except for the engineering section, there seemed to be solid grounds for a reversion to the Trenchard Scheme whereby technical officers should also have flying and operational experience. On 10 March 1943, A.M.P. and D.G. of S. met and agreed in the main with the recommendations of the sub-committee. On the question of the selection and training of G.D. officers for signals duties, it was agreed that as a general principle and where it was found possible to release the personnel, a number of pilots should be selected and trained as signals officers. Meanwhile, D.G. of S. made a selection from the few pilots who could be found from Fighter and Coastal Commands and from suitable radio observers and wireless operators/air gunner. The number of G.D. officers required was estimated as probably not more than 25-30 a year.<sup>1</sup>

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<sup>1</sup> A.H.B./IIE/243/1/3.

## CHAPTER 9

# PRODUCTION AND DISTRIBUTION OF SIGNALS PUBLICATIONS

### Distribution

After the 1914 to 1918 War it was the practice for all secret and confidential publications, irrespective of their subject, to be issued by the Air Ministry department concerned to the signals staffs at the distributing authorities (command and certain group headquarters). The practice arose because the majority of such publications in the years immediately following the war dealt with signals matters. This meant that the signals staff spent a considerable amount of time receiving, distributing, amending and mustering a large number of secret and confidential publications. The burden was very heavy. On 12 January 1937 the task of distributing these publications was withdrawn from group headquarters and concentrated in the four home command headquarters. Newly established civilian code and cypher officers at command headquarters were made responsible for secret and confidential publications. The code and cypher officers overseas already carried out this task and the arrangement worked satisfactorily.<sup>1</sup>

At the outbreak of war responsibility for the bulk custody and distribution to the distributing authorities of R.A.F. signals publications and codes and cyphers rested with Signals 1(f) at the Air Ministry. When the R.A.F. Code and Cypher School was opened at Oxford in September 1939 Signals 1(f) was transferred there, the officer-in-charge of the section becoming commanding officer of the school. A separate distribution section was formed at the school the duties of which included allotment of W/T call-signs and delivery groups, liaison with other Services on all questions of signalling procedure and related regulations for conduct of communications. When the book production section was formed at the Code and Cypher School, the unit became known as the Air Ministry Book Production and Distribution Centre (A.M.B.P. & D.C.), and its duties were extended to include the production and amendment of all signals publications including code and cypher books.<sup>2</sup> When the Code and Cypher School was placed in No. 26 Group in February 1940 the A.M.B.P. & D.C. was also placed under it for general administration only; similarly it was transferred to No. 27 Group in June 1941. Throughout these changes the Air Ministry Directorate of Signals retained direct control of the production and distribution of signals publications. When in July 1942 the Director of Technical Training became responsible for training policy at the Code and Cypher School it was decided to move the A.M.B.P. & D.C. to Harrow. This was in order to facilitate control of the Code and Cypher School by D.T.T. and to provide for its extension.

<sup>1</sup> A.M. File S.38365/I.

<sup>2</sup> A.M. File S.2083.

The move was made in the autumn of 1942. A.M.B.P. & D.C. moved again in April 1943, this time to Aeroville, Hendon, where it remained for the rest of the war.<sup>1</sup> Distribution of signals and cypher books within the United Kingdom was made by command headquarters under their own regulations, which conformed in principle to those laid down in King's Regulations. This was that the delivery and collection of cyphers, confidential codes and secret and confidential signals books were always to be undertaken by an officer personally.<sup>2</sup>

Before the war the quantity of signals books required for overseas was small and delivery was by members of the Directorate of Signals staff to the ships. At the beginning of the war the practice was adopted of sending the bags through the Air Ministry registry who forwarded them through the Post Office for transmission by ship. This method was unsatisfactory because little security protection was afforded; several times bags were left unattended overseas until the addressees were notified of their arrival. At the end of 1941 the Admiralty took responsibility for the overseas distribution of secret and confidential books and documents. Bags were delivered to the Admiralty in London and collected at the destination from the Fleet Mail Officer. This arrangement was much more satisfactory although there were occasionally long delays in despatching accumulation of cargo from London. Investigation of losses was more prompt and was believed to have been reasonably reliable.<sup>3</sup> When units overseas required publications application was made to the nearest R.A.F. command headquarters or authority. If publications were not available on the spot the Air Ministry despatched them to the command concerned, who reissued to the unit or persons requiring them.<sup>4</sup>

At the beginning of the war R.A.F. secret and confidential publications used by R.A.F. Ferry Command, the R.A.F. Delegation, Washington, R.A.F. units in Canada, and the United Kingdom High Commissioner in Canada, were distributed by two authorities, the Royal Canadian Air Force and the Air Ministry, London. In October 1941 it was agreed that the R.C.A.F. should be the distributing authority for all R.A.F. units in Canada, including Ferry Command, and that the R.A.F. Delegation should distribute to all R.A.F. units in the U.S.A. including the British Air Commission. The arrangements were changed again the following month because of objections expressed by Signals Plans, Air Ministry. Headquarters R.C.A.F. was made responsible for distributing publications to all R.A.F. units in Canada connected with the Empire Air Training Scheme, Headquarters Ferry Command was responsible for all units connected with their organisation and the R.A.F. Delegation was made distributing authority for all R.A.F. secret and confidential publications in the U.S.A. whether held by R.A.F. or American authorities.<sup>5</sup>

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<sup>1</sup> A.M. File CS.11934.

<sup>2</sup> A.M. File CS.8437.

<sup>3</sup> A.H.B./IIE/243/4/1.

<sup>4</sup> A.M. File S.38365/1.

<sup>5</sup> A.M. File CS.11784.

### Distribution to U.S. Forces

The arrival of the U.S. forces in the United Kingdom meant that closer operational collaboration with the British was necessary and consequently far more use was made of R.A.F. codes and cyphers by the Americans. In 1942 the Air Ministry arranged that distribution of secret and confidential signals publications to U.S.A.A.F. units in the United Kingdom should be through the appropriate R.A.F. command. This was suggested because it was felt the command concerned would be familiar with the books suitable for the type of American unit it looked after. Headquarters Bomber Command opposed the suggestion on the grounds that the American Air Force would be working independently and Bomber Command would have no control or authority over the manner in which the books were treated. They felt that the American Air Force should be a distributing authority on its own account. It was agreed by the Air Ministry in June 1942 that the American Eighth Air Force Headquarters should carry out the distribution of signals publications to their units, but it was considered that issue should be through R.A.F. command headquarters in the initial stages to meet immediate requirements. When machinery for a recording system and distribution was established at the American headquarters and units, publications were distributed from the Air Ministry direct to American headquarters without going through R.A.F. commands.<sup>1</sup>

### Overseas Distribution Centre

In the spring of 1944 the Overseas Distribution Section (O.D.S.) was established within No. 85 Group as the sole authority for the distribution of secret and confidential publications to Allied Expeditionary Air Force units in Europe. In October 1944 it was reorganised because of the large number of scattered and inaccessible units in Europe. With effect from 14 November 1944 Headquarters Second Tactical Air Force disestablished the O.D.S. and transferred certain of the posts in it to their headquarters to distribute publications to 2nd T.A.F. units. Headquarters Fighter Command, however, took no action to establish the remaining posts as a nucleus overseas distributing centre in their command with the result that the Section functioned in No. 11 Group from 14 November 1944 without an establishment. The Air Ministry Directorate of Signals considered that the Overseas Distribution Section could function efficiently and economically only if based in the United Kingdom near its main supply depot, A.M.B.P. & D.C. Hendon. Authority was requested in February 1945 for the establishment of a unit to be known as the Overseas Distribution Centre. It was to be administered by Headquarters No. 11 Group but technically controlled by the Directorate of Signals because of its service for all commands on the continent. The commands concerned agreed to the arrangement. The unit had still not been established in April 1945 when D. of S. again requested establishment action, this time within Transport Command. In May 1945 the establishment was authorised in No. 46 Group, Transport

<sup>1</sup> A.M. File CS.14963.

Command, as a lodger unit at Uxbridge. It remained at Hillingdon House, Uxbridge, until 1946 when it was amalgamated with A.M.B.P. & D.C. at Hendon.<sup>1</sup>

### **Production in the United Kingdom**

In the United Kingdom the production of all basic code and cypher books, recyphering tables, key lists and call-signs for the three Services and for all government departments was centralised and undertaken by a special section of the Government Code and Cypher School.<sup>2</sup> At the beginning of the war the Air Ministry did not give the school sufficient guide for requirements but when this had once been done the response from the production side of the school was very good and the output of documents was high. Although the Government Code and Cypher School was responsible for code and cypher production the Air Ministry was responsible for preparing the drafts of cypher books and codes and for writing the relevant instructions. For about the first fifteen months of the war no provision was made for doing this work properly and the little that was done was undertaken by some of the staff at the R.A.F. Code and Cypher School in their spare time. This was unsatisfactory. The draft of the third edition of the cypher book was incomplete although the second edition had been in force for at least five years. No call-sign or delivery group books were in draft. It was therefore decided at the beginning of 1941 that an Air Ministry signals book production section should be established at the R.A.F. Code and Cypher School. Throughout its existence it remained a composite unit with the book distribution section. The section did invaluable work in producing call-sign and address sign books and drafts of various codes. It was also extremely valuable as an adjunct to Signals 5 Air Ministry because it was able to prepare drafts of long documents, such as procedure books and manuals.<sup>3</sup>

### **Production Overseas**

During the early months of the war all production of codes and cyphers was done in the United Kingdom. Difficulties of distribution caused delays in supply and thus endangered the security of signals communications. The Air Ministry therefore initiated a movement for the establishment of local production centres overseas, either under inter-Service control or R.A.F. control. The first centre to be established was in the Middle East. By August 1941 the distribution of signals publications, particularly cyphers, had become so difficult that all three Services decided to produce them in the Middle East. The Army already had a cypher production officer responsible for making up recyphering tables locally printed by the General Headquarters press or the Field Survey Company. Considerable discussion took place before production actually began. A committee, the Inter-

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<sup>1</sup> A.M. File CS.23830.

<sup>2</sup> A.M. File C.35326/47.

<sup>3</sup> A.H.B./IIE/243/4/1.



Service Cypher Production Committee, was formed. In October 1941, it was decided to establish one inter-Service printing section under an R.A.F. flight lieutenant. On 1 January 1942 he arrived to take charge of the Inter-Service Cypher Production Centre which was located in a cave at Tura. Considerable difficulties were experienced. In spite of handicaps during the first six weeks six editions of recyphering tables were produced on Gestetner machines. In the middle of February a Multilith plant was sent from the United Kingdom. At the beginning of March the first set of six machines arrived in Cairo but only three were usable. During the summer output rose, recyphering tables and call-sign and delivery group books having been printed. In the heat of the Egyptian summer the unsuitability of the cave became increasingly obvious. In July 1942 the centre moved to Air Headquarters Levant because of the military situation in Egypt. More machinery gradually arrived from the United Kingdom and by October 1942 ten Multilith plants were in operation and the monthly output of tables rose to twenty-four. In that month the centre moved to T.M.E. where working conditions were much better. In spite of the many difficulties encountered good work was done by the unit. At the end of the year the naval personnel were withdrawn because the Navy decided to use the centre no longer. During 1943 a Signals Production Unit was formed in the Middle East. In August 1944 it was decided that the Inter-Service Cypher Production Centre was to concentrate entirely on printing and the S.P.U. on litho-offset work.<sup>1</sup>

Printing of signals publications was also started in the Dominions as a result of Air Ministry initiative. In the winter of 1941 arrangements were made for the printing of Far East recyphering tables and cypher books in Australia. These were distributed to the Far East war theatre, Australia, New Zealand, and India, by Headquarters R.A.A.F. Melbourne. In April 1942 the Air Ministry decided to make Australia self-supporting in cypher matters. Production flourished and by October 1943 the R.A.A.F. had a staff of 33 people engaged on book compilation and distribution.<sup>2</sup> In April 1942 a unit for the production of code and cypher publications was established in Canada.<sup>3</sup> The production of codes and cyphers by local printing centres overcame the impossibility of world-wide distribution from the United Kingdom.

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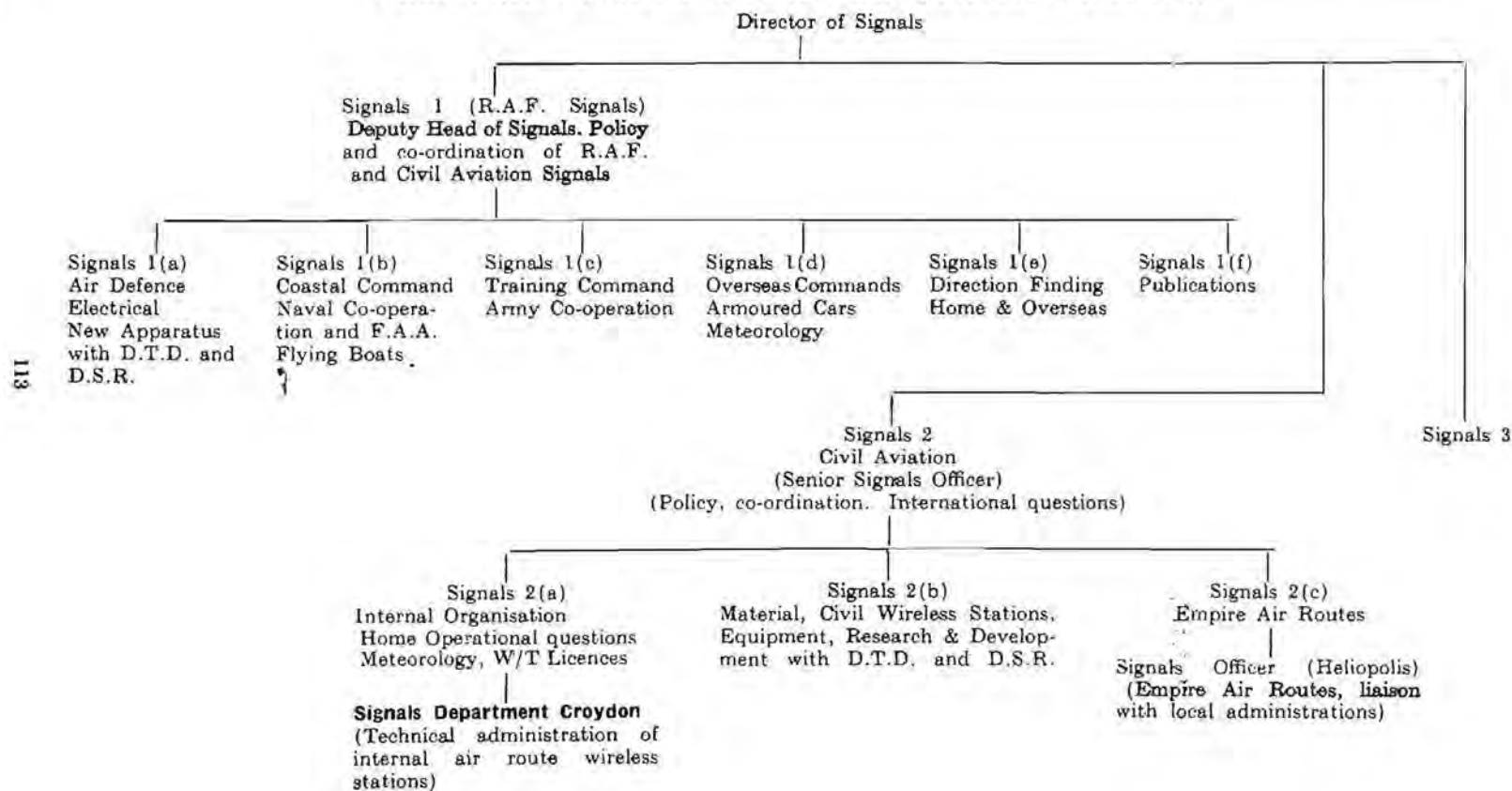
<sup>1</sup> A.M. File C.35432/47.

<sup>2</sup> A.M. File CS.13991.

<sup>3</sup> A.M. File CS.14037.

## APPENDIX No. 1

## ORGANISATION OF AIR MINISTRY SIGNALS DIRECTORATE—OCTOBER 1936



#### APPENDIX No. 2

### ORGANISATION OF THE AIR MINISTRY SIGNALS DIRECTORATE— FEBRUARY 1940

- Signals 1* R.A.F. aircraft signals organisation.  
Communications organisation in France.  
Radio Aids to Navigation.  
Command technical administration and liaison.  
Maintenance and modification questions.  
National Pigeon Service.  
Codes and Cyphers.  
Secret and Confidential books.  
Personnel questions.  
W.A.A.F. signals and organisation.
- Signals 2* All Civil Aviation signals matters, including Empire Air Routes.
- Signals 3* All landline and Defence Teleprinter Network organisation.  
Home and overseas W/T point-to-point systems.  
Inter-Command W/T system.  
Communication with the Dominions.
- Signals 4* R.D.F. policy at home and overseas.  
Organisation of R.D.F. systems at home and overseas.  
Technical administration of R.D.F. through the R.D.F. group.  
Technical questions affecting all types of R.D.F. equipment.

#### APPENDIX No. 3

### ORGANISATION OF DIRECTORATE GENERAL OF SIGNALS— APRIL 1943

Director General of Signals (Air Vice-Marshal)  
(Under him three Directors — R.D.F., Tels. and Signals)

#### Directorate of R.D.F. (Air Commodore)

- D.D. R.D.F.1* Co-ordination of Ground R.D.F. programmes at home and overseas.
- D.D. R.D.F.2* Co-ordination of airborne R.D.F. programmes at home and overseas.
- R.D.F. (Nav)* Navigational aspects of ground and airborne R.D.F.

#### Directorate of Signals (Air Commodore)

- Signals 3* Policy Secretariat.
- Signals 5 & 6* Signals personnel.
- D.D. of S.* Signals Plans — Combined signals planning.  
Signals 5 — Signals security and procedure.

#### Directorate of Telecommunications (Air Commodore)

- D.D. of Tels.1* Air Communications.
- A.D. of Tels.2* Bristol — Civil Aviation.
- D.D. of Tels.3* Ground Communications.
- Tels.4* Signals traffic control.

(A.H.B./TEE/44).

#### APPENDIX No. 4

##### COMPARISON OF No. 26 GROUP IN 1942 AND 1943

	Feb. 1942	June 1943
Main stations in the group	9	15
Sub-stations	138*	146
Telecommunications installations home and abroad	1,290	2,734
Landlines (Airfields, D.T.N. stations)	198	1,075
Vehicles fitted	1,180	2,585
Aircraft fitted	3,268	3,298
Marine craft including headquarters ships	72	185
Transportable W/T stations and pack sets	0	2,160
S.B.A. Installation	25	80
R.D.F. Beacons	0	250
Personnel	Officers 607	912
	O.R.s 9,522	23,923

\* Included 27 fitting parties of which there were only 9 in June 1943, i.e. net increase of 18 sub-stations.

#### APPENDIX No. 5

##### STATIONS AND UNITS UNDER THE OPERATIONAL, TECHNICAL AND ADMINISTRATIVE CONTROL OF H.Q. No. 26 GROUP, JULY 1943

###### No. 80 (Signals) Wing. (86 officers, 3,012 other ranks)

H.Q. No. 80 Wing controlled through six area H.Q.s approximately 80 small out-stations, all employed on radio countermeasures work. It also controlled the 'A - J' unit, whose function it was to counter jamming attacks on British R.D.F. and radio facilities.

###### No. 81 (Signals) Wing. (22 officers, 646 other ranks)

H.Q. No. 81 Wing administered the Western Area Signals Offices at Worcester, Gloucester, Tetbury, Stroud and Stonehouse, providing facilities for Air Ministry and Record Office. It also administered a signals section, comprising receiving and transmitting stations at Birdlip and two standby W/T stations at Hartlebury and Bodmin.

###### No. 1 Signals Depot, West Drayton. (80 officers, 2,782 other ranks)

The functions of the depot were :—

- Prototyping of all signals and vehicle installations.
- Manufacture of equipment in urgent demand which could not be obtained from manufacturers within prescribed time limits.
- Testing of W/T, R/T and electrical equipment, signals vehicles and prototype vehicles.
- Installation of signals equipment in aircraft and marine craft and at ground stations at home and overseas units.
- Servicing of signals installations at home.

###### No. 2 Signals Depot, Fazakerly. (38 officers, 1,227 other ranks)

Similar functions as No. 1 Signals Depot except that no prototyping was carried out.

###### North West Signals Centre, Blackbrook. (19 officers, 524 other ranks)

Telephone and teleprinter switching centre covering the North Western Area. Also control of Long Range Cathode D/F Ray Service.

###### South Western Signals Centre, Corsham.

Telephone and teleprinter switching centre.

**Leighton Buzzard.** (103 officers, 1,693 other ranks)

W/T communications centre, co-ordinating and linking station of Inter-Command and home R.A.F. signals organisation. Comprised main centre at Leighton Buzzard which received main part of overseas traffic from all parts of the world; stations at Dagnall and Greenford which were the two transmitting stations for overseas inter-command circuiting; and receiving station at Cardington. Also Air Ministry Communications Sections at Kingsway and Whitehall.

**Powers and Responsibilities of Headquarters No. 26 Group**

**W/T Receiving Station, Redbrae.** (2 officers, 128 other ranks)

**W/T Transmitting Station, Symington.** (1 officer, 50 other ranks)

Signals stations for dealing with certain overseas traffic and also acting as standby for Leighton Buzzard.

**R.A.F. Station Chigwell.** (33 officers, 2,313 other ranks)

Responsible for the formation and training of signals units and the provision of P.D.C. facilities before despatch overseas for all signals and R.D.F. personnel trained under Nos. 26 and 60 Group organisations. Training was carried out at Chigwell (2,000 trainees) and its two satellites White Waltham (600 trainees) and Putteridge Bury (500 trainees).

**Base Signals Unit Chigwell.** (25 officers, 290 other ranks)

Base organisation for the installation and servicing of ground signals and R.D.F. equipment. It was intended, however, that this unit should not perform its role until in the field. In the U.K. the unit was based at R.A.F. Chigwell, which unit it was assisting to train signals personnel.

**R.A.F. Station Hinton-in-the-Hedges**

This consisted of:—

Signals Development Unit	— development and servicing of radio aids to navigation.
S.B.A. Section	— calibration, servicing and modification.
V.H.F./B.A. Section	— calibration, servicing and modification.

**Units under Administrative Control of No. 26 Group H.Q.**

**No. 105 (Combined Operations) Wing.** (92 officers, 678 other ranks)

Administered only by No. 26 Group while in U.K.

**Units under Operational Control only of No. 26 Group H.Q.**

A.M.C.S. Harrogate

A.M.C.S. (Z.A.)

**APPENDIX No. 6**

**TERMS OF REFERENCE FOR DEPUTY DIRECTORATE PROGRESSING COMMUNICATIONS EQUIPMENT (D.D.P.C.E.), 12 MARCH 1943**

D.D.P.C.E. has been set up within the Ministry of Aircraft Production to plan, initiate provision action (subject to para. 2 below) and progress the production under contracts of all R.A.F. Ground and Airborne Radio and Communications Equipment. The Deputy Directorate is also responsible for progressing all R.A.F. Ground and Airborne Radio and Communications Installations, and is also responsible for progressing Naval Radio and communications equipment and installation thereof in aircraft and marine craft.

**1. Planning and Control**

D.D.P.C.E. is responsible for advising D.G. of S. as to the rate of production of equipments where this is a determining factor in the planning of Radio and Communica-



tions programmes. In cases, where owing to shortages, control of priority of equipment by D.G. of S. is necessary to meet operational requirements, D.D.P.C.E. may at the request of D.G. of S. request D.G.E. to carry out the necessary movements of equipment. The priority of requirements will in all cases be determined by D.G. of S.

It is the responsibility of D.D.P.C.E. to ensure that the complete 'Consisting of Schedules' (C.O.S.s) and all relevant technical and policy information regarding equipment and programmes is furnished to D.G.E. at the earliest possible moment.

## **2. Initiation of Provision action**

Broadly speaking the initiation of provision action falls into three distinct headings:—

(a) Where C.O.S.s exist.

In this case ordinary equipment procedure can be adopted and D.G.S. will indicate to D.G.E. his requirements giving at the same time a copy of this direction to D.D.P.C.E. D.G.E. will undertake to furnish D.D.P.C.E. with all information required by D.D.P.C.E. for their progressing responsibilities.

(b) Where C.O.S.s do not exist.

It frequently happens that special equipment which is urgently required for operational purposes needs provision action before the preparation of the relative C.O.S. In these cases D.G. of S. will furnish D.D.P.C.E., as necessary, with the basic information to enable him to prepare a 'requisition request' which will be passed to D.G.E. so that the necessary provision action may be taken. In this connection, D.D.P.C.E., who will at all times receive full information from D.C.D., will, on the basis of scales of main and spare equipments indicated by D.G. of S., inform D.G.E. of the quantities required to meet the D.G.S. programme. D.G.E. will add whatever quantities are considered necessary by him for maintenance and stock build up. D.D.P.C.E. will however advise D.G.E. at all times on all technical information available to him, to enable D.G.E. to form his decisions on quantities required.

(c) Where C.O.S.s do not exist but the equipment is required with extreme urgency.

Occasionally limited quantities of equipment are required for operational purposes with extreme urgency, and where it is necessary to place a contract within a few hours. In these cases D.G. of S.'s requirements will be communicated directly to D.G.E. and a copy will be sent to D.D.P.C.E., who will give whatever assistance is needed in the particular circumstances to facilitate the placing and fulfilment of the contract.

D.D.P.C.E. is responsible for supplying all technical information regarding Embodiment Loan and associated items on major apparatus to D.G.E., to ensure that there shall be no hold up on production for lack of orders on Embodiment Loan and associated items. D.D.P.C.E. will request D.D.E.13 to place L.P.O.s (Local Purchase Orders) when these are necessary and appropriate for all Radio and Communications Equipment required for implementing D.G.S. programme.

## **3. Progressing Production**

D.D.P.C.E. is responsible for Progressing the Production of all ground and airborne radio and communications equipment so as to ensure that all types of equipment are available to meet the requirements of D.G. of S. In this connection D.D.P.C.E. is responsible for drawing the attention of the appropriate authorities in Air Ministry or M.A.P. to any delays caused either by design difficulties with the result of modifications thereto, administrative difficulties, in Finance or Contracts, and draw the attention of the Production Directorates concerned where production rates are not meeting the planned requirements of D.G. of S. as specified by D.G.E. D.D.P.C.E. will be responsible for keeping D.G. of S. promptly informed of all production delays likely to affect known target dates for meeting operational requirements and commitments.

This does not relieve D.G.E. of his overriding responsibility for supply of all Radio equipment, which carries with it the responsibility for hastening Production and drawing the attention of the Air Member for Supply and Organisation, where he considers it necessary, to any instances in which lack of supply may interfere with operations.

#### 4. Progressing Installations

D.D.P.C.E. is responsible for Progressing the installation of all Radio and Communications ground and airborne equipment as well as vehicles and marine craft in this country.

In this connection it is necessary to emphasise that this progressing work will include all associated and ancillary equipment.

### APPENDIX No. 7

#### W/T BOARD—1918

Detailed duties were:—

Co-ordinating the views of the three Services on signals communication matters generally.

Allocating frequencies between the three Services, and publishing a list of them.

Collaborating with the G.P.O. in the matter of licences for Wireless Telegraphy stations and on other matters which might affect the Services.

Arranging for the prevention of interference between Service and other Wireless Telegraphy stations.

Standardising signalling procedure for use between the three Services.

Providing the necessary wireless telegraphy, line telegraphy and visual signalling information required for a combined operation.

Proposing the views of the Services for international telecommunications conferences.

Arranging for the dissemination of technical information obtained from various sources.

### APPENDIX No. 8

#### INTER-SERVICE COMMITTEE ON R.D.F.—NOVEMBER 1938

Terms of reference were:—

To examine the progress of research and development on R.D.F. from the point of view of strategical and tactical applications.

To suggest relative priorities in R.D.F. research and development.

To recommend on relative priorities in application and production.

To recommend on scale of provision for research, development and production in R.D.F.

To recommend action required to avoid or mitigate mutual interference between R.D.F. and other military organisations.

To recommend on provision of facilities for large scale tactical trials and operational research work involving one or more Services.

To consider and recommend on submissions from Service R.D.F. panels.

APPENDIX No. 9

**RADIO POLICY SUB-COMMITTEE, FEBRUARY 1942**

Terms of reference were:—

- To co-ordinate and determine inter-Service radio policy, particularly when conflicting interests, requirements and proposals arose.
- To determine priorities for the allocation of radio personnel and equipment to the three Services when requirements conflicted.
- To determine the distribution of effort on development and production when necessary.
- To determine policy of disclosure of radio information to allied authorities.
- To recommend policy of provision of radio equipment to Dominion, Colonial and Allied governments.
- To act as the channel of liaison with similar bodies set up by Allied governments.

APPENDIX No. 10

**R.D.F. BOARD—FEBRUARY 1942**

Terms of reference were:—

- To co-ordinate inter-Service R.D.F. requirements for present or contemplated operations as might be required by the planning staffs.
- To plan inter-Service R.D.F. requirements for existing or contemplated operations as might be required by the planning staffs.
- To provide information to the planning staffs of the three Services on existing R.D.F. cover.
- To recommend the allocation of British R.D.F. equipment to meet inter-Service requirements and those of Dominion and Allied authorities.
- To estimate future inter-Service requirements for R.D.F. equipment for the guidance of production planning.
- To collect and maintain information on existing or planned R.D.F. cover in all theatres of British, Dominion and Allied operations.
- To collect and maintain information on performance and major technical details of all R.D.F. equipment in use by the British, Dominion or Allied Forces.
- To consider and propose to the R.D.F. Technical Committee lines of research and development of R.D.F. apparatus to meet inter-Service operational requirements.
- To advise on the operational utility of new developments or methods submitted by the R.D.F. Technical Committee or other sources.
- To co-ordinate action for the provision of R.D.F. means of identification for the British Forces and to co-operate with Dominion and Allied authorities in the introduction of a common R.D.F. identification system.
- To determine personnel requirements for planned inter-Service R.D.F. programmes and recommend action for the provision and training of such personnel.
- To co-operate with Dominion and Allied authorities on questions of R.D.F.

APPENDIX No. 11

**RADIO BOARD — SEPTEMBER 1942**

The functions of the Board were :—

To co-ordinate inter-Service radio policy, research, development and production to meet Service and departmental requirements, particularly when conflicting interests and proposals arose.

To determine the order of priorities for research, development and production referring when necessary to the Defence Committee.

To co-ordinate the activities of the several departments in research and development.

Without disturbing the existing responsibilities of the departments to ensure that there was adequate forward planning of production.

To ensure the largest practicable degree of standardisation in finished equipment and in components.

To determine the distribution of technical personnel between research, development, production, maintenance, operation and other uses.

To determine the policy of disclosure of radio information to the Dominion, Colonial and Allied governments as far as production was concerned and to advise the Chiefs of Staff on the security aspects of the use of secret radio devices in operations.

Within the framework of the Combined Chiefs of Staff, the Combined Production and Resources Board, and other combined bodies, to enter into relations with the appropriate U.S. authorities for the purpose of the exchange of information, the integration of programmes and policy and other related matters.

Similarly to act as the channel of communication with Dominion and Allied governments on matters falling within these terms of reference.

APPENDIX No. 12

**DIVISION OF RESPONSIBILITIES BETWEEN R.A.F. AND  
AIR FORMATION SIGNALS**

(Extract from Air Ministry Directive dated 19 November 1943)

1. Provision of landline equipment and maintenance spares at:—

(a) *H.Qs. of R.A.F. Wings, Groups, higher formations and at Signals Centres*

- (i) All telegraph equipment, operational or otherwise, and maintenance spares will be provided by Air Formation Signals.
- (ii) All operational landline equipment, other than telegraph equipment, will be provided through R.A.F. channels.
- (iii) All other landline equipment and maintenance spares will be provided by Air Formation Signals.

(b) *All other H.Qs. of R.A.F. formations and units*

- (i) Air Formation Signals will provide such telegraph equipment and maintenance spares as are required.
- (ii) The appropriate R.A.F. War Equipment Schedules indicate the equipment required for internal landline communications. This equipment, together with maintenance spares, will be provided through R.A.F. channels.

2. Installation and maintenance of landline equipment at:—

(a) *H.Qs. of R.A.F. Wings, Groups, higher formations and at Signals Centres*

All landline equipment, operational or otherwise, will be installed and maintained by Air Formation Signals subject to the following conditions in relation to operations and filter rooms: that the equipment only includes that which involves a technique common to equipment included in the syllabus of training of Royal Signals tradesmen; that maintenance is restricted to first echelon repairs; that the R.A.F. is entirely responsible for the provision of all components and spares; that the commitment will not involve an additional liability for army manpower.

(b) *All other H.Qs. of R.A.F. formations and units*

(i) All telegraph equipment, operational or otherwise, will be installed and maintained by Air Formation Signals.

(ii) All other landline equipment will normally be installed and maintained by Air Formation Signals; this responsibility is, however, without prejudice to the R.A.F. installing and maintaining when such an arrangement is more convenient.

3. Staffing of landline equipment at:—

(a) *H.Qs. of R.A.F. Wings, Groups, higher formations and at Signals Centres*

(i) All telegraph equipment, operational and otherwise, will be staffed by Air Formation Signals.

(ii) All operational landline equipment, other than telegraph equipment, will be staffed by the R.A.F.

(iii) All other landline equipment will be staffed by Air Formation Signals.

(b) *All other H.Qs. of R.A.F. formations and units*

(i) Air Formation Signals will staff such telegraph equipment as is provided.

(ii) All other landline equipment will be staffed by the R.A.F.

4. Provision of landlines:—

(a) *Main Trunk Junction and Point to Point Circuits*

The responsibility for providing or arranging provision of these circuits rests with Air Formation Signals.

(b) *Airfield Circuits*

The responsibility for laying these circuits rests with the R.A.F., with such assistance as Air Formation Signals can provide. Where multi-core cabling is involved Air Formation Signals will undertake responsibility.

(c) *Circuits for the Remote Operation of Wireless Transmitters*

The responsibility for laying these circuits rests with Air Formation Signals where distances are in excess of the length of cable supplied for the purpose by the R.A.F.

(d) *Local Subscribers' Circuits*

Subscribers' extension circuits will be provided by the Service installing the associated switchboard.

5. Provision of despatch rider services:—

The provision of all despatch rider services required by the R.A.F. in the field will be the responsibility of Air Formation Signals with such assistance as the R.A.F. can provide.



6. Organisation and control of combined signals traffic offices:—

Combined signals traffic offices will be established in all cases where the R.A.F. and Air Formation Signals have joint responsibilities. The responsibility for organising and controlling such offices rests with the R.A.F.

*Notes*

Air Formation Signals will be responsible for the operation and control of telegraph, telephone (Admin. switchboard) and despatch rider arrangements.

'Operational landline equipment' is defined as follows:—

'Landline equipment and internal cable installed in an operation or filter room (static or mobile) or provided specially for the termination of operational circuits.'

- (a) R.A.F. formations and units will be despatched overseas complete with the equipment detailed in their War Equipment Schedules. Any further requirements of landline equipment for which the R.A.F. is responsible will be demanded through the local R.A.F. Equipment Officer by the R.A.F. Signals Officer concerned.
- (b) Maintenance spares required by Air Formation Signals for equipment supplied through R.A.F. channels will be similarly demanded.
- (c) Any hastening action necessary in respect of equipment or spares demanded through R.A.F. equipment sources will be taken through the same channels.

APPENDIX No. 13

INTER-SERVICE RADIO COUNTERMEASURES AND JAMMING COMMITTEE

*Terms of reference :—*

1. Review from time to time the radio countermeasures in operation in the three Services at home and overseas in order to determine what modifications, if any, were desirable.
2. Prepare rules governing the operation of radio countermeasures when such rules were deemed by the committee to be desirable.
3. Consider all proposals for the institution of new radio countermeasures by any of the three Services before such proposals were put into effect and advise whether such proposals should be implemented and if so the nature and extent of any restrictions that should be imposed.
4. When radio countermeasures were decided upon allocate the tasks between the three Services.
5. Initiate and co-ordinate experimental work relating to radio countermeasures to be carried out by the three Services.
6. Determine whether any proposed experimental radio countermeasures were likely to be overheard by the enemy and decide, before any such proposals were put into effect, what restrictions would be necessary in the interests of security.
7. Co-ordinate the allocation of equipment for radio countermeasures between the three Services, for use at home and overseas.
8. Recommend the allocation of British equipment for radio countermeasures required by Dominion or Allied authorities, referring to the Radio Policy Sub-Committee for confirmation and priority rulings when such allocations interfered with those under 7.

9. Maintain liaison with Dominion and Allied authorities on questions of radio countermeasures policy and the provision of apparatus for radio countermeasures.
10. Estimate future requirements of equipment for radio countermeasures.
11. Collect information on existing or planned radio countermeasures in all theatres of British, Dominion and Allied operations.
12. Determine probable future personnel requirements for radio countermeasures programmes and advise upon the provision and training of such personnel.
13. Refer to the W/T Board for their agreement with proposals for the allocation of all frequencies required for the purpose of radio countermeasures.
14. Maintain liaison with the W/T Board, the R.D.F. Board, the R.D.F. Technical Committee and the R.C.M. Supplies and Material Committee.

**Note**

The term 'radio countermeasures' was taken to include all countermeasures designed to reduce the effectiveness of enemy radio aids to navigation and bombing, enemy R.D.F., enemy communications and any other enemy radio transmissions.

APPENDIX No. 14

SIGNALS TRADES AND STRENGTHS ON 1 DECEMBER 1942

**Wireless and Radar Maintenance Groups**

Wireless Operator Mechanic R.A.F.	6,814
Wireless Mechanic R.A.F.	11,696
Wireless Mechanic W.A.A.F.	12
Radar Mechanic R.A.F.	1,115
Radar Mechanic (Air) R.A.F.	3,811
Radar Mechanic (Ground) R.A.F.	4,513
Radar Mechanic (Ground) W.A.A.F.	12

**Wireless and Radar Communications Groups**

Wireless Operators R.A.F.	28,194
Wireless Operators W.A.A.F.	1,593
Wireless Operators W.A.A.F. (Slip Reader)	206
Wireless Operators (D/F) R.A.F.	3,551
Radar Operators (Ground) R.A.F.	5,734
Radar Operators (Ground) W.A.A.F.	2,258
Radar Operators (I) R.A.F.	480
Radar Operators (I) W.A.A.F.	701
R/T Operators (incl. D/F) R.A.F.	4,760
R/T Operators (incl. D/F) W.A.A.F.	1,383
R/T Operators (Balloon) R.A.F.	285
R/T Operators (Balloon) W.A.A.F.	2
Teleprinter Operators R.A.F.	1,951
Teleprinter Operators W.A.A.F.	4,007
Telephonist R.A.F.	2,852
Telephonist W.A.A.F.	4,036

Requirements generally were in excess of strengths.

APPENDIX No. 15

EDUCATION STANDARDS AND SPECIFIED QUALIFICATIONS FOR PERSONNEL IN THE SIGNALS TRADES (DECEMBER 1944)

<u>Trade</u>	<u>Educational Standard</u>	<u>Details of Courses</u>
High-speed Telegraphist, Group I, R.A.F. and W.A.A.F.	Recruited from Wireless Operators.	Basic Wireless Operator Course followed by 26 weeks Course in the operation and minor maintenance of automatic high-speed wireless telegraph equipment.
Radar Mechanic (Air), Group I, R.A.F. and W.A.A.F.	Elementary education and a bent for wireless mechanics.	Initial training of 24 weeks at a Technical College in basic theory and practice followed by an advanced Radar Mechanic Course of 10 weeks at an R.A.F. Radio School on specialist equipment.
Radar Mechanic (Ground) Group I, R.A.F. and W.A.A.F.	do.	do.
Wireless Mechanic, Group I, R.A.F. and W.A.A.F.	do.	Initial training of 24 weeks at a Technical College in basic theory and practice, followed by a 16 weeks Course at an R.A.F. Radio School on communications and equipment.
Wireless Operator Mechanic, Group I, R.A.F. and W.A.A.F.	Recruited from Wireless Operators.	Basic Wireless Operator Course followed by a 25 weeks Course at an R.A.F. Radio School to achieve the 'Mechanic' qualification.
Wireless and Electrical Mechanic, Group I, R.A.F. only.	This trade had become obsolescent. The qualifications had been similar to Wireless Operator Mechanic with knowledge of the Electrician trade in place of Morse operating.	
Radar Operator, Group II, R.A.F. and W.A.A.F.	Candidates had to be above average intelligence and of undoubted integrity, and not likely to become flurried under pressure of work. Technical knowledge was not essential but elementary knowledge of radio was an asset.	A six weeks Course at an R.A.F. Radio School in interpreting displays on cathode ray tubes, followed by six months experience before being finally approved.

APPENDIX No. 15 (2)

<u>Trade</u>	<u>Educational Standard</u>	<u>Details of Courses</u>
R/T Operator, Group II and IV, R.A.F. and W.A.A.F.	Candidates were required to be intelligent and of good education but not necessarily possessing technical knowledge. They were required to have good speaking voices, preference being given to those with experience of microphone or telephone speaking.	Ten weeks training at an R.A.F. Radio School to achieve Group IV status. Candidates were then mustered to Group III at their units when they achieved the necessary qualifications.
Teleprinter Operator, Group IV, R.A.F. and W.A.A.F.	Preference given to civil teleprinter operators or typists, but not essential. They were of the clerk type of personnel, of undoubted integrity.	A ten weeks Course at an R.A.F. Radio School.
Telephonists, R.A.F. and W.A.A.F.	Elementary education sufficient but ability to write quickly and legibly an asset. Clear diction and quick wittedness were required.	Two weeks training in Post Office Telephone Exchanges, followed by one month's experience on an R.A.F. station telephone exchange switchboard.
Wireless Operator, Group II, R.A.F. and W.A.A.F.	Elementary education sufficient but ability to write legibly and spell correctly essential.	26 weeks Course at an R.A.F. Radio School.
W/T (Slip Reader) Operator, Group II, R.A.F. and W.A.A.F.	Recruited from Wireless Operators.	Basic Wireless Operator Course of 26 weeks, followed by a 26 weeks Course in high-speed automatic operating at an R.A.F. Radio School.

(A.M. File S.75175/2)