

DEVELOPMENTS IN AIR DEFENCE 1945 – 1970

Introduction

Fighter operations in two world wars, mock air battles and aerobatic displays in peacetime supplemented by a steady diet of factual and fictitious experiences in print and beloved by the mass entertainment industry has helped the public form its own idea of the fighter role in peace and war. Portrayal of the qualities required in the men who fly them have not always been accurate. The picture ranges from canvas wire and wood biplanes flown by leather-coated intrepid aviators desperately fighting above the battlefields of Flanders, to impressions of men in flying suits at the controls of a metal monster hurtling vertically towards the stratosphere at supersonic speed. Between, perhaps, is a recollection of vapour trails etched across the sky, symbolic of the aerial battles over Southern England in the summer of 1940.

Any of these pictures might be a fair portrayal of events at the appropriate time. Without doubt the qualities of courage, determination, disregard of risks and acceptance of the hazards that attend aerial combat will always be required in generous measure from RAF aircrew. But men and aircraft are like the eyes and arm of the warrior who wields a sword. Their effectiveness however, also depends on the skill and talents of those who helped design and forge the blade. The heroism and skill of the Battle of Britain pilots would have been of no avail without the control of radar reporting system evolved prior to 1939 and now developed into the sophisticated radars of the 1970s.

This chapter looks briefly at 1914-45 developments before examining in detail what has occurred in the 25 years after World War II. Ground attack operations are covered elsewhere. The struggle by the defences to match the speed developments in aircraft and weapons has become more intense as ground launched missiles develop. The financial and material costs of re-armament programmes launched since 1948 have been enormous and the position has not been improved by the speed of technical and scientific advance making it necessary to revise – or even abandon projects outdated by events.

But scientific advance has not meant the demise of the manned fighter despite pronouncements to the contrary. The doctrine of flexible response adopted after 1967 revived its declining fortunes. It is still an integral part of the defence system – and likely to remain so in the foreseeable future.

AIR DEFENCE 1914 – 1945

Air Defence 1914 – 1918

Until 21 December 1914, when a German aircraft dropped a bomb into Dover harbour the problem of defending Britain against attack had been two dimensional. A new and potentially decisive element foreshadowed 3 years earlier when small bombs made from grenades were dropped on Turkish troops from Italian aircraft – had come into warfare. Attacks by Zeppelins and aircraft gave the impetus to improving the primitive system of air defence that existed at the beginning of the War. When hostilities came to an end in November 1918 it had developed into an effective centrally controlled organisation involving co-ordinated action by aircraft, searchlights and guns, a chain of observer posts

and an early warning system utilising the public telephone network¹. The London Air Defence Area covered much more of the country than its name implied; it was, in fact, a prototype of the system used by the RAF with conspicuous success in World War II with the difference that sound locators were used in 1914-18 and radar stations in 1939-45.

Organisation of Air Defence 1919-1936

Demobilisation and cutbacks after the armistice so pruned Britain's defences – then primarily the concern of the War Office although the Air Force was responsible for providing fighter squadrons – that by 1921 not a gun or searchlight was deployed for the defence of London, and not one fighter squadron was specifically assigned to air defence². However, in 1922 when responsibility for air defence was transferred from the War Office to the Air Ministry the Government accepted a scheme for the provision of a Metropolitan Air Force of 14 bomber and 9 fighter squadrons. The following year another expansion scheme was adopted, designed to provide 52 Squadrons, 17 of which were fighter squadrons (204 aircraft).

Main feature of the air defence plan was the Aircraft Fighting Zone a strip of country about 15 miles wide and 150 miles long stretching from Duxford round the East and South of London to Devizes, illuminated by searchlights for night fighting and divided into ten sectors, each manned by one or more fighter squadrons. Along the forward (Eastern and Southern) edge of the sectors was the Outer Artillery Zone. London was defended by a ring of anti-aircraft guns and searchlights. The size of the gap between the aircraft fighting zone and the coast was dictated by the time taken by fighters to reach combat height – estimated at 14000 feet – and the time it took between bombers crossing the coast and reaching the fighting zone. Warning of approaching raids was given by sound locators on the coast and a chain of observation posts. Defending forces were controlled by HQ Fighting Zone, a subordinate command of the Air Defence of Great Britain. Fighters were directed through operations rooms at HQ Fighting Zone and the principal airfield in each sector. The introduction of reliable radio-telephone communications between controllers and pilots from about 1933 was a great step forward³.

Rearmament 1934-39

Political decisions influenced by a difficult economic situation slowed down the rate of expansion. Thus in 1932, when the assumption that there would be no war involving the British Empire for at least 10 years was deemed to be no longer tenable, about 80% of the planned bomber and fighter squadrons had been formed but only about 30% of the guns and searchlights were available. Successive expansion schemes adopted from 1934 onwards; the creation of Fighter Command in 1936; re-orientation and expansion of the air defence system to take account of the emerging German threat; technical advances in airframe, engine and armament design and the introduction of radar; these factors had a dramatic effect on the RAF. By 1939, with some exceptions (mainly overseas), it was a force of monoplanes. The decision to standardise on eight gun armament for fighters – capable of over 300mph at 19,000 feet on the outbreak of war – coupled with the adoption of radar ground controlled interception techniques contributed largely to the preparedness of air defence in time for the Battle of Britain.

¹ The Home Defence Establishment at the close of hostilities included 16 Sqns of fighter aircraft, 480 anti-aircraft guns and 706 searchlights (Defence of the United Kingdom – Basil Collier, Chapter I (ii).

² Ibid

³ The first use of RT to direct movements of Home Defence aircraft occurred in June 1918.

Growth of Fighter Aircraft 1939-1945

At the outbreak of war Fighter Command had a front line strength of 39 Squadrons⁴ of which 26 were equipped with Spitfires or Hurricanes. There were five squadrons of obsolescent Gladiators in the Middle East and no fighters at all in the Far East. By May 1945 there were 2,795 fighters in 160 operational squadrons available worldwide for air defence.

Aircraft and Weapon Development

With the exception of the development of the jet engine 1939-1945 advances in RAF aircraft were due not so much to changes in basic design philosophy as to progressive increases in the power of engines and constant improvements in equipment and operational techniques. Piston engined fighters were reaching the limit of their development in 1945; the first jet fighters – Meteors and ME262s – and German missiles (V1 and V2s) were pointing the way ominously to the future.

Developments in Control and Reporting

The invention of radar in 1935 provided a new method of air and ground detection of aircraft. Radio communication, in conjunction with radar provided the means of fighter control and the whole organisation depended on an elaborate and extensive land line communication system. This was expensive in terms of manpower and required a considerable number of radar stations – over 250 were built in Britain alone – to provide cover at all altitudes. The development of this system is described in detail elsewhere⁵ and the importance of the control and reporting organisation can hardly be over-emphasised as the World War II attacks on air defence radars and associated centres of communication and control show. Later, technical advances enabled many radar stations – particularly overseas – to assume a dual function of early warning and fighter control. Thus the changeover from a network of dispersed ground stations to a master control radar station, combining the functions of early warning and fighter control was achieved – albeit on a limited scale – before hostilities ended.

Under the Stage II plan for the re-organisation and contraction of Fighter Command during the period between the defeat of Germany and surrender of Japan⁶ known as Stage II a force of 4 long, 16 short range day and 6 night fighter squadrons deployed in three Groups (Nos. 11, 12 and 13) were to be formed in the United Kingdom as a strategic reserve. The Command was responsible for producing trained fighter aircrews as replacements for squadrons in the Far East, Europe and Britain. Tactical and technical developments of fighter aircraft and associated air and ground equipment were to continue and plans for the post war structure of Fighter Command developed. To discharge these tasks the United Kingdom was divided into a “Defended Area” – broadly the country east and south of a line joining Cape Wrath, Banbury and St. David’s – in which the squadrons would be stationed and essential installations, equipment and communications maintained in operational condition. The remainder of the United Kingdom and Northern Ireland was a “Shadow Area” where only a defence framework existed. After the capitulation of Japan, the

⁴ About 608 aircraft and including the four squadrons allocated to the Advance Air Striking Force in France (Defence of the United Kingdom Chapter 5 (i)).

⁵ AP1063 Signals Volume 1, Radar in Raid Reporting

AP1116 Signals Volume V, Fighter Control and Interception

⁶ Outline Plan Fighter Command FC/S.40695/Plans dated 12 July 1945.

Command's operational responsibility came to an end; thereafter efforts were concentrated on a progressive and orderly peacetime re-organisation.

Post War Contraction

Of the eight Groups in the Command in May 1945 only two, Nos. 11 and 12, were retained on full status. These Groups took over the functions of Nos. 10, 13 and 70 (Training) Groups which were disbanded by May 1946. No. 38 Airborne Forces Group was transferred to Transport Command in July 1945 and No. 60 (Signals) Group amalgamated with No. 26 Group to form No. 90 (Signals) Group in April 1946. No. 88 Group, formed within the Command on 7 May 1945 to establish an air force presence in Norway on the collapse of German resistance, was disbanded on 31 December 1945. During 1946 there was a gradual reduction in the size of the area over which the C & R system was maintained and it eventually became concentrated into a Training Area extending coastwise from Portland Bill to Flamborough Head and inland as far as the old Defended Area boundary. By December 1946, Fighter Command's front line strength had been reduced to 192 aircraft in 18 day and 6 night fighter squadrons all on cadre establishment.⁷

The operational squadrons were in 11 Group (Southern and Metropolitan Sectors) and 12 Group (Yorkshire and Eastern Sectors); most of the training establishments including the Central Fighter Establishment (CFE) were in No. 12 Group. There were two anti-aircraft co-operation (AAC) squadrons in each of the Groups and an AOP squadron in No. 12 Group.

A comparable reduction took place abroad. In BAFO (Germany) by 1 January 1947 the establishment of fighter aircraft in the air defence role had been reduced to five squadrons (78 aircraft), in RAF Mediterranean/Middle East (MEDME) one squadron (16 aircraft) – with another squadron (8 aircraft) designated for fighter operations but employed in the light bomber role in reserve – and in Air Command Far East (ACFE)⁸ only one squadron (8 aircraft).

Post War Role of Fighter Command 1946-49

An interim directive⁹ issued by Air Ministry to the Air Officer Commander-in-Chief Fighter Command on 1 November 1946 said that for the next two years the Command should concentrate on research and experiment in air defence as first priority – meanwhile disposing its available resources so that, in conjunction with AA Command, air defence was provided for the maximum areas which could be manned effectively. Stress was laid on attaining the highest possible interception rate by day and night irrespective of weather; on raid reporting and fighter control organisation and standardisation of operational and training techniques to permit rapid reinforcement of the Command in an emergency by fighter squadrons from Germany. CFE was to be responsible for tactical development in offensive air support but BAFO (Germany) for development and training in the role.

⁷ For strength of aircraft by squadrons see Appendix

⁸ Weekly State of Operational Aircraft in Home Commands and BAFO September – December 1946.
MEDME Orbat September 1946 – January 1947

ACFE Orbat September 1946 – January 1947

⁹ Air Ministry letter C28599/45 D of Ops dated 1 December 1946

Operational Fighter Aircraft 1945-1950

Since the end of hostilities Fighter Command had been re-equipping with jet aircraft; all the long-range American built Mustangs were withdrawn by March 1946 although some remained in service with Polish squadrons until the end of that year. Three day fighter squadrons had been re-equipped with Tempests after hostilities ended in Europe but they were re-armed by June 1946, as were other squadrons, with either Meteors or Vampires. The six squadron night fighter force had Mosquito XXXVs.

By January 1947 out of 18 front line day fighter squadrons 13 were equipped with jets, four had Hornets and one Spitfires. The Air Ministry had announced on 2 June 1946 that this force would later be supplemented by 13 day and 3 night fighter squadrons of the reformed Auxiliary Air Force (Aux AF) equipped with either Spitfires or Mosquitoes.¹⁰ Later this number was increased to 20 with the transfer of the four Aux AF light bomber squadrons to the fighter role.¹¹ These squadrons came under the control of a new formation called Reserve Command but were not transferred to Fighter Command until 1 Nov. 49.

The day fighter squadrons in Germany operated Tempests and night fighter defence was provided by a detachment of Mosquitos from the United Kingdom; there was a Spitfire squadron in Malta and another in the Far East. (Fighter aircraft in Palestine were employed mainly for ground attack and reconnaissance as were those in India and Japan). The air defence of the Middle East was however, reinforced in April 1947 by a monthly detachment flight of six Hornets from Fighter Command. These flights provided good training in long-range flying and it was planned to extend them further afield as the aircraft were developed.

By 1947 Fighter Command had the most modern operational types produced by the British aircraft industry, but in the cases of jets they were powered by engines which had out stripped airframe design. This meant that although the jet engine was producing power to go very fast indeed, supersonic flight could not be achieved without an airframe of a different aerodynamic shape. Higher speeds too posed additional problems in gunnery and weapons technology. Front line fighters in the late 1940's were armed with guns and cannon¹² which although effective enough in air defence in World War II were unlikely to be so for much longer. The development of a new offensive weapon – the guided missile – was to be a lengthy process; it was not until 1958 that the first fully operational air-to-air missile came into RAF squadron service.

The High Speed Flight

The 1946 British decision that research into supersonic flight should be conducted by air launched models because the risks involved in manned flight were considered unacceptably great¹³, prevented Fighter Command from probing the sonic barrier but not from an assault on the world air speed record.

¹⁰ AMB No. 23188

¹¹ PUS of S for Air in House of Commons 3 December 1947. It was also planned to establish in what was now the R Aux AF a number of Air Defence Units (later known as Fighter Control and Radar Units) located throughout the United Kingdom. Their task would be to reinforce the fighter control and reporting system of any future war.

¹² Spitfire XVIII aircraft in squadron service in MEDME & ACFE were armed with 20mm cannon and 0.50 guns. The Sabre (1953-56) carried 6 x 0.50 guns.

¹³ The Supply of Military Aircraft (Cmd 9388) (February 1956).

The High Speed Flight was formed at RAF Tangmere on 14 June 1946 under the command of Group Captain E M Donaldson, with the object of raising the air speed record during the summer. Its other aims were to provide data for research into characteristics of high speed flight and studying relevant techniques. The existing record established by a jet had been set up by Group Captain H J Wilson in a Meteor IV at Herne Bay on 7 November 45 with a speed of 606.25 mph. Regulations required the speed runs to be made under 1,000 feet with a limited gain in height between runs and were the same as those governing the Schneider Trophy competitions of the 1920s and 30s.

It was soon realised that with the extra thrust available from special engines, airframe capabilities would be the limiting factor in the attempt on the record. Thus the likelihood of exceeding Mach.82 was remote because of compressibility¹⁴ - the term to be used to describe the breaking up of the airflow as sonic speeds are approached. This was dependent on a variety of conditions involving temperature and air density and the consequent effect on the speed of sound which is the determining factor.

The course off the coast near Littlehampton was easy to fly though subject to considerable bumpiness. Turns after completion of the timed runs proved the most difficult part, involving, as they did, a height limitation of 300 metres (about 1000 ft) while turning at high speed with 55-60 degrees of bank. Eight attempts were made on the record between 7 and 24 September 1946 in the hope that an average speed of over 1,000 kph would be recorded. Although this was not achieved the world's air speed record was raised to 616 mph (991 kph) at the first attempt. On the first timed run the aircraft reached its terminal velocity and remained fully compressed over the whole 12 miles of the course. During the flight a light drizzle developed along the course but four runs were completed successfully. The aircraft landed after 14 minutes flying using 208 gallons of fuel.¹⁵ All record attempts were characterised by terrific vibration, buffeting the aircraft becoming nearly uncontrollable as they reached their critical Mach Number. Such behaviour just above the sea was far from agreeable.

A considerable amount of scientific data was collected during three attempts and the team's final report went into considerable detail about the difficulties encountered. Significantly it stressed that the Meteor's cruising speed was over 80 mph faster than the top speeds of the most contemporary fighters; this factor would raise entirely new problems in the handling and employment of fighter aircraft. Such a situation had, in fact, been foreseen some two years before and the raid reporting and control organisation had already been the subject of a detailed study.¹⁶ Trials of a revised system were conducted by No. 11 Group under the code name Exercise 'Cherry'.¹⁷

Re-organisation of the Raid Reporting System

Towards the end of the war the AOC-in-Chief Fighter Command made certain broad recommendations to Air Ministry for improving the raid reporting organisation in particular, advocating that the radar and observer systems should be merged into an RAF organisation. Air Ministry were not, however, prepared to support – or oppose – the

¹⁴ In practice the limiting Mach No. proved to be about .81 at sea level.

¹⁵ Report on the Meteor IV High Speed Flight made in 1946 at Littlehampton (FC – S41498/Ops).

¹⁶ SD564 Memorandum Produced by HQFC on Raid Reporting and Control Aspects of the UK Air Defence Organisation – November 1945.

¹⁷ Trials of Certain Aspects of Revised Raid Reporting System in SW England – FC/S40458/Ops 2 dated 11 February 1946.

proposals, even in principle until satisfied that a detailed scheme based on them would work satisfactorily in practice.

The study, completed by November 1945 had taken more than a year to prepare. It covered future requirements for the reporting and control aspects of defence against aircraft and put forward an immediate plan (The Interim System) to implement the new requirements – as far as possible – with available equipment and facilities. A long term plan designed to incorporate the improvements in the Interim System, involving the deployment of new equipment for the acquisition transmission and display of information and the use of specially designed Sector C and R Centres was also advanced. Unlike the Interim System, which applied only to England and Wales, the Final System was designed to cover the whole of the United Kingdom.

The main factor affecting air defence, dictating the need for new defensive dispositions was the operational deployment of jet aircraft. Whereas the 1939-45 defences had to cope with bomber speeds of about 3 miles per minute, potential attackers were flying twice as fast and twice as high. Time lags, inaccuracies and duplication inherent in the Second World War system of raid reporting and fighter control was too slow and cumbersome for use post war future targets. Development of special radar installations or Ground Control Interception Stations (GCIs) which enabled a controller to work directly off a PPI¹⁸ and watch the exact relative positions of fighter and target overcame many problems and made precision interception practicable. However, experience in 1943-44 proved that no one Sector or radar control station could satisfactorily effect the interception of very high and fast enemy aircraft.¹⁹ The revised system was designed to streamline and simplify the C and R system by improving the quality of information at control points through co-ordinating data supplied by the Royal Observer Corps (ROC) and radar information at selected 'master' stations (MRSs). Sectors were reduced in number and enlarged. The master GCI in each Sector – or selected master GCI Station where there was more than one in a sector – was nominated as Sector Master Station. These stations had space for the Sector Controller and his staff who continued to be responsible over the Sector for the detection of threats, reaction to them, and for maintaining adequate fighter forces within the Sector. Interception Control could be exercised from either the combined SOC/GCI Station or another GCI station within the sector. Overall command still remained with HQFC Air Defence Operations Centre (ADOC).

Although Air Ministry approval was obtained in May 1945, trials at the four GCI Stations selected as MRSs (Sopley, Hope Cove, Treleaver and Wrafton) did not start until 21 March 1946 because of extensive structural and wiring alterations. The delay had repercussions. Comparatively untrained personnel had to be employed because of demobilisation and, due to communication difficulties in Europe as a whole, insufficient information on aircraft movements increased difficulties of identification. In April 1946 Wrafton and Treleaver had to be closed because of an increasing shortage of technical personnel but despite these difficulties by August 1946 the results of the trails clearly justified acceptance of the MRS principle for raid reporting and plans were drawn up to transfer²⁰ the four SOCs functioning in the Training Area, from their existing locations²¹ to selected MRS/GCI Stations at Sopley (Southern Sector), Trimley Heath (Metropolitan),

¹⁸ PPI – Plan Position Indicator

¹⁹ SD564 Part I. Appendix C.

²⁰ HQFC letter FC/S41463/Ops 2 dated 20 August 1946.

²¹ Southern Sector Nether Wallop (Stockbridge)
Metropolitan Blake Hall (Ongor)
Eastern Horsham St. Faith (Norwich)
Yorkshire Church Fenton (Tadcaster)

Neatishead (Eastern – amalgamated Norfolk and Lincolnshire Sectors) and Patrington (Yorkshire). This was the first step in a programme of continuous re-organisation and development designed to keep the C and R system in the UK and overseas at peak efficiency. Though there was as yet no obvious enemy threat to British interest, a chill wind was blowing from the East.

EXPANSION 1948 – 1953

Defence planning after the war was based on an assumption there would be no further conflict for at least 10 years. This assumption had the economic advantage of a slower rate of expenditure and making the maximum use of existing aircraft, equipment and weapons. This meant that the RAF would not be operating new front-line aircraft until about 1957. In the interim it was to use types of which large quantities existed plus limited numbers of new types that appeared during the war, the development of which was to continue.²² Furthermore, by 1948, the loss of a high percentage of trained personnel through demobilisation created very severe difficulties in the transitional period when the RAF was being re-organised as a peace-time force.²³ Against this background plus the blockade of Berlin and growing international tension, the Government announced its measures to strengthen the Defence Forces.

In September 1948 the House of Commons was told that production of the latest types of jet interceptor was to be doubled and reconditioning of older types of fighter accelerated. Air defences were to be improved with the introduction of new equipment and the overhaul of stocks of wartime material still of use with later types of aircraft. The key position of Air Defence units and fighter squadrons in the defence of Britain made it also important to bring the R Aux AF up to strength;²⁴ re-equipment of its squadrons with jet aircraft was to be completed as soon as possible. Overseas the re-arming of the DF/GA Tempest squadrons in BAFO with Vampire Is had already started and the two MEDME day fighter squadrons (Nos. 32 and 73 in Cyprus and Malta) were converting from Spitfires to Vampire IIIs. Air defences of the Delta²⁵ and Canal Zone, considered by the Commander-in-Chief's Committee to be extremely weak, were to be strengthened by formation of a night fighter squadron.²⁶

With the Meteor and Vampire already in service the RAF day fighter force was comparatively well placed for expansion but prospects for modernising the night fighter force were less promising. Wartime experience showed that two-seater night fighters were essential and a specification had been issued early in 1948 for an all weather jet aircraft to be in service as soon as possible.²⁷ If the night fighter force were to remain effective until

²² The Supply of Military Aircraft (Cmd 9388 Feb 1955).

²³ Air Estimates 1948-49.

²⁴ Hansard Vol. 456 14 and 23 September 1948

²⁵ Although British Forces withdrew into the Canal Zone in 1947 there were still Treaty commitments to Egypt under the Anglo-Egyptian Treaty of 1936.

²⁶ CAS File Air 8/1602. No. 324 Mobile Fighter Wing (6 and 213 Sqns (Tempest 6)), 39 LB Sqn (Tempest 6) and 205 FR Sqn (Spitfire 18) were committed in the event of a major outbreak of hostilities to operations in support of the land forces. In December 1948 a joint fighter/AA operations room was set up by HQ 205 Gp to co-ordinate the air defence of the Canal Zone against a threat from the small Israeli Air Force in the event of the RAF being embroiled in fighting between Jewish and Arab forces (HQ 205 Gp Cp Order 26/48). In this event some of the DF/GA sqns would be employed predominantly in the air defence role. It was considered there was no threat from Arab airforces – if only because of our Treaties with Jordan and Egypt.

²⁷ Spec 4/48 called for a two-seat all weather fighter and the contract for the production of the design (subsequently called the Javelin) was issued in 1952. Development difficulties delayed its introduction to squadron service until February 1956.

such a type came into service a stop-gap would have to be introduced and it was decided to proceed with a night fighter version of the Meteor.

By coincidence, a test of the efficiency of the Air Defence System in Britain had recently taken place in Exercise DAGGER (3-5 September 1948) when the control and reporting machinery not used as a whole since 1945, regular and auxiliary squadrons, fighter control and ROC Units and the Territorial and Regular elements of AA Command were brought to readiness to counter attacks by bomber, maritime, training, Germany based and USAF aircraft on targets in south east England. The weather provided suitable testing conditions but although there was a lot of cloud and rain and visibility was generally poor, at no time were the aircraft grounded. USAF B 29 Super Fortresses were intercepted at 33,000 ft by jet fighters and Spitfires were able to carry out attacks at 29,000 ft. Despite the success of radio counter measures adopted by these attacking forces the rate of interception, particularly before the attacking aircraft had crossed the coast was satisfactory; Auxiliary Squadrons, operating under war conditions for the first time since 1945 – achieved results comparable with the RAF Squadrons.

Encouraging as the results were in this relatively short exercise, the perennial shortage of man power prevented the forces involved from operating continuously throughout the period and a 10 hour stand down was imposed halfway through the exercise. Facilities provided by the reorganised C and R system were found to need further modification and plans were made to improve operational flexibility by bringing some of the master GCI stations up to the standard of Sector Operations Centres (SOCs) so that both types of control centre could undertake similar tasks. Work was completed by 1949 and the modifications worked well in two major air defence exercises soon afterwards. These two exercises were also the first occasions when personnel of Western Union Air Forces participated in a major RAF exercise. In FOIL (23 June – 3 July 49) the Dutch sent a Meteor 4 squadron to Thorney Island and both Dutch and Belgian ground personnel were integrated into the C & R organisation. Dutch, Belgian and French squadrons supported by more C and R personnel formed part of the defending forces in BULLDOG (23 – 26 September 49). In the latter exercise the South Western Sector operations room was manned almost entirely by volunteers from the FCUs of the R Aux AF and the C & R system reinforced by personnel drawn from 22 of the 26 FCUs. By now the scope of these exercises was being steadily widened. To provide experience in intercepting high speed, high flying aircraft some Meteors operated as bombers.

The tempo of events began to quicken as the measures to strengthen the Armed Forces announced by the Government in September 48 began to take effect. A new Directive issued by the Air Ministry to the AOC-in-C Fighter Command in August 49, reflected the urgency of the situation. In contrast to the previous one which was concerned with research and experiment in air defence and the defence of the maximum area of the United Kingdom which could be manned effectively, the new directive stated unequivocally that the Command's operational commitment was the defence of the United Kingdom against air attack.²⁸ In a series of moves to strengthen the Command and bring all components of the active air defence in the United Kingdom under operational control of Fighter Command²⁹ the early warning radars which had been placed in 90 (Signals) Group after the war, were re-absorbed into the Command as were the reserve and auxiliary

²⁸ Directives to AOC in C Fighter Command G/240075/IF/8/49/60 dated 17 August 49 and G254140/IF/12/49/60 dated 8 December 49.

²⁹ The formal request for the transfer of all active regular and auxiliary elements of the air defence in the UK to the control of the AOC-in-C Fighter Command was made in HQFC letter FC/S42126 C-in-C dated 6 June 49.

control and reporting units.³⁰ The R Aux AF squadrons all of which were now considered to have reached a sufficient standard of operational training to take their place in front line units,³¹ were transferred from Reserve to Fighter Command on 1 November 49 and the Royal Observer Corps from direct Ministry control on 1 March 50. In July 1950 the readiness state of the Command was brought to a higher pitch when a number of aircraft were put on armed alert to intercept unidentified aircraft approaching British air space.³² The timing of this action was significant coming as it did when international tension was rising after the invasion of South Korea on 25 June 50. On 27 July 50 the Ministry of Defence revealed alarming figures on the estimated strength of the Soviet Armed Forces whose airpower was calculated at 19,000 aircraft, including jet fighters and long-range bombers. On 3 August the British three year defence plan was announced.³³

There was little that could be done about strengthening the front line until production of aircraft built up but by early 1951 Fighter Command's regular day fighter strength had been doubled and all squadrons had been equipped with jets.³⁴ In November 1951, fighter strength in Great Britain was further increased with the arrival of an RCAF Sabre Wing at North Luffenham where they remained until April 1955. By then Vampires were being phased out of service in the United Kingdom being replaced in the front line by Meteor 8s. This new mark fitted with an ejector seat had better range and performance than its predecessors but the RAF still awaited a swept wing fighter – at that time only available from the United States.

In BAFO the DF/GA squadrons had been re-armed with Vampire Vs which were also in service in the Middle and Far East; their delivery to FEAF involved a flight of 8,500 miles and was the longest jet delivery flight by any airforce to date (for strength of aircraft by squadrons see Appendix). This flight was another noteworthy first for the RAF who in July 1948 made the first jet crossing of the North Atlantic when Vampires of No. 54 Squadron flew to Canada and the United States via Iceland and Greenland.

Introduction of the Sabre (F86E)

The growing number of Russian fighter aircraft in Eastern Europe and the introduction of increasing numbers of the MIG 15 was viewed by Britain and her NATO allies with mounting concern particularly as the performance of the types in service with Western European airforces was inferior to that of the MIG 15. In 1950 it was thought that in about three years suitable fighters would have been developed in Europe and be in production, but the immediate problem was to meet the situation which would arise in the event of war within that period.³⁵

It was appreciated that if hostilities occurred during the 1953-56 period the Russian medium bomber force – probably jet-equipped from about 1954 – would be largely engaged in attacking the United Kingdom, but tactical bombers would not be available to attack targets in Britain until after a stalemate was reached in the land campaign, probably

³⁰ CH, CHLs and CHELs stations (raid reporting units) in the Development Area were transferred from 90 Group to HQFC on 1 December 49 but 90 Group retained responsibility for 3rd and 4th line servicing and major overhauls (HQFC Adm Inst. 21/49 dated 24 November 49). The R Aux FCUs transferred from Home Command on 1 November 50 (Reserve Command renamed Home Command 1 August 50).

³¹ HQFC Admin Inst 18/49 dated 25 October 49 & Memo by S of S for Air (Feb 50).

³² ID9/900/2/Pt 2 VCAS 2370 dated 27 Oct 55.

³³ The plan costing £3600m later increased to £4700m was the largest peacetime defence expenditure in British history up to that date.

³⁴ The completion of rearming the R Aux F squadrons with jet aircraft was announced in the 1952 Air Estimates.

³⁵ ID3/940/3 Pt 1 WERPG 30 Nov 50.

on the Rhine. Whether the Russians reached the Channel coast or were held on the Rhine, it was assumed that UK based air defences would have to meet Russian short range fighters.³⁶

In October 1950 the Air Ministry began to examine the question of obtaining F-86E (Sabre) aircraft as a short range day fighter and the Canadian CF100 which was thought might meet RAF requirements for a high performance all weather fighter under Spec 4/48. In the event the plan to obtain CF100s was abandoned at an early stage because of financial limitations under the Mutual Defence Aid Programme and the aircraft would not come into service much before a projected British all-weather fighter in 1954. Although there were disadvantages in introducing an interim type it was decided after preliminary F-86 trials at CFE to negotiate for 395 of these,³⁷ sufficient to equip six squadrons (22 per squadron) (with a war reserve) in 2 TAF as part of our contribution to NATO. Subsequently the number of squadrons was increased to 10.³⁸

Canadair built the airframes under licence and assembled the complete aircraft with engines and other equipment supplied by America. It was originally hoped some F86s would be available in 1951, but because of supply problems caused by expansion the Sabres did not become available until late 1952. They were ferried across the Atlantic by RAF pilots in Operation 'Beechers Brook' which lasted from December 1952 to December 1953 and equipped the first swept-wing fighter squadrons in the RAF (Nos. 6, 67 and 71 at Wildenrath) between March and May 1953. Fighter Command got its first Sabres with the formation of No. 66 Squadron at Linton-on-Ouse in December 1953.

Despite some criticism at the time it was a wise decision to introduce the Sabre as a stop gap pending the advent of British swept-wing fighters. It gave the RAF squadrons in Germany an aircraft in the 700 mph class at a critical period when East-West relations were tense. Hunters – the first successful British swept-wing fighter did not arrive in NW Europe until the spring of 1955.³⁹ By the end of June 1956 they had superseded the Sabres which were withdrawn from service.

The Rotor Plan

While plans to re-equip and form new fighter squadrons were being put into effect, other arrangements were being made to ensure that the capability of the C&R system matched the growing strength of Fighter Command and interceptor squadrons overseas. In 1949 control stations in the C&R system at home and overseas were still very largely dependent on equipment designed and installed in 1941. An operational requirement had recently been issued to provide a new air defence ground radar with increased early warning and control cover to help counter the development of high speed altitude aircraft. A detection range of about 260 miles was specified with accurate position and height finding and a considerable degree of automation in the correlation and display of information. Other equipment termed a 'radar link' was to be developed so that information could be fed back from a radar head, thus allowing the early warning, position and height finding scanners to be sited remotely – such dispersal reducing the system's vulnerability.

³⁶ DD13/TS/3/2/Air dated 14 Feb 52.

³⁷ Subsequently only 370 were authorised under MDAP arrangements. In December 1952 another 60 F84Es were made available, and, following a change in American policy regarding the supply of interceptor aircraft to European governments these F86s were allocated to Fighter Command to equip two squadrons at 22 UE. (1D/53/1/67 Pt 2 – CMS/858/51 dated 26 Feb 53, 11/127/3/4 – 1/5663/CMS/1831 dated 19 Nov 52 and TD3/940/3/Pt 2 – CAS 379 27 Feb 53).

³⁸ 1D3/940/3/Pt 1, CMS 1858/51 and 1858/51 dated 23 and 25 Jan 53 respectively.

³⁹ The Supermarine Swift entered service a few months before the Hunter but was not successful.

There were no insuperable problems in developing equipment to meet the new standards but as this would take some years it was essential to improve the performance of existing radars without fundamental redesign.⁴⁰

Existing radar cover on the East and South coast of Britain also had to be improved and extended to certain vulnerable locations outside the main Defended Area. This expansion programme took place under the Rotor Plan of 1950 and was directed towards having the improved C&R facilities manned and operational by mid 1953 at latest. Basically it involved improving the reliability of radar installations by making servicing easier; improving overall cover by duplicating stations, reducing vulnerability by going underground and improving readiness by manning additional watches with regular personnel.

It was considerable undertaking involving amongst other projects the emergency rehabilitation of 28 CH⁴¹ stations to provide a measure of early warning cover in advance of the main programme. Sector Operations Centres were moved from the master GCIs and three new centres constructed underground to supplement three existing ones. Nine GCI operations rooms adjacent to the East and South coasts were also put underground. Such was the importance of reactivation and extension of the C&R system that in March 1951 the Ministry of Defence stated that the programme had a higher priority than the provision of aircraft and that by some means or other the work had to be completed on time. A fifth fighter sector had already been established in Scotland to control the A Aux AF squadrons there and in Ulster when they became part of Fighter Command on 1 November 1949. In an emergency it was planned to open a sixth (Western) Sector.⁴² There were also moves to integrate the Western European air defences with those of the United Kingdom but as yet there was no link between the British and Continental C&R systems. Thus until the first stage of the resuscitation, modification and expansion programme could be completed in mid 1953 the country would be extremely vulnerable to air attack; subsequently the defences would rapidly improve. An Air Defence Operations Centre (ADOC) was also formed at HQFC in 1953 to provide the AD Commander with a battle centre from which he could direct air defence operations in war. Information about the air situation over the country as a whole enabled him to make changes in the disposition of his squadrons between sectors, thus increasing the force's flexibility.

Despite special measures the original time-table for Rotor was found to be unrealistic and it was not until 1954 that the first phase of the extension and modernisation of the United Kingdom radar network was largely complete. Seventy one radar stations were required to give complete cover to the United Kingdom. Because of the great dependence of nearly all elements of the air defences on Auxiliaries and Reserves and a shortage of trained serving personnel the C&R system was not manned continuously; 49 stations were on part-time operation and the remaining 22 were only at readiness (not operational in peacetime).⁴³ By February 1956 it was possible to mount continuous control and reporting coverage from a Type 80 station in East Anglia. At the same time the night/all weather fighter squadrons were incorporated into the quick reaction alert force ensuring there were

⁴⁰ ID9/99/3/Pt 1.

⁴¹ Chain Home

⁴² Western Sector was subsequently established on a non-operational basis on 15 Dec 50. It became operational in January 1952.

⁴³ Periodic Report to Chiefs of Staff on the State of Air Defence of the United Kingdom in September 1953 by Air Defence Commander (COS(53)506) Pt II 9 October 1953 (ID9/900/1/Pt 2).

some aircraft at various degrees of readiness throughout the 24 hours to investigate unidentified approaches to UK airspace.

Concurrently with Rotor another programme (Vast) was instituted to procure mobile and static radars for overseas commands. These equipments too were affected by development and manufacturing delays and it was the end of 1954 before the first mobile radar destined for 2 TAF was assembled. By then new equipment such as the American FPS3 long-range early warning radar supplied under the MDA Programme and British Type 80 were becoming available. These radars gave an increase in cover well beyond that provided by equipment re-engineered under the Rotor Plan.

Their significant improvement in range control and discrimination indicated it might prove possible to reduce the number of C&R stations, while producing better results. This was not the first time that fulfilment of operational plans had been overtaken by technical advance. As the rate of development accelerated, increasing numbers of plans — particularly for air defence — had to be modified or abandoned before completion. Even before the February 1955⁴⁴ announcement that Fighter Command expansion was complete⁴⁵ (except that the proportion of all weather fighters would grow) an appreciation of the air threat to the United Kingdom from 1960 envisaged drastic changes in the Order of Battle of the RAF in general and its air defence forces in particular.

Completion of the 1950 Expansion Programme

To improve the readiness of the air defences in 1951, the R Aux AF fighter squadrons were called up for three months continuous training and the auxiliary and reserve personnel manning the C&R system in the United Kingdom were given 15 days refresher training. To relieve the operational groups of training tasks, No. 81 Fighter (Operational Training) Group was re-formed on 1 January 1952 to control operational training units, Control and Reporting Schools and other units associated with specialist training of air and ground personnel. On 4 April 1955 No. 13 Group was re-established to control the Northern and Caledonian Sectors; No. 11 Group continued to control the Southern and Metropolitan Sectors, No. 12 Group the Eastern and Western. Simultaneously a works programme was in progress developing airfields to meet the expanding fighter force requirements. A start had already been made before 1950 in developing the main fighter bases to meet higher operating standards. To improve reaction time, operational readiness platforms (ORPs) were built at the end of main runways, enabling aircraft to be positioned for immediate take-off. These aircraft were linked by telephone or 'telescramble' to their controlling authority thus enabling the pilots at cockpit readiness to get their take-off orders direct from the controllers thus improving reaction time.⁴⁶

The first Meteor night fighters came into service in September 1951 in time to take part in the major autumn air defence exercises (Pinnacal and Cirrus) and four night fighter squadrons equipped with Meteor NF11s and two Vampire NF10s formed between October

⁴⁴ Cmd 9397.

⁴⁵ In December 1954 the AOC-in-C Fighter Command had 630 day and 225 N/AW fighters under his command — or operational control — in 20 short range day and nine night RAF squadrons; 20 R Aux AF short range day squadrons; three RCAF short range day squadrons; three USAF N/AW squadrons plus two SRD & 1 N/AW RAF squadrons made up from non operational units. In an emergency about another 50 day and 30 N/AW fighters could be found from No. 81 (Training) Group resources. (COS (55) 48, dated 22 March 1955)(1D9/900/1/Pt 3). It was planned to increase the number of front line RAF squadrons to 36 (18 day and 18 N/AW) by 1956.

⁴⁶ It was planned to have 6 operational airfields equipped with telescramble by Sep 1952 and 22 by Sep 1953 (QLR No. 23).

and December 1951. Two Meteor NF11 Squadrons formed in 2 TAF by April 1952 and Venom NF2s started to replace the Vampire NF10 in Fighter Command in 1953.

Overseas the day fighter strength in Malta was augmented in July 1952 by 2 RAAF squadrons (Nos. 75 and 76) equipped with Vampire 9s; No. 14 Sqn (Vampire 9s) RNZAF deployed to Nicosia in October. The Venom FB1 started to replace the Vampire DF/GA squadrons in Germany from August 1952 and were introduced into the Middle East Air Force in February 1954. The Mosquito night fighter squadrons in the Canal Zone were re-armed with Meteors by April 1953.

The Venom was the last of the interim fighter aircraft to come into squadron service during the expansion period started in 1950. Jet fighters which came into service after World War II showed a significant improvement in performance over their predecessors and filled a gap until a British swept-wing interceptor became available. The first, the Supermarine Swift, entered service with No. 56 Squadron at Waterbeach in February 1954.

Development of the Swept-Wing Fighter

When war broke out in Korea in 1950 plans for re-equipping the RAF about 1957 had to be reviewed. In October 1950 a swept-wing day fighter – which had been under design since 1948 – was ordered ‘off the drawing board’ before the first prototype had flown. More were ordered early in 1951; this aircraft was later named the Hunter. As an insurance an operational version of a research aircraft, the S535 later named the Swift was also ordered off the drawing board; it was hoped this would get into production before the Hunter. Both prototypes and production aircraft were ordered in November 1950. Thus because of the emergency, orders for both types were placed much earlier in their development than would normally have been the case.

Clearly the decision to order early meant taking risks; it also led to overloading some firms in the aircraft industry. On the other hand there was hope that some of the latest types would be available earlier and could be used operationally even if their performance did not completely meet the original requirement. But serious development problems were encountered. The decision of 1950-51 to order many hundreds of aircraft meant that whilst development was still at an early stage production arrangements were being pushed ahead. Development and production tended to be telescoped. One intractable problem could affect and delay all development flying. For example when difficulty was experienced in making the Hunter air-brake slow the aircraft without upsetting the pilot’s aim, early production aircraft had to be diverted to assist development flying – while increasing numbers of aircraft were coming off the production line with major design features still unsatisfactory. Firing the guns caused interference with air intake into the engine and in rarefied atmospheres this occasionally led to engine stalling. Measures were taken which eliminated these troubles but they took time. In the event the Hunter – the last pure day fighter in the RAF, proved a great success. Subsequently employed in the ground attack role it was still in service 20 years later.

Development of the Swift was less successful. The changes involved in introducing armament and equipment plus re-engining what was basically a research aircraft so complicated the process of development that the Swift Mk 1–4 never reached an acceptable operational standard. It was eventually withdrawn from Fighter Command in May 1955, and later modified for fighter-reconnaissance. (Swift Mk V).

The Javelin all-weather delta wing fighter also encountered development difficulties. A series of accidents with the prototype delayed its introduction into service, and the first FAW1s were issued to No. 46 Squadron at Odiham in February 1956. The Javelin, the first twin jet delta wing fighter in the world, was designed to intercept bombers flying at great altitudes and high subsonic speeds. Its FAW7 version was the first to carry infra-red homing air-to-air missiles (Firestreak) as standard armament.

Meanwhile the development of an even more advanced day/night interceptor capable of Mach 2 in level flight was being pressed forward with the aim of having it in squadron service by the end of the 1950s. This aircraft would be the first RAF single seater fighter to enter service designed from the outset as an integrated weapon system. With airframe, engines, armament and fire control radar all carefully co-ordinated and an automatic 'lock on' equipment which would enable the pilot to intercept and attack without the need to see his target it would be a formidable aircraft.

The Hunter F1-6 in Squadron Service

Until 1960 the Hunter was the standard RAF single seat fighter. It superseded the Meteor F8 in home fighter squadrons and from 1955 Sabres and Venoms in 2 TAF (Germany). It was the first widely used RAF day fighter to be equipped with powered controls and its single point refuelling system and detachable Aden gun pack reduced turn round time to as little as seven minutes. The fire power conferred by the four 30mm cannon – which delivered ten times as much high explosive per second as the cannon of the Russian MIG⁴⁷ - marked one of the major advances in the fighters' basic weapon since the 20mm Hispano came into general use in 1941.

The first to re-equip with the Avon engined Hunter F1 was No. 43 Sqn at Leuchars in July 1954. Nos. 54 and 222 Sqns were the only other units so equipped as the F1 could not fire its guns above a certain altitude because of engine surge. This problem did not affect the Sapphire engined F2 version which entered service with No. 257 and 263 Squadrons at Wattisham at the end of 1954.

Whereas the F1 and F2 were essentially short range interceptors, the F4 had additional fuel capacity in the wings and provision for a wide range of stores below them. No. 54 and 111 Sqns re-equipped with Hunter F4s in March 1955 and the following month the first Hunters to be sent overseas went to No. 98 Sqn in 2 TAF supplanting Venoms. By 1956 the Hunter F4 had become the mainstay of the day fighter/ground attack force in Germany equipping 13 squadrons. Within two years all RAF day fighter squadrons in Europe had been re-equipped with the Hunter F6 which was powered by an up rated Avon engine giving it a much improved performance. The first F6s joined the Middle East Air Force in March 1958 when 208 Sqn was redeployed from Malta to Cyprus.

Air Defence Operations in the Suez Campaign (Oct/Nov 1956) (Musketeer)

When President Nasser seized the Suez Canal in July 1956 there was no effective air defence system in Cyprus. A Sector Operations Centre had been set up at Nicosia in an old hut but its only communications were two landlines to the GCIs stations; there were no communications to airfields. Until then the SOC's primary role had been to assist the internal security forces. Internal re-organisation, additional communications and other improvements carried out over the next few weeks enabled the SOC to operate efficiently in its air defence role. Re-siting and deploying existing and new radars as they became

⁴⁷ The Supply of Military Aircraft – Cmd 9388 February 1955.

available improved coverage; use of one or two RN frigates to the south of the island as picquet ships gave early warning of low flying aircraft. Frequent exercises brought the whole system up to a reasonable standard of efficiency.

On 8 August 1956 Hunter Mk Vs of Nos. 1 and 34 Squadrons arrived in Cyprus from Tangmere to join the build up of forces in the area. Initially they were based at Akrotiri, then under construction as a bomber base, but when work was completed on a secondary runway at Nicosia the wing moved there on 3 September 1956, joining No. 39 Sqn (eight Meteor NF13s) which had arrived from Malta on 9 August. The defence provided by these three squadrons was augmented by 23 HAA and 178 Bofors guns, deployed in various parts of the island. No. 6 Sqn (16 Venom IVs) at Akrotiri was the only resident DF/GA Sqn in Cyprus; No. 73 Sqn (Venom Is) was at Aden relieving No. 8 Sqn (Venom IVs) on armament practice at Habbaniya. To form a DF/GA Venom Wing No. 249 Sqn transferred from Amman to Akrotiri on 27 Aug and No. 8 moved from Habbaniya on 5 September, No. 72 Squadron being left at Aden. GCI coverage was provided by four radar convoys – one of which was sent from the United Kingdom to replace equipment at Mafraq previously earmarked to reinforce Cyprus but which could not be moved from Jordan. There was considerable variation in the performance of the GCI radars; with some the pick up range extended to 140 miles, but on average an aircraft at medium altitude was detected at about 100 miles.

Because the Meteor FR9 did not have the range to operate over Egypt from Cyprus with worthwhile time in the combat area – and aircraft parking space was at a premium – No. 208 Sqn was moved from Akrotiri to Malta on 7 August 1956. Thus the AOC Levant who was designated Air Defence Commander had under his operational control a Sector Operations Centre (SOC) at Nicosia; four GCI stations to control aircraft; two day and one night fighter squadrons, plus one or two RN frigates as available. It was also envisaged that when not engaged in ground attack operations the Venom IVs from Akrotiri could be made available for air defence.

As tension in the Middle East increased certain precautionary measures were taken. From 24 September 1956 a small number of fighters were placed at readiness for the purpose of intercepting unidentified aircraft. The fighters were unarmed and could only identify, shadow, or, under some conditions, order aircraft to land. The next day, restrictions were imposed on military and civil aircraft movements in the Cyprus area and from 9 October authority was given for warning shots to be fired or aircraft committing hostile acts to be destroyed. Fighters were on readiness from 24 September to 21 December; their number and degree of readiness varied with the likelihood of enemy action and was highest during the actual period of operations and particularly at dawn and dusk.

As there were no operational readiness platforms (ORPs) at Nicosia an area of hard standing adjacent to one of the main runways was resurfaced and used as an ORP for the Hunters. Night fighters operated from a dispersal elsewhere and their scrambling time was therefore inevitably increased because of the taxiing distances involved. There was no telebrief either; this meant further delays and aircrews had to get their scrambling instructions after they were airborne. Instructions from SOC to scramble the day fighters were relayed to air traffic control (ATC) by direct teletalk link; ATC effected the scramble by firing coloured Very cartridges according to the number of aircraft required. Vectors and other combat details were also relayed through ATC when RT contact was made. Night fighters were scrambled in a similar way.

Patrols were flown at dawn and dusk; usually when strike aircraft were returning and at other times when ordered. In the case of the Meteors this was necessary so they might have some hope of making an interception against a high speed high altitude target; in addition identification problems often resulted in a fighter having only a short time in which to intercept an unidentified aircraft. Between 29 October and 15 November, 216 interceptions were made on aircraft not positively identified as friendly. Some were identified by the SOC before the fighter sighted its target, but the interception was usually completed for practice purposes. No hostile aircraft approached Cyprus; one general and one limited air raid warning alarms were sounded but both were false. Fortunately throughout the period before and during the Suez campaign the weather did not restrict operations. Immediately following Musketeer, but while defensive fighters were still at readiness, the weather deteriorated and the difficulties of operating fighters with only one alternative airfield became apparent.

On offensive operations eight Hunters carried out two fighter sweeps over Cairo at 40,000 ft on 3 November and four others gave fighter cover on six occasions during the assault on Gamil airfield and its resupply. Three sorties at 48,000 ft were also flown by a flight of four Hunters to cover the return of Canberras from photographic reconnaissance.

During Operation Musketeer the defending fighters were not really put to the test. Overall the Hunter V proved adequate for its task but the Meteors were clearly outdated. At night, had the fastest Egyptian aircraft attacked the British bases in Cyprus the Meteor could not have interfered with their operations. The C&R system operated efficiently within the limits of its obsolescent equipment and inadequate communications. However, it was unlikely that the system would have provided adequate control or given all round warning of the approach of the latest types of hostile modern aircraft being flown to their limits.

AIR DEFENCE IN THE NUCLEAR AGE

The Threat to the United Kingdom 1960-70

Requirements for new aircraft and equipment for the RAF, to come into service in the early and middle 1950s, had been drawn up shortly after World War II. But by 1950 the defence situation had changed so drastically that new plans had to be made to meet a threat to the United Kingdom in the 1960-70 period.⁴⁸

In broad terms it was appreciated that from about 1960, Russia could threaten Britain with medium range ballistic missiles (1500 miles range) or by attacks at medium and high altitude by aircraft carrying free fall and stand-off nuclear weapons and flying at increasingly faster speeds and greater height – possibly Mach 2.5 at 70,000 ft by 1970. Sophisticated forms of electronic countermeasures (ECM) might be used to support them. Low altitude sub-sonic attacks could also be expected, but until the technical difficulties of releasing nuclear weapons at low level were overcome these attacks were not considered to be initially as likely as those at medium and high level. The defensive system to counter these threats would not have to be saturated by large numbers of aircraft and the warning time had to be long enough to ensure interception at least 20 miles from the coast. Britain's geographical position behind the NATO radars gave improved warning of attack, but an adequate national early warning system was still necessary.

⁴⁸ Based on AD Committee Working Party AD(54) 2 (Final) AHB11/127/3/207

Acquisition of accurate information at maximum range on high, medium and low level targets to be transmitted to missiles and aircraft with minimum delay called for automated data handling equipment and adequate resistance to ECM.

The reporting radars in use, or about to become operational in 1955, were vulnerable to electronic countermeasures and the system was limited in the number of attack and defending aircraft it could handle. Manned fighters in the large numbers required to meet mass raids presented many problems of readiness, take off and recovery which tended to degrade the effectiveness of the force as a whole. The first generation surface-to-air guided weapons (SAGW) due to come into service towards the end of the decade were comparatively short range, vulnerable to ECM and could only provide a limited improvement in defence if costs were to be kept within reasonable bounds. Even developed versions would not provide a complete defence. Thus although fighter costs were markedly greater than those of SAGW for a given level of defence effectiveness, the aircraft with its ability to discriminate, intercept, identify targets and report, - something the SAGW could not do – would still be an essential element in the defensive posture of the 1960s. Retention of the fighter also provided a safeguard against delay or cancellation in the SAGW programme.

Broad statements reflecting the policy to use both aircraft and ground-to-air missiles in the air defence of the United Kingdom and the linking of the C&R system to Continental radars appeared in the 1954-56 Statements on Defence. Latterly these stressed that counter offensive strength was the most effective defence against aggression. This doctrine – Deterrence – was to form the basis of future British defence policy.

In April 1957 the Government dramatically announced considerable cuts in the number of fighter aircraft in Britain and 2 TAF and eventual replacement of manned fighters by guided missiles.

Early that year (January 1957) the disbandment of the R Aux AF fighter squadrons was announced at a time when post war RAF fighter strength (inc. Auxiliaries) was at a peak of 87 squadrons (1186 aircraft)⁴⁹.

The decision to disband the R Aux AF fighter squadrons had been foreshadowed about two years before when it had been considered impossible to replace their Meteors and Vampires with Hunters – except at the expense of the regular squadrons. They would however continue to operate their existing aircraft for the time being. It had been hoped some Auxiliary pilots might be trained on Hunters but this could not be done either. Finally because of the growing cost of equipment it became clear the squadrons could not be retained even with Meteors and Vampires and they all disbanded on 10 March 1957. Changes in the organisation of the C&R system made it possible to disband seven Auxiliary FCUs at the same time and the remaining 12 FCUs were all disestablished by 31 January 1961.

Defence of the Deterrent Bases

To help maintain the effectiveness of the deterrent force it was essential that a would be aggressor should not be allowed to knock out the V bomber bases before aircraft could

⁴⁹ There were 18 RAF and 20 R Aux AF ARDF squadrons (448) aircraft and 17 squadrons of N/AW fighters (272 aircraft) established in the United Kingdom. Overseas 2 TAF had 19 DF/GA squadrons (266 aircraft) and four N/AW squadrons (64 aircraft); MEAF five DF/GA squadrons (80 aircraft) and one N/AW squadron (8 aircraft); FEAF three DF/GA squadrons (48 aircraft).

take off. Defence of the bomber airfields was therefore essential. A manned fighter force, smaller than that established in 1956, but adequate for this limited purpose – and progressively equipped with air-to-air missiles – was to be maintained until replaced by a ground-to-air missile system. In these circumstances it was unlikely that the RAF would have a requirement for fighter aircraft more advanced than the supersonic P1 Lightning.⁵⁰

Contraction of the Fighter Force 1957/1959

Once the decision was announced to recast the air defences to concentrate on bomber airfield defence and cut the strength of 2 TAF the reduction of the fighter force was rapid. By December 1957 two Hunter and three Venom NF sqns had been disbanded in Fighter Command, 17 DF/GA sqns disestablished in 2 TAF and one sqn in MEAF. A further ten were withdrawn from Fighter Command in the next two years reducing established front line strength in December 1959 to 124 aircraft in ten short range day Hunter squadrons and 160 aircraft in ten N/AW Javelin squadrons. In addition 20 stations were transferred to other Commands; another 16 were either closed or became inactive and 53 radar stations and units including six Sector Headquarters disbanded. Overseas the establishment became five day fighter and four N/AW squadrons in 2 TAF and a N/AW squadron in FEAF. The two fighter squadrons in British Forces Arabian Peninsula were employed in the DF/GA role (for details see Appendix).

The training organisation was also changed to meet its reduced task. No. 81 Group; one day and one night fighter operational conversion unit and other small training units were disestablished. OCU training was concentrated in No. 11 Group, day fighter training at Chivenor, night/all weather at Leeming.

Need for Re-organisation of the C&R System

Before the introduction of the Type 80 and AN/FPS 3 into the United Kingdom C&R system no long-range radar giving precise control was available. As a result reporting and control became almost separate functions. It was on the former – a slightly delayed (and assumed to be accurate) picture – built up from different sources of the actual air situation that executive action was taken; but fighter control was exercised from GCI stations on the raw radar picture from short range PPI radars. With changes in tactics and increases in aircraft speeds these pictures became less and less compatible. Such a system fell far short of what was required in a thermo-nuclear age when rapid allocation of targets was of the greatest importance. Something better than a manually created General Situation Map (GSM) with its multiplicity of sources of information was required. The fundamental need for a Sector Commander and interception teams was a common reference system.

Dependence on Reservists and Auxiliaries to fill more than 60% of the war establishment of the C&R system meant the organisation as a whole was incapable of attaining a high degree of effectiveness until some time after mobilisation. This did not satisfy the readiness requirements of modern air defence and the forthcoming introduction of the SAGW⁵¹ into the system made it more important than ever that controlling authorities should be provided with an accurate up to date air picture not achievable by manual means.

⁵⁰ Outline of Future Policy on Defence (Cmd. 124 April 1957).

⁵¹ Surface to Air Guided Weapons

Impact of the Type 80 Radar

All these factors pointed to a radical re-organisation of the C&R system and the happy coincidence of the introduction of the Type 80 radar and other equipments into service provided the primary means of achieving this. Not only could the Type 80 be used for both reporting and control, allowing both these functions to be centralised, introduction of a photographic display unit (PDU) enabled the radar picture from a normal PPI to be optically magnified and projected on to a large screen. This provided control and reporting authorities with a simultaneous true air picture of the air situation at a given moment.

The 1958 Control and Report Plan (Razor Plan)

Proposals put forward by HQFC in July 1956⁵² provided the basis for re-organising the C&R system by 1958. In the scheme finally agreed (Razor Plan)⁵³ the United Kingdom was divided into eight sectors for air defence. Each sector was controlled by a Master Radar Station (MRS) or '[Comprehensive Station]' which had a dual role – reporting and control.⁵⁴ In some sectors there was an additional satellite GCI station to increase the control capacity of the parent MRS, and an early warning station – provided under the Rotor Plan – to extend sector coverage and give insurance against breakdown of the Type 80s. Some EW radars had a low level reporting role and radar links were used to transmit raw radar information between stations.

Responsibility for defence within each sector rested with a Master Controller – located at the MRS – who initiated action against raids entering his area. MRSs also passed back to the Air Defence Operations Centre (ADOC) – who were responsible for overall supervision of the air battle – a general picture of air activity in their sector. Rapid reaction to any threat was achieved by giving MRSs complete autonomy and in effect they assumed the operational responsibilities of the old Sector Operations Centres (SOCs) which were not required under the new organisation.

With the integration of control and reporting responsibilities at the same stations, introduction of long-range radars and the PDU it was possible to dispense with the Centralised Filter Plotting Centres (CFPC)⁵⁵ where early warning information from a variety of sources was correlated and passed on to appropriate stations. It was planned that Patrington, Neatishead and Bawdsey sectors who had the responsibility of countering the major threat from the East would control aircraft from 19 of the 27 airfields expected to be available to the defences in 1958. When SAGW stations became operational in the early 1960s they too would be controlled from an MRS.

Streamlining of the C&R system offered a great saving in operating personnel. Apart from a small organisation manned by reserve personnel to deal with the low level raids it was planned to staff the new organisation with regular personnel; hence there was no requirement for the Auxiliary FCUs. Disbandment of these units released more trained regular personnel and meant that almost the whole manpower requirement of the 1958 plan could be met from within Command resources. Further planned reduction in the fighter force, more modifications and economies in the original plan allowed an additional five GCIs and some of the re-engineered early warning stations provided under Rotor to

⁵² Outline Plan for the Organisation, Equipment, Operation and Manning of the UK C&R System in 1958 (FC/TS 48547/Plans 26 July 1956)

⁵³ Razor Plan – Phased Programme issued under FC/TS 48547/Pt 3/Plans dated 9 Aug 57.

⁵⁴ The MRS at which the AOC installed his HQ was called a Group Control Centre (GCC).

⁵⁵ The CFPCs closed on 1 September 1956 in advance of the issue of Razor Plan.

be closed. Between February 1957 and August 1959 1430 officers, 15,950 airmen and 21 civilians were disestablished in Fighter Command – a reduction in strength of 42%. By operating radar stations for about 16 hours a day and phasing their times of operation it was possible to maintain a continuous watch over the approaches to the UK and satisfy the training requirements of the re-equipped N/AW force. The long-range of the new radars also made a new and simple concept of re-enforcement possible. If a particular sector had more hostile aircraft in its area than it could engage with its own control capacity, one or both of its adjacent sectors could assist with theirs.

Implementation of Razor Plan

Sopley, Wartling and Bawdsey in No. 11 Group; Neatishead and Patrington in No. 12 Group; Boulmer, Buchan and Killard Point in No. 13 Group were selected for conversion to MRSs. To avoid prolonged shut down periods and to get the stations operational as soon as possible, work was divided into two stages. Phase 1, involving installation of new radars, a PDU, more height finders, modifications to display equipment and alterations to buildings, was almost complete by the middle of 1958. By then it was evident that the second phase, envisaging the need for greater control capacity, additional height finders, installation of a second PDU and numerous electronic improvements could not be completed before 1961. A study of the requirements of a system from 1962 onward, involving SAGW and supersonic aircraft and making maximum use of automatic data processing equipment and electronic computers – involving centralisation of control in a new type of centre and a change of role for some of the MRSs – made it uneconomic to complete the second phase or Razor Plan in its entirety. The revised programme limited improvements to those likely to be needed for the 1962 system. A new plan called AHEAD (estimated to cost £30 million) to cover requirements after that date was drawn up. This figure proved a gross underestimate; within a year the cost was put at between £70 and £100 million.

Introduction of Surface to Air Guided Weapons (SAGW)

When in 1953 the Air Ministry assumed responsibility for development and operation of surface-to-air guided weapons (SAFW) primarily intended for the defence of the United Kingdom,⁵⁶ SAGW development – which had begun about four years before – was reaching initial prototype trials. Based on a report by a study group⁵⁷ under Gp Capt D C Stapleton and other staff studies at Air Ministry and Fighter Command, plans were formulated by a new deputy directorate established under ACAS (Ops) for the progressive integration of the new system into the air defence organisation from 1958.

Training of technical personnel for employment on acceptance and service trials and maintenance of the equipment once it came into service started in 1954; specialist courses for GD officers who would man the operational side of the system were deferred until the programme was further advanced. An announcement that ground launched missiles would be introduced to supplement the defences and that they might possibly supplant piloted aircraft in the future was made in the 1954 Statement on Defence. In 1955 it was decided that the first SAGW station would be RAF North Coates, Lincolnshire.

The SAGW selected for RAF service was the Bloodhound I developed under the code name Red Duster by Bristol Ferranti. It utilised a semi-active radar homing system and

⁵⁶ Cabinet Defence Committee 3rd Meeting 25 Feb 53 (IVA/138 Appendix E).

⁵⁷ A survey of the Initial Surface-to-Air Guided Weapons System and its Integration into the United Kingdom Air Defence System (1 June 1955) (IVA/138).

was designed to engage targets flying between 10,000 and 60,000 ft at 20 miles range. The missile was powered by two Thor ram jets and had four short burning rocket-boost Gosling motors to accelerate it to a cruising speed of M2; it was fitted with a high explosive war head actuated by proximity fuse. The associated ground system consisted of a tactical control radar which acquired the targets and allotted them to firing sites and a target illuminating or guidance radar which trained on selected targets, producing a reflected radar response on which the missiles homed. The missiles and their associated radars were brought to readiness after the early warning chain of the C&R system had detected and identified a potential target and the SOC/MRS had decided that it should be engaged by SAGW in preference to fighters. Selection of missile sites for individual engagement was made at a Tactical Control Centre (TCC), which was responsible for passing information on the target's position, height, course and speed – obtained initially from the MRS – to the launching site. The illuminating radar would then acquire its assigned target and the missile be fired. Extensive use was made of radar, data links and computers for the rapid transmission, processing, display and exchange of information at all levels between the early warning radar stations and the launch control points (LCPs).

The original deployment plan envisaged the construction of nine missile sites to give SAGW defence – or surface-to-air missile (SAM) cover as it became known – the Class 1 airfields in Eastern England developed for the V Force.⁵⁸ The projected SAM sites also gave a degree of protection to some of the Thor IRBM complexes then being built, and indirectly afforded a degree of defence to the USAF Strategic Air Command bases which lay further inland. Subsequently, following further technical development, a reduction in the number of firing units on LCPs and redeploying the spare fire units to make up a total of 11 missile sites, it was found possible to defend all the projected Thor bases and afford adequate protection to the V Forces bases – as well as defending some of its dispersal airfields.⁵⁹

The SAM system which was to be fully deployed by mid 1961 was organised into four Wings each with its TCC and associated missile squadrons. The first Bloodhound 1s came into service in July 1958 at North Coates where a TCC was located. Later that year the North Coates Wing was renumbered No. 148 (AD) Missile Wing. Initially its role was to conduct service trials in conjunction with the satellite station at Dunholme Lodge – although No. 148 Wg would also have an operational capability from both stations. Live weapon firings were conducted at Aberporth and later a second satellite was built at Woodhall Spa to house a third squadron. Thus the Wing as a whole gave cover to the V bomber bases at Scampton, Waddington and Congingsby and the Thor squadron at Hemswell. No. 151 Wing (TCC North Luffenham) defended the bases further south; No. 24 Wing (TCC Watton) those in East Anglia and No. 2 Wing (TCC Lindholme) the Northern deterrent complex.⁶⁰

The introduction of the Bloodhound into Fighter Command involved an extensive programme of works services. Some units were located on established RAF stations, but most of the squadrons were sited on isolated disused wartime airfields. New technical and domestic accommodation had to be built where existing facilities could not be rehabilitated and a SAM Operational Training School (SAM OTS) established.⁶¹ Although there were some delays in the delivery of equipment three squadrons (96 missiles) were operational by September 1960 and the deployment of all 11 squadrons (352 missiles) was completed

⁵⁸ Deployment of Stage 1 SAGW AC(58)29 (CMS 2850/56) dated 1 Apr 58 (1D3/909/1/PG1).

⁵⁹ For deployment in mid 1961 see Appendix. Each squadron had 32 missiles.

⁶⁰ VCAS Progress Reports (1D9/A7-1).

⁶¹ Initially SAMOTS was located at North Coates; later it moved to RAF Watton.

in July 1961⁶² - within two months of the target date set in December 1957. This was a considerable achievement. Incorporation of the Bloodhound into Fighter Command's Order of Battle followed closely on the start of a programme to re-arm Hunter Squadrons with the supersonic Lightning. These arrangements together with the Javelin Mk 8 and 9s made up a formidable force for the defence of our deterrent bases.

Air to Air Missiles

The performance of jet aircraft presented serious problems to manned interceptors. Fast high flying targets not only reduced the time available for the reaching of an interception point; speed and altitude imposed restrictions on manoeuvrability. Supersonic speeds increased the radius of turn so much that interception normally had to be initiated outside visibility distance and therefore under radar control. These factors might well limit the fighter to a 'single pass' capability; therefore a weapon with greater lethality than conventional armament was required. Such a weapon was the air-to-air missile with its ability to home on a target. Furthermore if it could be fired at the target from any angle the fighters manoeuvrability requirements were much reduced. Such a tactic required a high degree of accuracy in ground control, but the introduction of automated methods of control and transmission of information could do much to eliminate human errors.

Work on British air-to-air weapons systems began in 1949 and led to the development by Fairey Aviation of Fireflash (code name Blue Sky) which was the first British missile to destroy a target aircraft. It never equipped operational fighter squadrons but was used at RAF Valley in 1957/58 by the guided weapons development squadron armed with Swift Mk 7s, for training and development of tactics. Fireflash was propelled by two boosters which jettisoned on burn out, the missile coasting to its target. It was guided by a radar beam projected from the nose of the launching aircraft. This beam was held on the target by the fighter pilot using a conventional gun sight.

Firestreak (Blue Jay) developed from 1951 onwards by Havilland propellers, entered service with RAF units in 1958. Powered by a solid fuel rocket motor it was first carried by the Javelin Mk 7 and homed on its target by means of a heat-detecting cell; later Firestreaks were carried by Lightnings. This weapon pursued its target; its development, Red Top with a more powerful rocket motor and improved manoeuvrability, could be launched at greater ranges and had the advantage of intercepting targets from much wider angles of attack.

Guided missiles did not completely replace guns in the home based RAF front line defence squadrons until September 1965, when Nos. 19 and 22 Sqns (the last gun armed Lightning F2 squadrons in Britain) were deployed to Germany. Guns were re-introduced in June 1970 however when the Lightning F6 was cleared to fire ventral guns.

Developments in Air Defence Overseas

The first of the radar convoys authorised under the 'VAST' programme to meet the air defence requirements of overseas commands arrived in Germany early in 1955. Until then C&R cover in the 2 ATAF area provided by worn out and obsolescent wartime equipments, was sparse and the cause of considerable concern particularly to the Commander Allied Air Forces Central Europe.⁶³

⁶² VCAS Progress Report No. 14 (CMS 3189/DD Ops (SAM) 2 Nov 61 (1D9/A7-1).

⁶³ DO letter from ACM Sir Basil Embrey to CAS (MRAF Sir William Dickson) Aircen-CC-DO-53 6 Dec 54 (1D3/96/3).

Three further convoys arrived in 2 TAF by June 1955 and three Type 80 radars of the type being installed in the UK and by the RCAF at Metz were operational on the Continent by 1957.⁶⁴ These improved static radars gave better early warning, GCI and aircraft control facilities within 2 TAFs operational area. They augmented radar information available to the national air defence systems of Belgium, Holland and Germany and extended the UK early warning cover.⁶⁵

In FEAF static operations centres were to be constructed at Penang and Kuala Lumpur in addition to Singapore, and the three mobile (VAST) convoys earmarked for FEAF eventually replaced by static high powered long-range radars.⁶⁶ The radar in Malta, which had been in constant use since 1941, reverted to the early warning role when No. 30 Squadron disbanded in June 1958 leaving the island without a resident fighter squadron. This situation did not change plans made earlier to put a Type 80 on Malta to control fighters detached there for training or in support of contingency plans. An early warning station was also planned for Cyprus: this radar was due to be operational by 1961 and form part of a projected NATO early warning chain. Separate air defence facilities for British national requirements were also to be provided.

Apart from Operation Musketeer when major reinforcements were sent to Cyprus, British contingency plans called for strengthening of the island's air defences in certain circumstances. In May 1955 when there was unrest in the Middle East and tension between Egypt and Israel RAF Sabre squadrons from 2 TAF became the first swept wing RAF fighters to be deployed to Cyprus, demonstrating to Middle East States an ability to reinforce the theatre with modern fighters at short notice. From November 1958 until its move to BFAP in March 1959, No. 208 Squadron (Hunter F6s) formed part of the island's garrison which was strengthened by regular detachments of squadrons from Fighter Command. These detachments continued after No. 208 Squadron left Nicosia, establishing the permanence of an additional regular role for Fighter Command⁶⁷ - overseas reinforcement and the development of techniques to accomplish this as speedily as possible.

Overseas Reinforcement

As the number of front line aircraft decreased after 1957 the ability of the home based squadrons to reinforce garrisons overseas for exercises and in emergencies assumed greater importance. The ever present threat from about 1960 of the loss of RAF airfields and staging posts around the world, particularly in the Middle and Far East, focused attention on the reinforcing range of all RAF aircraft – especially fighters. Some rather inconclusive flight refuelling trials of the 'dry hook up' type had earlier been undertaken with a Javelin Mk 4 fitted with a wing mounted probe and a Canberra tanker. In later trials with two Javelin Mk 9s and Valiant and Canberra tankers, a large fixed probe some 20 feet long was mounted high on the starboard side of the fuselage. This position was much more successful and the first of the modified Javelins entered service with No. 23 Squadron in May 1960. Also four Hunter Mk 6 squadrons in Fighter Command were

⁶⁴ The RCAF Type 80 became operational 1 Jul 55: 2 TAF commenced 24 hour surveillance at 1200 on 30 Apr 56.

⁶⁵ ACAS(S)CMS 2410 dated 10 Nov (1D3/96/3).

⁶⁶ Deliveries of VAST convoys to all overseas commands were completed during 1956.

⁶⁷ On 31 December 1958 the AOC-in-C Fighter Command was informed by the Air Ministry that from 1 March 59 the fighter element of the air defence of the Middle East was to be provided from Fighter Command. The maximum number of squadrons for MEAF reinforcement was three Hunter 6s and one Javelin 7 one of which was to be continuously deployed in Cyprus. One further squadron of either type was to be available at seven days' notice: two further Hunter squadrons were to be at 21 days' notice. AM letter BF 616/ACAS(Apr) (AD) dated 31 December 58.

brought up to interim FGA9 standard to improve their overseas reinforcement capability and the Lightning, about to come into service, was given a flight refuelling capability.

Following a trial flight to Cyprus and back in August 1960 by two Javelins supported by Valiant tankers, four Javelin Mk 9s of No. 23 Squadron flew to Singapore and back from Coltishall in October 1960 refuelling from No. 214 Squadron tankers, two of the aircraft landing only at Akrotiri, Mauripur and Gan on the outward trip. Later the fully fuelled range of the Javelin was increased with the addition of four 100 gallon tanks on underwing pylons, and all Javelin Mk 9s were brought up to full reinforcement standard. This involved not only fitting flight refuelling probes but making considerable modification to the radio and navigation equipment. Flight refuelling exercises to Cyprus by pairs of Javelins became a regular feature of N/AW squadron training, and on 19 October 1962 three Mk 9s of 23 Squadron completed the longest non stop air refuelled flight by fighter aircraft – flying from the United Kingdom to Aden in 8hr 40mins. The same squadron conducted the first refuelling at night on 18/19 December 1962. Perhaps more significantly the Lightning Mk 1As of No. 56 Squadron had flown non-stop to Cyprus in July 1962 refuelling in the air. Their performance showed that longer flights were possible and Lightning reinforcement of FEAF a practicable undertaking.

Introduction of the Lightning

Lightning first entered service with the RAF at the Central Fighter Establishment at Coltishall in December 1959 and the first operational unit to get the aircraft was No. 74 Squadron, also at Coltishall, in July 1960.

This was a notable event in the history of Fighter Command as never before had such a spectacular advance in performance been achieved in a single stride. With a Mach 2 capability in level flight the Lightning more than doubled the Hunter's speed (M.0.95) as well as having a ceiling (60,000 ft) far in excess of any previous fighter. Its introduction also represented an end to the convention of separate requirements for day and night/all weather fighters. In practice, for some time previously, night fighters as represented by the Meteor NF marks, Venoms and Javelins and been used in both day and night sorties with equal facility, but the SR/DF Meteors, Vampires and Hunters were confined to daylight hours. Advances in automated electronics gave the Lightning navigation and airborne interception equipment which allowed its pilot to undertake the tasks normally performed by a two-man crew. Conversion training was carried out by the Lightning Conversion Unit which formed at Coltishall in early 1960. Later it was renamed the Lightning Conversion Squadron and moved to Middleton-St. George in Mid 1961. On 1 June 1963 it became 226 OCU – a unit with a long tradition of fighter training.

The Lightning F1 was quickly followed by the F1a which differed only in details of internal equipment and in having a refuelling probe. By August 1961 two more squadrons (Nos. 56 and 111) had been re-equipped with F1as. Fighter Command then had three Lightning, eight Javelin and four Hunter squadrons (212 aircraft): there were ten squadrons of Javelins, Hunters and Venoms in the fighter, ground attack and fighter reconnaissance roles overseas (115 aircraft). (See Appendix)

Developments in Command and Control 1960-1965

The policy of developing closer links between the C&R system of the United Kingdom and those on the Continent took a further step forward on 28 September 1960 when the North Atlantic Council approved the creation of an integrated air defence system for the

European NATO area. Governments concerned were invited to assign their air defence forces in Europe to the operational command of the Supreme Allied Commander Europe (SACEUR) for use in peace or war subject to provisions for safeguarding national interests – and, in the case of the United Kingdom, to certain reservations in respect of Fighter Command. These concerned control of the size, composition, role and deployment of Fighter Command including movements of squadrons overseas. In December 1960 the Ministry of Defence announced that the UK would form one of four NATO air defence regions. On 1 May 1961 the squadrons, air defence missile squadrons and C&R system of Fighter Command were assigned to NATO and came under the operational control of SACEUR, the AOC-in-C Fighter Command assuming the additional title of Commander, United Kingdom Air Defence Region.

Progressive reduction in the size of the Command prompted a review of its structure. Since the disbandment of No. 81 (Training) Group in March 1958, this had consisted of three operational groups. On 1 January 1961, the Command was reduced to two groups: No. 12 at Horsham St. Faith retained its identity and No. 13 at Ouston was re-numbered No. 11 Group. This organisation lasted until 1 April 1963 when, to improve the subordinate command structure for the tasks for which the Command now undertook following more reductions in front line strength, the two groups were replaced by three sectors – No. 11 (Northern), No. 12 (East Anglian) and No. 13 (Scottish).⁶⁸ Operational control, technical and administrative responsibility were transferred to HQFC: the sectors, with very small staffs at Master Radar Stations, retained responsibility for operational effectiveness and training.⁶⁹

These changes were the result of the growing missile threat to the United Kingdom, and recognition that a gradual but radical departure from the Command's traditional role of air defence had taken place. Not only had it to provide the earliest possible warning of an approaching air threat and investigate violations of airspace, the Command was also required to prevent reconnaissance and deter or inhibit – airborne attempts to jam UK warning system. This role became increasingly important with the commissioning in September of the Ballistic Missile Early Warning system (BEMEWS) at Fylingdales. Additionally part of the United Kingdom fighter force had to be held available to support overseas operations.⁷⁰

As Allied Air Defence Commander United Kingdom Air Defence Region (UKADR) the AOC-in-C Fighter Command became responsible to SACEUR for the operation of all assigned air defence forces in Britain and for co-ordinating air defence plans and operations directly with other NATO Commanders. Because of divergences between national and NATO policy as to the impact of the Soviet Bloc missile capability on the effectiveness of conventional air defence forces, the period of warning likely before the outbreak of global war and the threat of mass attacks by manned aircraft – still thought likely by NATO – it was not possible at first with the available national force to meet SACEUR's requirements fully. However a revision of the alarm policy in 1963 taking account amongst other factors of the increased warning time available to the UKADR because of its geographical position, enabled Fighter Command to improve its readiness.⁷¹

⁶⁸ Air Council Standing Committee – Re-organisation of Fighter Command CMS 2325/53 SC(62)31 dated 14 September 1962.

⁶⁹ UKADR/S.188/3.

⁷⁰ Directive to AOC-in-C Fighter Command effective 1 April 1963 – C141016/61/F. 101/Ops 9561 ACAS Ops dated 8 November 1962

⁷¹ Report on State of Fighter Command FC/TS 55010/Plans & Pol dated 9 September 1963 (1D9/A3-5) and History of UKADR 1962 and 1963 – UKADR/S188/63.

Reduction of the SAM force

Operational capability of the Bloodhound 1 system was increased by procedures developed during 1961/2 to enable squadrons to operate under direct control of an MRS in the event of failure of TCC control through unserviceability or jamming. In 1962 there were 11 Squadrons and four TCCs but a review of defence expenditures forced economies in elements making only a limited contribution to the defence system. As a result TCCs – which had been found susceptible to jamming – were withdrawn on 1 January 1963 and the SAM squadrons regrouped under Patrington and Bawdsey MRSs.⁷² Further economies were made during that year: an accelerated rundown of the Bloodhound force started in the last quarter and all the squadrons were disbanded by 30 June 1964. This reduced Fighter Command to a front line strength of five Lightning and two Javelin squadrons⁷³ (88 aircraft). However, commitments had not decreased proportionately; the complexity of operations plus an increased reinforcement task stretched the Command to its limit.⁷⁴

Coincidentally with the phasing out of Bloodhound 1 steps were taken to introduce the Mk 2 version, which was air transportable: No. 25 (SAM) Squadron and a training school were established at North Coates on 1 October 1963. Because of its world wide reinforcement role the squadron was not assigned to SACEUR: but when in Britain it contributed to national air defence.⁷⁵

Disbandment of the Sector Organisation 1965

Fighter command continued to contract with the redeployment and closure of various units after the Bloodhound squadrons were disbanded. The projected moves of No. 64 Squadron (Javelins) to FEAF in April 1965 and Nos. 19 and 92 Squadrons (Lightnings) to Germany (to replace the two Javelin squadrons) towards the end of the year meant that the trend would continue. The assumption by HQFC of increased responsibilities for tactical control of operational units was also likely to go on. It was therefore decided to reduce the number of sectors by one from 1 April 1965.⁷⁶ No. 12 (East Anglian) Sector was retained at Neatishead and No. 11 (Northern) Sector replaced No. 13 Sector at Boulmer.

Although the sectors played an important part in the operational control and day-to-day training of the units assigned to them it was found that the need to decentralise lessened as the Command contracted. More direct control of operational units was necessary to avoid conflicts in priorities and make the best use of limited resources. The introduction of a new air defence system called Linesman/Mediator about 1968, would call for further centralisation as operational control would be exercised from the ADOC through a main control centre at West Drayton.⁷⁷ In consequence there was no need to retain the two sectors for long and they were disbanded in November and December 1965.⁷⁸ This

⁷² Subsequently the TCC radars were modified and used for control of air traffic above 25,000 ft pending the introduction of a new ATC and AD radar system (Statement on Defence 1964).

⁷³ In an emergency two Hunter squadrons and one Lightning squadron could have been formed from OCU aircraft, but they were not assigned to SACEUR (UKADR/S.188/3 – 1963).

⁷⁴ Report on the State of Fighter Command dated 9 September 1963.

⁷⁵ No. 12 SAM Sqn formed at Woodhall Spa on 2 November 1964: it became operational on 4 January 1966 and moved to Cyprus in October 1967. No. 41 formed at West Raynham on 1 September 1965: it disbanded in September 1970.

⁷⁶ Air Force Board Conclusions of Meetings 4/65 15 March 1965.

⁷⁷ Sector Organisation in Fighter Command (AFB(65)28 – Note by VCAS 17 September 1965).

⁷⁸ Air Force Board Conclusions of Meetings 20 September 1965.

marked the virtual end of the old Fighter Group organisation which had served the Command well for nearly three decades.

Plan Ahead

Plan Ahead, designed to modernise the UK control and reporting system to meet the air threat from the mid 1960s, took account of the increasing threat from ballistic missiles. Whilst this was considered to be the most likely form of attack upon Britain after 1963 it was appreciated that both medium and tactical bombers would continue to be a threat for at least the next decade. Hostile aircraft would also be used for electronic warfare and reconnaissance. The original plan, which envisaged five tracking stations with improved radars, a passive detection system and two control centres where information would be collated with data obtained from the Continental early warning chain, had been drastically reduced by 1960, but the cost was still put at about £60m.⁷⁹

One of the projects not included in the revised plan was Blue Joker, an early warning radar suspended from a balloon and designed to detect attacks by low flying aircraft. To achieve surprise such attacks would have to use a circuitous one way route. It was thought unlikely that such tactics would be adopted in times of tension. The possibility of low level attack on the deterrent bases was considered an acceptable risk.⁸⁰ Effective early warning of an attack by aircraft was, of course, still required so that appropriate political and military counteraction might be taken - as were facilities for the control, under all operating conditions of the albeit smaller force of defending Lightnings and Bloodhounds. Since Blue Joker was vulnerable to jamming – even assuming there was a jamming and intruder threat at low level – because it was only a reporting and not a control radar the requirement was cancelled.⁸¹

As an insurance against the very limited threat now envisaged, Plan Ahead at £60m was hard to justify. It was clear that so long as the scheme remained a self contained independent system no substantial reduction in its cost was possible. However the civil aviation authorities also needed to know what was going on in and around British airspace. Since they made some use of RAF facilities to supplement their own air traffic system and would soon have to replace equipment and expand their organisation it was decided to design a single system to cover defence and civil needs.⁸² West Drayton was selected as the site of an integrated master control centre catering for these.⁸³

Although the formulation of the civil requirements was not as far advanced as the RAF's it was aimed to get the joint system operationally by 1965 but this date could not be met. Because of the considerable alterations to the concept and plan of the new C&R system it was decided to rename the project. From February 1961 the project covering the future ground environment of the UKAD System was called Linesman:⁸⁴ Mediator referred to the civil aviation programme.

⁷⁹ S of S for Air D (60) 9th Meeting 16 September 1960 (1D9/A3-111 Pt 1).

⁸⁰ Loose Minute by Hd of S6. BF2484/S6 dated 5 October 1960 (1D9/A3-111 Pt 1).

⁸¹ Loose Minute by Hd of S6 S6/7701 dated 7 October 1960 and QLR57 (1D9/A3-111 Pt 1).

⁸² Note by Minister of Defence DFB60 – November 1960 & Conclusions of CAS's Meeting 24 January 1961 (CAS 308) (1D9/A3-111 Pt 11).

⁸³ Statement on Defence 1964.

⁸⁴ Loose Minute by D of Radio CMS 3228 dated 22 February 1961 (1D9/A3-111 Pt 11).

Linesman/Mediator

Adoption of the Linesman/Mediator programme was approved by the Cabinet Committee on 24 October 1964.⁸⁵ Acceptance of the concept that the primary threat to the UK had changed from that of the manned bomber to the ballistic missile against which there was no defence had led to the reduction of the UK fighter force to five squadrons (three of which were earmarked for overseas reinforcement). It was intended that the project would be completed by 1968, but for numerous reasons involving delay⁸⁶ the date slipped back to 1974 when the system became operational in a simplified form.⁸⁷

Both Plan Ahead and Linesman/Mediator were conceived when NATO military strategy was based on the tripwire concept. Consequently protection of the Linesman system was not a factor which had to be taken into account and there appeared nothing illogical in locating the nerve centre in one place. However, by the mid 1960s the validity of the Tripwire concept was being questioned and in 1968 the philosophy of flexible response, which admitted to the possibility of a nuclear exchange being preceded by a period of conventional war, was formally accepted by NATO.

Understandably Linesman was found wanting in a number of ways when matched against the new concept, not least was its vulnerability. Indeed the danger of this happening was recognised prior to formal acceptance of the new doctrine and plans were made to provide some of the radar tracking stations with a limited control capability called Stand-By Local Early Warning and Control (SLEWC). Completion of the programme in 1973 gave the stations a measure of autonomy, but only to the extent of providing a modest standby facility for the full Linesman system.

In 1970 a reassessment of the capabilities of the Russian long-range bomber forces exposed a further weakness in the air defence system. For the first time the Soviet long-range air force was credited with the ability to reach targets in Britain from any direction at both high and low level. Additional radars were required to give better cover to the West and North-West of the British Isles. The air defence system of the United Kingdom is now orientated to meet the threat of attack from any direction.

Quick Re-Action Alert (QRA)⁸⁸

The possibility of attack on Britain from the West by Soviet aircraft had been foreshadowed as early as 1962 when unknown aircraft were detected by radar flying southwest between Scotland and the Faroes. In 1963 when Fylingdales became operational more tracks were observed one of which came within 60 miles of the Shetlands before returning northwards. A clue to their origin was obtained when USAF fighters identified a Soviet Bear reconnaissance aircraft flying in the vicinity of Iceland. An aircraft of this type was tracked at extreme range by Norwegian radars on 18 February 1964 as it flew south from the Arctic and later was detected by British tracking stations approaching Saxa Vord in Shetland. It was the first time since World War II that a Russian military aircraft had approached British airspace. A QRA aircraft was scrambled from Leuchars to intercept but it caught fire on starting; a replacement was rapidly prepared but the Russian turned

⁸⁵ QLR No. 65 (Oct-Dec 62).

⁸⁶ (Not for publication). The first requirements were specified in terms of defence thinking some years before. It was not therefore surprising that as changes in philosophy took place they were reflected in alterations to requirements. Also it proved difficult to meet requirements within the constraints of the computer hardware available. R&D Authorities Report on the Moulton Working Party 16 April 1970 (AF CT1455/72).

⁸⁷ Report on UK Air Defence Ground Environment System Study Group AF/K 116/71/811 (AF/CT 286/22).

⁸⁸ Based on Form 540 for ADOC 1953-70 (inc).

away to the northwest before the fighter could take off. The flight path of the intruder in the area of the Shetlands and later near the Faroes strengthened the impression it was on an electronic intelligence mission.

The following year Soviet air activity associated with a large scale Russian naval exercise in the Norwegian Sea showed a considerable increase. On 27 and 28 June 1965 Lightnings of No. 23 Squadron were scrambled from Leuchars seven times to intercept unidentified aircraft over the North Sea. Three of the contacts faded from the controlling stations radars when the intruding aircraft lost height, but four interceptions of Badgers were made about 200 miles from the coast. The sighting, although over international waters, gave notice to those concerned that aircraft approaching United Kingdom airspace were liable to be investigated. These interceptions gave the greatest satisfaction both to the Squadron and ground stations.

From 1965 onwards there was a gradual rise in the number of Soviet aircraft flying in the UK Air Defence Region (UKADR). One of the Russian tactics to avoid interception or break off contact, once sighted by a fighter, was to descend to low level. This forced the interceptor to reduce its altitude if it wanted to keep in company, an action which considerably increased fuel consumption. To extend the Lightnings endurance and range making it possible to complete an interception further from the coast, Victor tanker aircraft were deployed to Leuchars in March 1966. Later, Soviet aircraft occasionally employed electronic countermeasures in attempts to avoid interception.

The importance and flexibility of the C&R organisation was highlighted on 18 February 1966 when the operations block of the Neatishead MRS covering the southern North Sea, was totally destroyed by fire. Within 24 hours the radar station at Bawdsey had taken over Neatishead's reporting role and other responsibilities, thereby maintaining the continuity of C&R cover to east of the United Kingdom.

By May 1966 four-engined reconnaissance Bears were penetrating far enough south to be intercepted by QRA aircraft from RAF Binbrook. On 3 August 1966 two Bisons were intercepted by Lightnings from Leuchars when heading southwest through the Faroes-Iceland Gap. In October two more were intercepted over the North Sea before turning about for their bases in Arctic Russia. Often aircraft on such reconnaissance flights were handed over by British radars to their Norwegian counterparts who took over shadowing the Russians as they returned north.

Interception of Soviet reconnaissance flights over the North Sea and through the Iceland-Faroes Gap before they flew far out over the Atlantic subsequently became a routine operation and is still going on. QRA aircraft and supporting tankers are regularly scrambled to intercept, and during the course of one of these flights (on 25 April 1968), a Lightning carried out the longest non-refuelled interception made up to that time. Contact was made with a Bison 350 miles from Leuchars at three minutes to midnight. This was perhaps an appropriate finale to the day that saw the Disbandment Ceremony of Fighter Command.

Air Defence Operations Overseas from 1960

Apart from Germany (QRA aircraft) and Zambia (a detachment of No. 29 Squadron's Javelins and supporting air defence units for nine months after Rhodesian UDI) the principal overseas areas where fighters have been active in the air defence role since 1960 have been in Aden, the Far East and to a lesser extent the Eastern Mediterranean.

Aden

Border violations in the West Aden Protectorate were nothing new, but they took on a new aspect on 22 October 1962 when a number of unidentified aircraft crossed the Yemen frontier near Beiham and made a rocket attack on some villages. For some time afterward Hunters from Nos. 8 and 208 Squadrons maintained dawn to dusk patrols over the frontier but the incursions were not repeated. The following month radar convoys were moved in from Cyprus and the United Kingdom to give early warning and GCI facilities and plans were made to meet long term requirements for air defence radars. Towards the end of 1963 there were more border incidents when Egyptian or Yemeni IL14s violated Federation airspace eight times. Hunters were scrambled on a number of occasions and on 2 December 1963 an IL14 was intercepted but it ignored all warning signals. The same day another IL14 with Egyptian Army and Air Force personnel landed at Lodar by mistake. The crew and passengers were repatriated on 6 December but the aircraft was detained. Early in 1964 during operations in the Radfan, Yemeni aircraft made a number of flights over the border and an armed helicopter accompanied by two MiGs made a raid on Bulaq near Beihan. Shortly afterwards the Khormaksar Hunters retaliated by attacking a fort inside Yemeni territory with satisfactory results.

Although air attack on Aden from the Yemen was unlikely, the occasional violation of the frontier by Egyptian flown MiGs gave cause for concern as the British base was only ten minutes flying from some parts of the frontier. At the end of 1964 mobile radar units were positioned at Mukeiras to operate an early warning system in conjunction with a battle flight of Hunters at Khormaksar. This allowed the cumbersome Type V radar convoy to go back to Masirah to provide a Command reserve and watch over air to air refuelling operations on the Far East route. In June 1965 air patrols along the frontier by pairs of Hunters were reintroduced when a border post near Beihan was attacked by two MiGs and two Arab women were killed.

Following an attack on the same area by Egyptian flown fighters on 30 July 1966 a pair of Hunters were, for the first time, maintained at five minutes' notice during daylight hours on the Beihan airstrip. They flew border patrols three times a day for several months under control of the radar station at Mukeiras. No hostile aircraft were encountered but the patrols acted as a deterrent. There were few violations thereafter but air defence sorties continued along the frontier from time to time until the British forces withdrew from Aden in November 1967.

Far East

Two operations in Borneo from March 1963 which acted as a curtain raiser for confrontation (December 1963 – August 1966) between Malaysia and Indonesia only involved fighter aircraft in occasional flag waving and low level reconnaissance flights along the border. When an Air Defence Identification Zone (ADIZ) was established on 25 February 1964 over Sarawak and Sabah and Eastern Malaysian territorial waters and the Malaysian Government announced that any unauthorised aircraft in the ADIZ would be destroyed, four Hunters from No. 20 Squadron and two No. 60 Squadron Javelins were deployed to Labuan and Kuching to provide a defensive fighter force.⁸⁹ Provision of a night-all weather air defence in Borneo meant that No. 60 Squadron activities ranged from one end of Malaysia to the other – a total front of 1600 miles. To meet its commitments

⁸⁹ QLR No. 70 January – March 1964

the squadron establishment was increased from 16 to 24 aircraft. Equipped with Javelin Mk 9 and 9Rs armed with cannon and Firestreak missiles it was a formidable fighting unit.

No noteworthy incidents occurred involving Indonesian aircraft as Hunters and Javelins patrolled the border or provided escort to supply dropping Hastings, Argosies, Beverleys and Valettas. In fact there was a lull after the brief although perhaps unspectacular appearance of the Indonesian Air Force (AURI) over North Borneo earlier in the year – an action which had resulted in the establishment of the ADIZ. On 2 September 1964 an AURI C130 managed to evade detection and dropped paratroops in North Central Jahore. The implications were serious. If a transport could approach, drop men and retire unscathed it followed that AURI strike aircraft could threaten RAF bases in Singapore and the RAAF station at Butterworth. Nos. 20 and 60 Squadrons and the RAAF Sabres at Butterworth were brought to a high state of alert and on 23 September 1964 the airspace over the whole of Malaya and Singapore was declared an ADIZ. No. 65 (SAM) Squadron, equipped with Bloodhound II missiles and engaged in Tropical trials in FEAF, was told on 14 September to bring one of its sections to immediate operational readiness. HMS Kent guided missile cruiser was deployed in the Malacca Straits in the air defence role and the defences stiffened with the arrival on detachment of another Javelin squadron – No. 64. Later in the year infiltration again increased and defending forces were once more brought to higher alert states.

The introduction of Bloodhounds reinforced the LAA low-level air defence system provided by the RAF Regiment. Nos. 1 and 63 Regiment Squadrons had already been converted to an LAA role and No. 26 Squadron was brought from Cyprus in January 1964 to reinforce the defences of RAF airfields. Later two Army LAA batteries from Germany arrived in FEAF to join a Royal Australian Artillery and two RAF batteries already in the theatre.

Although in 1965 the RAF continued to be primarily concerned with supply it was still involved with air defence operations connected with the ADIZ, and No. 60 Sqn Javelins at Labuan completed their 1000th sortie on 30 March 1965. A high state of alert was maintained and No. 64 Squadron from RAF Binbrook permanently deployed to Tengah early in the year with an establishment of 22 Javelins. As a result of the continuing requirement for Javelin aircrew in FEAF No. 228 OCU (which had closed in August 1961) was reopened in July 1965 at Leuchars to train reinforcements. It closed again in December 1966 after Confrontation ended.

There was no let up in activity as the year progressed. Indonesian aircraft violated Sarawak airspace several times, and an AURI Hercules narrowly escaped being shot down by a No. 64 Squadron Javelin on 16 September when it was intercepted in a valley south of Pensiangan. The C130 immediately turned for the Indonesian border and by the time the Javelin had got into an attacking position had reached the safety of Indonesian airspace. Fighters were also scrambled against AURI Badgers which were identified and shadowed but remained outside the ADIZ. As an additional guarantee of air space integrity the SAM defences were improved and a Bloodhound II section of No. 65 Squadron was established at Kuching by December 1965: two missile sections of No. 33 Squadron became operational at Butterworth at the same time. By April 1966 Butterworth had four SAM sections established.

The Bangkok Agreement signed on 11 August 1966 brought Confrontation to an end. The readiness states of the fighter SAM and LAA squadrons were relaxed the same day and the ADIZ was disbanded on 15 September 1966. By the end of the year No. 1 LAA

Squadron had returned to the United Kingdom and both Nos. 60 and 64 Squadrons been reduced to an establishment of 12 aircraft.

For much of the time during Confrontation the air situation had been unreal. FEAF aircraft had enjoyed complete freedom of action over friendly territory but were not permitted to venture over the Indonesian border – even in hot pursuit. AURI aircraft made few incursions. The determination shown by the defences to maintain the integrity of Malaysian territory and air space, which contained as they did attractive targets for attack, clearly demonstrated to the Indonesians that such action would be costly – and reprisals would inevitably follow. This attitude did much to influence the Indonesian Government to end Confrontation.

But the days of the Javelin in FEAF were numbered. On 10 July 1967 at Tengah No. 64 Squadron took part in a fly past to mark the Queen's Birthday. In conjunction with No. 60 Squadron, 19 Javelins flew by in formation; it was the last time so many were seen in the air together. Six days later No. 60 Squadron was disbanded. On 12 June 1967, No. 74 Squadron equipped with Lightnings was permanently deployed to the Far East. Fitted with overwing tanks and flight refuelled they flew from Leuchars to Tengah via Akrotiri, Masirah and Gan. No. 60 Squadron remained in FEAF a few months longer. When disbanded on 30 April 1968 it was the last Javelin squadron equipped in the RAF.

Eastern Mediterranean

There was no resident fighter squadron in Cyprus after No. 208 was moved to BFAP in March 1959 until No. 43 Squadron (Hunter GA9s) arrived at Nicosia on 21 June 1961. This squadron went to Aden in February 1963 and was replaced at Nicosia by No. 29 (Javelins) from Leuchars. The following March No. 29 moved to Akrotiri where they were joined later by Lightnings detached from squadrons in the United Kingdom to reinforce the island's air defences. From December 1965 to August 1966 the number of Lightnings in Cyprus was increased from time to time while No. 29 Squadron kept up to ten of its aircraft in Zambia after Rhodesian UDI. On 11 May 1967 No. 56 Squadron, equipped with Lightning 3s, was permanently deployed from Wattisham to Akrotiri: No. 29 returned to the UK to re-equip with Lightnings and the three year Fighter Command detachment to Cyprus ceased. By the end of 1967, No. 122 (SAM) Bloodhound squadron had arrived in Cyprus to form part of the air defence forces.

During periods of tension between Greece and Turkey over the future of Cyprus, the MEAF battle flight was frequently scrambled to intercept aircraft – usually identified as Turkish – flying in the vicinity of the island. An increase in activity by Soviet built aircraft was also detected. These flights coincided with a growing Russian naval presence in the Mediterranean and the consequent interest shown by elements of the United States Sixth Fleet in their movements. Between October and December 1968 five Badgers with UAR markings were intercepted by the MEAF battle flight and, to improve early warning and tracking, arrangements were made for the RAF air defence operations centre in Cyprus to exchange information on unidentified aircraft tracks with elements of the Sixth Fleet operating in the Eastern Mediterranean.

Activity by UAR reconnaissance aircraft continued and later was no longer confined to daylight hours. Subsequently Mail turbo prop amphibians, Cub four-engined transports and IL28 tactical light bombers were amongst aircraft intercepted. When the USSR helicopter carrier Moskva was operating in the Mediterranean in 1970 four Hormone anti-submarine helicopters were encountered by Cyprus QRA aircraft. As in the United

Kingdom, the tactics adopted by some of the intruding aircraft on reconnaissance in the vicinity of Cyprus left little doubt as to the object of their flight – information on the state of the defences.

Germany

In January 1960 there were five day fighter and four night/all weather squadrons in Germany. The rundown plans formulated after 1957 spelt the disbandment of the 2 TAF fighter force at the end of 1960. Later it was decided to maintain one Hunter and two Javelin squadrons in Germany throughout 1961, reinforcing them as necessary with detachments of Javelins and Lightnings from Fighter Command. Subsequent plans to withdraw this force at the end of 1962 were changed. The Hunter Squadron (No. 14) was disbanded on 16 December 1962 but Nos. 5 and 11 (Javelin) Squadrons were retained, re-equipped with Mk 9s and concentrated at Geilenkirchen from November 1962. Later their Javelins were to be replaced with Lightnings. Maintaining aircraft on quick reaction alert, participation in frequent air defence exercises, detachments to different bases in 2 TAF, other NATO countries in Europe and British bases elsewhere overseas kept the squadrons at full stretch. Scrambles by the battle flight in all types of weather to intercept unidentified tracks, countering flights by Soviet aircraft close to the border or, for other reasons, such as assisting aircraft in difficulties demanded a high degree of readiness and considerable dedication from ground and air crews alike.

On 23 September 1956 the first Lightnings to be stationed overseas arrived in Germany. No. 19 Squadron went to Gutersloh taking the place of No. 5 which had been operating from Geilenkirchen. The latter squadron disbanded as a Javelin squadron on 7 October 1965 and re-formed with extended range Lightning 3s in the UK on the following day. No. 92 Squadron's Lightnings moved to Geilenkirchen in December 1965 and No. 11 the other Javelin squadron disbanded on 12 January 1966.

Dispersal of the Lightning force thus on two airfields – one forward at Gutersloh the other to the rear at Geilenkirchen – meant that No. 92 Squadron could not, if required, operate to full advantage in the Berlin air corridors. Negotiations in 1966 to get Celle as a second forward airfield were not successful, so on 22 January 1968 No. 92 Squadron moved forward to Gutersloh. Geilenkirchen closed as a RAF base on transfer to the German Air Force on 31 March 1968.

The two Lightning squadrons remained the principal air defence units in Germany until 1970 when to strengthen the defences of the three Rhine airfields – Laarbruch, Bruggen and Wildenrath – against conventional attack, an enlarged Bloodhound 2 squadron (No. 25) of six missile sections was deployed to NW Europe. Close defence of the three Rhine airfields and Gutersloh was provided by RAF Regiment LLAD Squadrons. No. 26 RAF Regiment Squadron moved to Gutersloh in June 1970 to help meet the requirements of SACEUR's airfield survivability programme and the first two missile sections of No. 25 (SAM) Squadron became operational at Laarbruch at the same time. In August 1970 the airfield SAM defences were reinforced by the arrival of No. 1 RAF Regiment Squadron in the low-level air defence role. By 1 February 1971 the remaining four sections of No. 25 Squadron were operational at Bruggen and Wildenrath. This then was the deployment pattern of RAF squadrons tasked with providing air defence in Germany. The RAF Regiment squadrons were to re-equip with Rapier, a short range surface to air guided missile system. Some of the Phantom FGR squadrons stationed in Germany from July 1970 onwards have a dual capability and can be used for air defence operations in an emergency.

AIR DEFENCE IN THE SEVENTIES

Disbandment of Fighter Command

When the re-organisation of Fighter Command was completed in December 1966 with the disbandment of Nos. 11 and 12 Sectors the establishment of front line aircraft had contracted to five squadrons of Lightnings (60 aircraft).⁹⁰ Other changes included disbandment of the Central Fighter Establishment on 31 January 1966, but the trials element of CFE and the Air Fighting Development squadron were combined to form a trials unit which remained at Binbrook. The remainder of CFE's functions were absorbed in a new tactics branch at HQFC. A small element of the Day Fighter Combat School reconstituted on 1 November 1965 as the Weapons Instructor Flight at 229 OCU RAF Chivenor took over advanced specialised training in the fighter role.

Centralisation of command and control of the air defence forces in Britain at HQFC was, however, to have a relatively short existence. On 16 June 1967 plans for improving the command structure of the RAF in the United Kingdom were announced.

In April 1968 Fighter and Bomber Commands were to merge into a new formation called Strike Command: the Headquarters of Fighter Command at Bentley Priory was to become No. 11 (Fighter) Group. The reduction of Fighter Command to Group status was only one of a number of changes in the country's future defence policy announced by the Government in 1966 and 1967.

The purpose of the Government's Defence Review instituted in 1964 was to release the strain imposed on the economy by military expenditure and formulate a new programme for the 1970s.⁹¹ In air defence, the RAF's responsibilities were to be widened and the fighter force re-equipped. Land based aircraft would take over the maritime air defence role (much reduced after the mid 1970s) and a combination of Phantoms purchased from America and P1127s (Harrier) replace the Hunter a ground attack aircraft. Later a strike version of the Anglo-French Jaguar would replace Phantoms to replace the Lightning.⁹² Until then the UK Lightning force would remain established at five squadrons equipped with either Mk 3s or the recently developed Mk 6, the first of which arrived at Binbrook on 1 April 1966. As Phantoms were not to be earmarked on HMS EAGLE as originally intended it was decided to transfer some of the naval fighters to the RAF and form a FG Mk 1 squadron, primarily to offset the reduced carrier-borne fleet air defence capability resulting from keeping Sea Vixens in HMS EAGLE.⁹³ When in the future the carriers were phased out – probably in 1972 – the RAF would take over the remainder of the FG1 force and form further land based squadrons which would be primarily identified with the maritime task. The first RAF Phantom FG1 squadron was to be based at Leuchars.

On 30 April 1968 Fighter and Bomber Commands merged to form Strike Command. Five days earlier a fly-past to mark the disbandment of Fighter Command took place at Bentley Priory. Aircraft from all units in the Command took part; there were 24 Lightnings, four Hunters, three Meteors and one Canberra, followed by a formation of Hurricanes and a solitary Spitfire.

⁹⁰ The last Javelin squadron in Fighter Command was re-deployed to FEAF on 1 April 1965.

⁹¹ Statement on Defence Estimates 1966 Cmd 2901.

⁹² Ibid

⁹³ QLR 86

Introduction of Phantoms in the Air Defence Role

The first British order for Phantoms was in July 1964 for a deck landing version for the Royal Navy, but in June 1965 – following the cancellation of the P1154 – it was decided to order Phantoms for the RAF. Two types came into service: the FG1 (the version used by the Navy for air defence), and the FGR2 for ground attack/fighter reconnaissance. Both the RN and RAF aircraft differed from their American counterpart in having Rolls Royce Spey turbo-fans in place of General Electric engines. Capable of M2.1 at 40,000 ft and flying supersonically at tree-top height the FG1 has a service ceiling comparable with the Lightning but can fly further without refuelling; armament is four Sparrow air-to-air radar guided missiles and four Sidewinder air-to-air infra red missiles. Two man crews for the first RAF Phantom FG1 squadron were trained by the Royal Navy at RN Air Station Yeovilton during 1969 and No. 43 Squadron formed at RAF Leuchars on 1 September 1969.

Airborne Early Warning (AEW)

A study instituted by the Ministry of Defence in 1967 to determine the requirements of future air defence systems concluded that from about 1976 the low level threat to NATO land and maritime forces in the European theatre would best be countered by the provision of an airborne early warning system (AEW) in combination with fighter aircraft and linked with the NATO Air Defence Ground Environment (NADGE).⁹⁴ Development of a suitable AEW radar was estimated to take up to seven years and the cost of this programme such as to make a multi-national basis for it highly desirable. These factors alone meant that under the plan to phase out strike carriers in 1972 there would be an interim period of some four or five years when the RAF would be required to provide AEW coverage from land bases for the Fleet at sea.⁹⁵ In addition to the maritime requirement the re-appraisal of the low level threat to the United Kingdom showed that while cover from land based radars was adequate to detect medium and high level penetrations there were serious gaps at low altitude. Cover from AEW aircraft would help fill these and an interim system had to be devised rapidly. Among a number of possible solutions the most practical one was to install the Naval Gannet radar (APS 20) in Shackleton Mk 2s about to be replaced in the maritime role by Nimrods.

The AEW Shackleton flew for the first time on 30 September 1971 and twelve aircraft were scheduled for modification. On 8 January 1972 No. 8 (AEW) Squadron formed at Kinloss making military history by becoming the first airborne early warning squadron in the RAF. With four or five times the endurance of the Gannet and carrying a bigger crew the Shackleton can remain on task for about eight hours depending on the distance it has to go to its patrol line. Not only does its radar provide increased early warning of attack, particularly at low level but in the event of the controlling authority (either on land or at sea) not being able to see the incoming raid on their radars, the Shackleton can control intercepting fighters. Its ability to see both target and intercepting aircraft has another application. It can be used to guide strike aircraft at low level below enemy radar cover obviating the need for them to use their own equipment and thus reducing the chances of detection.

⁹⁴ QLRs 90 and 91.

⁹⁵ The subsequent decision to retain HMS Ark Royal in service until 1978 did not affect the requirement for an AEW aircraft.

Withdrawal East of Suez

The intention to withdraw British Forces from Malaysia and Singapore by the mid-1970s (later advanced to the end of 1971), while retaining a general capability to deploy forces overseas when required, highlighted the important attribute developed by fighter aircraft of rapid long-range re-deployment between bases. All squadrons had been equipped for flight re-fuelling by mid-1967, overseas reinforcement exercises were a regular occurrence and by December 1969 Lightnings were being flown to FEAF with only one stop (at Masirah). They had also visited the United States with a non stop Atlantic crossing and Lightnings from FEAF had flown direct from Singapore to Australia (Tengah to Darwin) supported by Victor tankers. The routine nature of these flights was only made possible by the high standard of training achieved by fighter and tanker crews. This made possible the biggest air-to-air refuelling mounted by the RAF up to January 1969 when 166,000 gallons of fuel were transferred to ten Lightning Mk 6's of No. 11 Squadron in 228 air re-fuelling contacts during a flight from the United Kingdom to FEAF.

But time for the Hunters and Lightnings in the Far East was running out. On 18 February 1970 No. 20 Squadron (Hunters) disbanded followed by No. 74 (Lightnings) on 18 August 1971. HQ FEAF closed on 1 November 1971. By 21 December British Forces had also withdrawn from the Persian Gulf but Masirah was retained as a staging post.

RAF Fighters in the 1970s

The decision to retain HMS Ark Royal in commission until 1978 meant a delay in the formation of more RAF Phantom FG1 air defence squadrons. However as Jaguars become available for strike and close support operations the Phantom FG2s they replace will be re-assigned to air defence. Thus until an interceptor version of the Multi-Role Combat Aircraft (MRCA) is made available, air defence in the UK and Germany will be largely Phantom orientated.

As before, the fighter squadrons in Britain will be controlled from the Air Defence Operations Centre, which moved from its underground bunker at the old Fighter Command HQ to a new location at Headquarters Strike Command, High Wycombe, on 1 March 1971.

Date	11 Group					12 Group					13 Group					
	Sector	Sqn & Role	Location	Aircraft	Est	Sector	Sqn & Role	Location	Aircraft	Est	Sector	Sqn & Role	Location	Aircraft	Est	
31 Dec 59	Metropolitan (Kelvedon Hatch)	41 DFSR	Biggin Hill	Hunter F2/5	16	Western (Longley Lane)	56 DFSR	Waterbeach	Hunter F5	16	Caledonian (Barton Quarry)	264 NAW	Linton-on-Ouse	Meteor NF12/14	16	
		600 DFSR	Biggin Hill	Meteor F8	8		63 DFSR	Waterbeach	Hunter F6	16		607 DFSR	Ouston	Vampire FB5	8	
		615 DFSR	Biggin Hill	Meteor F8	8		253 NAW	Waterbeach	Venom NF2	16		608 DFSR	Thornaby	Vampire FB5	8	
		64 NAW	Duxford	Meteor NF12/14	16		257 DFSR	Wymeswold	Hunter F2/5	16		29 NAW	Acklington	Meteor NF11	16	
		65 DFSR	Duxford	Hunter F6	16		263 DFSR	Wymeswold	Hunter F6	16		44 DFSR	Leuchars	Hunter F4	16	
		111 DFSR	North Weald	Hunter F6	16		504 DFSR	Wymeswold	Meteor F8	8		222 DFSR	Leuchars	Hunter F4	16	
		601 DFSR	North Weald	Meteor F8	8		616 DFSR	Worksop	Meteor F8	8		151 NAW	Leuchars	Venom NF3	16	
		604 DFSR	North Weald	Meteor F8	8		502 DFSR	Aldergrove	Vampire FB5	8		602 DFSR	Abbotsinch	Vampire FB5	8	
		25 NAW	West Malling	Meteor NF12/14	16		605 DFSR	Honiley	Vampire FB5	8		612 DFSR	Dyce	Vampire FB5	8	
		85 NAW	West Malling	Meteor NF12/14	16		610 DFSR	Hooton Park	Meteor F8	8		603 DFSR	Turnhouse	Vampire FB5	8	
		153 NAW	West Malling	Meteor NF12/14	16		611 DFSR	Hooton Park	Meteor F8	8						
	500 DFSR	West Malling	Meteor F8	8	613 DFSR	Ringway	Vampire FB5	8								
	MRS	Martlesham Heath				MRS	Horsham St Faith				MRS					
	31 Dec 59	Bawdsey Wartling	64 AWF	Duxford	Javelin FAW7	16	Neatishead Patrington	23 AWF	Coltishall	Javelin FAW7	16	Boulmer Buchan	66 DFSR	Acklington	Hunter F6	12
			65 DFSR	Duxford	Hunter F6	12		74 DFSR	Coltishall	Hunter F6	12		29 AWF	Leuchars	Javelin FAW6	16
			85 AWF	West Malling	Javelin FAW2/6	16		19 DFSR	Leconfield	Hunter F6	12		43 DFSR	Leuchars	Hunter F6	12
			41 AWF	Wattisham	Javelin FAW8	16		72 AWF	Leconfield	Javelin FAW4	16		151 AWF	Leuchars	Javelin FAW5	16
			56 DFSR	Wattisham	Hunter F6	12		1 DFSR	Stradishall	Hunter F6	12		33 AWF	Middleton-	Javelin FAW7	16
			111 DFSR	Wattisham	Hunter F6	16		54 DFSR	Stradishall	Hunter F6	12		92 DFSR	-St-George	Hunter F6	12
				Ouston				25 AWF	Waterbeach	Javelin FAW9	16					
								46 AWF	Waterbeach	Javelin FAW2	16					
31 Aug 61			Boulmer Buchan Patrington	19 F	Leconfield	Hunter F6		12	Bawdsey Trimingham	23 F	Coltishall		Javelin FAW9	16	Disbanded 1 January 1961	
	29 F	Leuchars		Javelin FAW9	16	74 F	Coltishall	Lightning F1		12						
	151 F	Leuchars		Javelin FAW5	16	64 F	Waterbeach	Javelin FAW9		16						
	33 F	Middleton-		Javelin FAW9	16	25 F	Waterbeach	Javelin FAW9		16						
	92 F	-St George		Hunter F6	12	1 F	Stradishall	Hunter GA9		12						
	94 ADM	Misson		Bloodhound I	32	54 F	Stradishall	Hunter GA9		12						
	112 ADM	Breighton		Bloodhound I	32	41 F	Wattisham	Javelin FAW8		16						
	247 ADM	Carnaby		Bloodhound I	32	56 F	Wattisham	Lightning F1A		12						
	264 ADM	North Coates		Bloodhound I	32	111 F	Wattisham	Lightning F1A		12						
	141 ADM	Dunholme Lodge		Bloodhound I	32	8 F	West Raynham	Javelin FAW8		16						
	222 ADM	Woodhall Spa		Bloodhound I	32	62 ADM	Woolfox Lodge	Bloodhound I		32						
				257 ADM	Worksop	Bloodhound I	32									
				263 ADM	Watton	Bloodhound I	32									
				242 ADM	Marham	Bloodhound I	32									
				266 ADM	Rattlesden	Bloodhound I	32									

Nos 11 and 12 Groups dis-established 1 April 1963 and replaced by Nos 11 (Northern), No 12 (East Anglian) and No 13 (Scottish) Sectors. No 13 Sector was disbanded on 1 April 1965 and Nos 11 and 12 Sectors in November and December 1965.

Date	11 Group					12 Group					13 Group				
	Sector	Sqn & Role	Location	Aircraft	Est	Sector	Sqn & Role	Location	Aircraft	Est	Sector	Sqn & Role	Location	Aircraft	Est
			Headquarters Fighter Command Stanmore												
31 Dec 66	Boulmer	5 F	Binbrook	Lightning F6	12										
	Neatishead	23 F	Leuchars	Lightning F3	12										
	Pattrington	74 F	Leuchars	Lightning F6	12										
		56 F	Wattisham	Lightning F3	12										
		111 F	Wattisham	Lightning F3	12										
		25 SAM	North Coates	Bloodhound II	24										
		41 SAM	West Raynham	Bloodhound II	36										
		112 SAM	Woodhall Spa	Bloodhound II	12										
			11 Group Stanmore												
1 Jul 70	Boulmer	5 F	Binbrook	Lightning F6	12										
	Pattrington	11 F	Leuchars	Lightning F6	12										
		23 F	Leuchars	Lightning F6	12										
		43 F	Leuchars	Phantom GF1	10										
		29 F	Wattisham	Lightning F3	12										
		111 F	Wattisham	Lightning F3	12										
		41 SAM	West Raynham	Bloodhound II	36										

NOTES:

1. Derived from Stats Forms 603 and Command Orders of Battle.
2. Fighter and Bomber Commands merged on 30 April 1968 to form Strike Command.
3. Squadrons on cadre strength.

Date	NW Europe				Mediterranean				Middle East				Far East				
	Sqn & Role	Location	Aircraft	Est	Sqn & Role	Location	Aircraft	Est	Sqn & Role	Location	Aircraft	Est	Sqn & Role	Location	Aircraft	Est	
31 Dec 59	No 83 Group Wahn (continued)																
	3 DFGA	Geilenkirchen	Hunter F4	14													
	234 DFGA	Geilenkirchen	Hunter F4	14													
	68 NAW	Wahn	Meteor NF11	16													
	87 NAW	Wahn	Meteor NF11	16													
									8 DFGA	Khormaksar	Hunter FGA9	12	60 AWF	Tengah	Meteor NF14	12	
									208 DFGA	Khormaksar (det Eastleigh)	Venom FB4	12					
	31 Aug 61																
5 F		Laarbruch	Javelin FAW5	12	43 GA	Nicosia	Hunter GA9	12	8 GA/FR	Khormaksar	Hunter GA9	12	60 F	Tengah	Javelin FAW9	16	
11 F		Geilenkirchen	Javelin FAW4	12									4	Kai Tak	Venom FB4	3	
14 F		Gutersloh	Hunter F6	16					208 GA	Eastleigh	Hunter FR10	12					
4 FR		Gutersloh	Hunter FR10	8							Hunter GA9	12					
2 FR	Jever	Hunter FR10	8														
31 Dec 66																	
	92 F	Geilenkirchen	Lightning F2	12	29 F	Akrotiri	Javelin FAW9	12	8/43 GA	Khormaksar	Hunter GA9	24	20 GA	Tengah	Hunter GA9	16	
	19 F	Gutersloh	Lightning F2	12					208 GA	Muharraq	Hunter GA9	12	60 F	Tengah	Javelin FAW9	12	
	2 FR	Gutersloh	Hunter FR10	8									64 F	Tengah	Javelin FAW9	12	
	4 FR	Gutersloh	Hunter FR10	8									28 GA	Kai Tak	Hunter GA9	3	
													33 SAM	Butterworth	Bloodhound	32	
													65 SAM	Seletar	Bloodhound	36	
1 Jul 70																	
	92 F	Gutersloh	Lightning F2A	12	56 F	Akrotiri	Lightning F3	12	8 GA/FR	Muharraq	Hunter GA9	8	74 F	Tengah	Lightning F6	12	
	19 F	Gutersloh	Lightning F2A	12	112 SAM	Episkopi	Bloodhound II	12			Hunter FR10	4					
	25 SAM	Laarbruch	Bloodhound II	16					208 GA	Muharraq	Hunter GA9	12					

NOTE: Derived from Stats 603 and Command Orders of Battle