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The key to success during the Battle of Britain was the established Command and Control system of RAF Fighter Command; the 'Dowding System'. Andy Saunders describes how it worked and how the 'Few' were controlled from the ground.

ABOVE Observer Corps plotters at an Observer Corps Group HQ track a German raid as reports come in from observer posts. he classic war film 'Angels-one-Five', starring Jack Hawkins and Dulcie Gray, tells the fictional story of a RAF fighter squadron during the Battle of Britain; its title simply a reference to wireless telephony code for the fighter controller's instruction for the fighters to climb to an altitude of 15,000ft. Interestingly, actor Ronald Adam played the fighter-controller in this film – thus reprising a role that he had *actually* played in 1940 as Fighter Controller at RAF Hornchurch. Quite possibly, no actor had ever been more appropriately cast! For Ronald Adam, of course, the whole panoply of the command and control system was no mystery – but doubtless it is the case that watchers of films and documentaries have wondered how it all worked when WAAFs push markers around large map boards and unintelligible orders are barked to the airborne squadrons.

In the air defence of the UK during the Battle of Britain, RAF Fighter Command was the sharp end of that defence, but the whole operation depended on an early warning system reliant upon radar and the Observer Corps. The information provided from these sources was disseminated up through the command and control system, enabling fighter squadrons to be directed onto incoming raids. But that is an oversimplification of how it all worked.

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THE DOWDING SYSTEM

'All the ascendancy of the Hurricanes and Spitfires would have been fruitless but for this system which had been devised and built before the war. It had been shaped and refined in constant action, and all was now fused together into a most elaborate instrument of war, the like of which existed nowhere in the world.'

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- Winston S Churchill, War Memoirs, Vol IV

Britain's system of early warning, interception and control was called the 'Dowding System' after the C-in-C of RAF Fighter Command who instigated its planning and implementation in the years running up to the war. The first of its kind in the world, the system comprised a network which stretched from the Northern-most parts of Scotland down to the South Coast of England and whilst the inner workings of RAF Fighter Command's system of command and control remained a closely guarded secret a surprising public glimpse of the system was given in 1941 in the illustrated HMSO booklet 'The Battle of Britain: August – October 1940', which printed an outline of the system. However, the schematic diagram was somewhat economical in detail and, importantly, left one particular element out of the explanation as to how the organisation worked; radar. And it was upon radar the whole system of earlywarning, interception and control was based.

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Although the Germans were aware of radar and using systems of their own,

their failure to understand its role within the command and control structure of RAF Fighter Command placed them at a serious disadvantage. However, they were aware of the chain of stations that sprang up around Britain's coast during the late 1930s sporting huge arrays of aerials and concrete bunkers. Although they appreciated these sites were significant, they did not understand to what extent. For this reason, their concentration of attacks on them was somewhat piecemeal. That said, the few attacks mounted on them did result in stations being knocked off the air, >>

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albeit temporarily. Had sustained attacks been made, then Fighter Command could have effectively been 'blinded' with the outcome certainly being different. As it was, the Luftwaffe could not 'see' their efforts and realised the towers were impossible to topple and the hardened structures difficult to hit. This, however, overlooked the fact that infrastructure (power supplies and communications) were being hit and stations disabled, even if no visible sign of damage was evident.

RADIO DIRECTION FINDING RADAR

The keystone was a network of R.D.F (radar) stations, and in the summer of 1940 the radar chain consisted of 22 "chain home" (C.H) stations, supplemented by 30 "chain home ABOVE RAF and WAAF personnel at a Chain Home radar station receiver room feed incoming information through to the Filter Room at

Fighter Command

HQ

BELOW One of the Chain Home radar

stations which were vital to the RAF's ability to detect incoming raids. low" (C.H.L) stations for detecting low-flying aircraft. These stations were positioned to ensure that, in theory, every aircraft approaching the British Isles from the east, south, or south-west would be detected by at least two stations.

The C.H. stations were capable of detecting aircraft at ranges of 100 to 200 miles, but in practice their performance was limited by atmospheric conditions, the skill of the individual operators, the height at which the enemy flew and the presence or absence of echoes from friendly aircraft or natural features. Accurate location of approaching raids at distances of 60 to 80 miles or more from the coast was not uncommon. Estimates of strength, although often vague, became more reliable as the range shortened.

All of the stations (except those in Fighter Command's 10 Group area),

passed information by direct landline to the underground Filter Room at RAF Bentley Priory where it was sorted and disseminated.

THE OBSERVER CORPS

Although the radar stations had some weaknesses in their operation, and in interpretation of results, it was also the case that they had one major shortfall; a fixed line of sight. In other words, they could only 'see' in the fixed direction the radar was aimed. This was away from the coast and towards the anticipated approach of threats. In other words, once a threat had passed overhead, and was inland and behind, then they became invisible to radar. From this moment on, approaching threats were monitored visually (or audibly at night or in poor visibility) by a network of ground-based observers; the Observer Corps.

The Corps was by no means new in 1940. Their history went back to the First World War when the RNAS was responsible for Britain's home defence. It was the duty of the local Police to act as observers and report to the Admiralty any sightings of enemy aircraft. It was not until 1921 that a civilian group of 'observers' were given the title Observer Corps; a title that was to stay with them when Dowding took over Fighter Command in 1936.

Dowding saw their importance and immediately ensured they worked within the air defence system in conjunction with RDF Stations. Whilst the task of RDF was to detect hostile aircraft whilst still out to sea, the job of the Observer Corps to track them once they were over land. However, the Observer Corps were much more highly trained whilst operating under the general aegis of Fighter Command than they had been in the First World War. Lectures in aircraft recognition became mandatory, as did lessons in judging aircraft height.

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Although not equipped with elaborate instruments, it was mainly enthusiasm, an aircraft recognition chart, a pair of binoculars and simple sighting instruments that were the tools with which this dedicated band tackled their vital duty.

Once radar had picked up a plot and the information passed on to the Filter Room at Fighter Command HQ, the Group Operations Room contacted the **Observer Corps Command Centres** who in turn notified small Observer Command Posts scattered at between six and ten miles apart along the coastline where it was calculated the enemy formation would be sighted. As soon as the call was received, the post, normally manned by three to five men, would scan the skies with their binoculars and keep a keen ear out for the sound of aircraft engines. In inclement weather or low cloud, visual sighting was almost an impossibility and detection could only be made by sound.

Once sighted, the observers had to detect the types of aircraft in the formation, how many, the heading they were taking and their height. All these factors were vital, because it would be the picture they presented which gave RAF Fighter Sector Stations an overview of the immediate situation. Unlike radar stations that gave Fighter Command HQ their sighting and contact first, the Observer Corps gave details of their first sighting to the Sector Station in their area so that fighters could be 'SCRAMBLED' as soon as possible. The observers would give the type of aircraft by name and were trained to observe formations and accurately estimate strengths, reporting as: '50 plus' or '100 plus' etc.

FIGHTER CONTROL

Essentially, there were three levels of Operations Rooms in RAF Fighter Command during 1940: Command, Group and Sector. Each had clearly





ABOVE The Operations Room at Fighter Command HQ.

ABOVE RIGHT Operations Room staff at Bentley Priory made decisions that were fed as orders through to Group HQs and also determined when civilian air raid warnings should be sounded.

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The preserved underground

operations room

at Uxbridge, HQ of

11 Group, which is

frozen in time as it

was at 11.30 on 15 September, 1940.

defined purposes and functions which allowed information and orders to cascade down, but was reliant upon information being relayed back up the system via its eyes and ears (RDF and Observer Corps) in order to allow it to function in the first place. Without that information no orders or instructions could be disseminated, and although the hierarchy of command should ordinarily dictate that the Fighter Command Operations Room should be at the top of the tree it would be more appropriate to look, first, at the point from which every direction from Command and Group Operations Rooms originated. This then fed down to Sector Operations Rooms so that direct defensive fighter action could be ordered and controlled. The point of entry for this raw information from RDF and the Observer Corps was The Filter Room.

FILTER ROOM

The accuracy of filtering is of vital importance. At only one point in the whole vast network of the radar system does the information collected and forwarded by the radar chain assume a tangible form on which fighter action may be taken.'

- Air Ministry File S.47071, Minute 68 The Filter Room at HQ Fighter Command, Bentley Priory, was the most important link in the whole air >>



defence command and control chain, this importance succinctly set out by the Air Ministry in its minute (above) which established its vital significance. In broad terms, it was here that all incoming information was channelled for assessment and action. (This was on a country-wide basis, except for 10 Group which passed the information to the Western Filter Room in 10 Group's area) The information was that received from RDF stations, Observer Corps centres as well as RAF Direction Finding stations that were plotting the movements of friendly aircraft. The information was displayed on a gridded map and passed by tellers through closed speech circuits to the adjacent Command Operations Room and to the operations rooms of appropriate Groups and Sectors. Usually, about four minutes divided first observations by radar operators from the appearance of corresponding plots in operations rooms.

The mass of incoming and everchanging information was quickly assessed and interpreted by Filter Room staff and passed, simultaneously, to the Command Operations Room and Group Operations Rooms for dissemination and orders. Upon judgements and ABOVE Plotters and tellers at the 11 Group Headquarters Operations Room. assessments made in the Filter Room rested decisions made by Fighter Controllers for the deployment of fighters.

FIGHTER COMMAND OPERATIONS ROOM

In 1925 the Air Ministry purchased Bentley Priory at Stanmore, Middlesex, and by May 1926 had established it as the RAF's Inland Area HQ. However, on the formation of Fighter Command in 1936 it was given over to that organisation and the construction of two temporary Filter and Operations Rooms. They were to be the centre of the 'hub' that was 'The Dowding System'. However, an enormous excavation just to the East of the main buildings was commenced in January 1939 for the underground command centre. The excavation reached 42 feet and reinforced concrete encased the underground rooms with the whole complex having its own services, air filtration and gas tight doors. It was completed in March 1940, just in time for the Battle of Britain.

Whilst the Fighter Command **Operations Room at Bentley Priory** might be considered the nerve centre of the Battle of Britain it was, in reality, Group and Sector Operations Rooms which more actively controlled the battle. That said, the Command Operations Room gave the C-in-C (or a nominated senior officer) an immediate overview of the whole situation, Group by Group, Sector by Sector. From his gallery position the C-in-C could view the overall progress of battle whilst looking down on the General Situation Map (GSM) marked out in the British Modified Grip and with its constantly changing display of counters and markers being moved around by RAF and WAAF personnel. However, there were two important functions carried out by the Command Operations Room.

The first of these was to allocate specific raids to the appropriate Group, and to then designate the raid to that Group. Once handed on, then the relevant Group's Operations Room would, in turn, delegate to the appropriate Sector or Sectors and theirown Operations Rooms.

RIGHT

Actor Ronald Adam played the role of Fighter Controller in 'Angels-one-Five' - a role that he played for real at RAF Hornchurch in 1940.

BELOW

One of the General Situation Map markers; this one indicates the height of 20 aircraft of the Spitfire-equipped 72 and 92 Sqns.



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The other function carried out by the Command Operations Room was to operate the National Air Raid Warning System. This covered the whole of the country (with the exception of the Orkneys and Shetlands) which was divided up into 130 'Warning Districts' determined by regional layouts of telephone networks. The officer responsible for ordering the warning to be issued could watch threats unfolding on the GSM and determine which districts were at risk.

GROUP OPERATIONS ROOM

In effect, the Group Operations Room was a scaled-down version of the Command Operations Room, but it was from here that an overall decision was taken as to which squadrons to allocate to each raid, and when. From his gallery overlooking the General Situation Map the Group Commander (or his nominated deputy officer) could see the incoming raids unfolding in his particular group. He also had to hand information relating to the availability of aircraft and pilots and their status on a regularly updated basis. Additionally, he had information as to convoys passing through his sea area and could duly allocate squadrons to provide fighter protection. It was here, then, that the detail of the battle began to be managed in terms of which squadrons to send where.

When a decision had been made, this information was flashed to the Sector Operations Room which the Group Controller considered was best-placed to counter the threat. Already, Fighter Controllers at Sector Stations would be watching the plots unfold on their own GSM's and would begin to anticipate the likely instructions from Group. Thus, when the order came, controllers would be ready to act.

Today, the perfectly preserved underground 11 Group Operations Room is to be found at Uxbridge, its GSM and plots 'frozen in time' exactly as they were at 11.30am on Sunday 15 September 1940; Battle of Britain Day.

SECTOR OPERATIONS ROOM

The Sector Operations Room was a further scale-down from the Group Operations Room. The same principals of the overall operating methodology applied, although at this level the Sector Controller was only interested in controlling his fighters onto the raids as directed from the Group Operations Room. However, the Sector Controller was also being fed back real-time information on the plots on his table



ABOVE

The Sector **Operations** Room at RAF Duxford in 1940. Now part of the Imperial War Museum, this operations room is also preserved exactly as it was during the Battle of Britain

direct from Observer Corps posts. Thus, he was working with up to the minute information to better enable him to control his fighters.

Today, preserved examples of Sector Operations Rooms exist at Imperial war Museum, Duxford, (formerly RAF Duxford) and at the former RAF Digby. These two Operations Rooms had been built during the interwar period and were single storey brick buildings with

Rooms to remote locations >>

R AF OPERATIONS ROOM CLOCK

Central to the function of all RAF operations rooms was the Colour Change Clock, Standard twelve-hour mechanical clocks, the faces were painted with coloured segments of red, yellow and blue in each 15 minute block.

The purpose of the colour segments was:

To provide a rough indication of the age (in minutes) of the plots shown on the table.

To provide for regular removal of out-of-date plots and tracks.

A plotter would receive information regarding the position and direction of flight and strength (i.e. number of aircraft) and the height of the aircraft or formation, together with a designation or identity number that had been allocated to that aircraft or formation.

A typical report might be:- Hostile 15-20+ Height 10,000 feet.

The plotter would then place arrows on the map indicating 'visual' plots obtained by sight or by radar, coloured to match the corresponding segment on the clock and in the order: red - yellow - blue. Once the blue segment was reached, then the red arrows would be removed, thereby ensuring that no plot was more than ten minutes old, and so-on, as the clock moved into the next fifteen minute guarter. Raid designations shown on three tiered plaques placed adjacent to the track of

- arrows were usually:
- Black H on yellow = Hostile

Black X on yellow background = Unidentified Red F on white background = Friendly

Additionally, other markers would be placed to follow the RAF squadrons. These included a 'flag' marked with the squadron number, and removable numbers that indicated the height and number of aircraft in that formation. In the case of the marker illustrated we are looking at a formation from 65 Squadron (Spitfires) flying at 20,000 ft, comprising nine aircraft.

The Controller, positioned on a balcony overlooking the table, could then talk his fighters into position to intercept the enemy.





a pitched roof and protected only by the

bank and retaining wall extending up to

later addition of a blast wall; an earth

The unsuitability of these almost

unprotected Operations Rooms on

Sector airfields soon became apparent

and their vulnerability pointed up the

need to move these Sector Operations

eaves level.

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away from the airfields themselves. However, new 'L' shaped Operations Rooms were built and ready for the battle at Tangmere, Hornchurch and North Weald whilst that at Middle Wallop was completed during the battle itself. Meanwhile, Kenley, Duxford, Northolt and Biggin Hill all had to make do with the pre-war buildings although it wasn't long before the RAF re-located these vital centres away from the airfields.

How it worked at Sector level is best described by Sqn Ldr Anthony Norman, one of the Kenley Sector's Fighter Controllers during the Battle of Britain:

'By the summer of 1940 the system was well oiled and we were confident of its ability. Really, I believed that nobody could come inland without being seen by some element of our system and I had absolute confidence in our ability to intercept anything that crossed the coast.

As soon as the first plots appeared I called our fighters held at AVAILABLE to READINESS. There wouldn't be any SCRAMBLE yet, and it was the Group Controller's responsibility to decide which squadron to use to intercept which raid. When that decision had been made, the order would be passed to the Sector Operations Room, but already I'd been watching the situation building on the map table. The first thing I'd see would be a raid counter appear on the map, but this would only give me the estimated number of aircraft, and their height. I'd have no idea if fighters or bombers. Or both. So, when I was eventually ordered by 11 Group to SCRAMBLE such-and-such squadron this would be the squadron that had been first called to READINESS, and Group would be able to see from their state board which squadron that was.

Observer Corps observers plot an incoming German raid and feed the details direct to the Fighter Controllers at RAF Sector

ABOVE

Stations

was my job to direct the CO not only to the interception but to get him up-sun if possible. I would not aim to go straight at the German formation, but instead try to climb at a slight angle away from the raiders and position the fighters so that they could then turn round and attack out of the sun. As a constant reminder, the position of the sun at any time was marked up on a blackboard facing me, with the raid details repeated along with the positions of our fighters.

Once I had ordered a squadron off, it

T ERMINOLOGY

After controlling them onto the engagement, our job was pretty much all but done, although it would often be the case that there would another raid to immediately control other fighters in the Sector on to. The policy of 11 Group was to have the first squadrons back on the ground re-fuelling and re-arming as the last squadrons were taking off. In theory, this made it possible to meet all raids and very seldom were there absolutely no fighters available although there was the now famous occasion when Winston Churchill visited the 11 Group Operations room and asked Park the question 'Reserves?' only to be told 'There are none, Sir.'

Overall, it was a really good system. Along the way we tinkered with it, but the basic control arrangements in place at the start of 1940 worked efficiently throughout the Battle of Britain.'

Ronald Adam would have surely agreed with his contemporary. Anthony Norman, on the system's efficiency when he issued his 'Scramble Dogrose Squadron, make Angels One-Five, Vector two-three-zero. Buster', with his plotters shuffling coloured pieces around the table until the fighter leader finally called: 'Tally-Ho!'

Hopefully, the reader can now make some sense of all of this when they next see a Battle of Britain documentary or film, or else view the now iconic images of RAF Operations Rooms. 📀

A range of code-words was used during the Battle of Britain during air operations, known as 'The Fighter Code'. These were code words for specific actions. They are set out in an order in which they might typically be issued:

Take off and set course immediately:	SCRAM
Climb to:	ANGEL
Alter Course to:	VECTO
Increase speed to normal full speed:	BUSTE
Increase speed to maximum full speed:	GATE
Reduce speed to normal cruising speed:	LINER
Circle and search:	ORBIT
Enemy:	BANDI
Unidentified aircraft:	BOGY
Enemy sighted:	TALLY
Return and land:	PANCA

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NOTE: Additionally, squadrons were never referred to by their number - always by their established code name; eg FIBUS, MYTOR, GANNIC, DOGROSE etc.

