BATTLE OF BRITAIN

# PIVOTAL TACTICS

## *BEHIND THE LEGENDARY BATTLE OF BRITAIN*

BY **BARRETT TILLMAN**

In the classic 1969 movie The Battle of Britain, Air Chief Marshal Hugh Dowding (Sir Lawrence Olivier) reviews the impending clash with a cabinet minister. After an unsatisfactory discussion, the minister exasperates, “So I tell the cabinet that you’re trusting in radar and praying to God?”

Dowding retorts, “More the other way around. I’m trusting in God and praying for radar.”

The basis for that prayer was laid long before a swastika-bearing aircraft entered British airspace.


**Although the Spitfire is seen in a starring role in the Battle of Britain, the Hurricane actually did much of the heavy lifting: there were significantly more Hurricanes in the fight than Spitfires. However, both were overwhelmingly outnumbered by Luftwaffe forces. (Photo by John Dibbs/planepicture.com)**

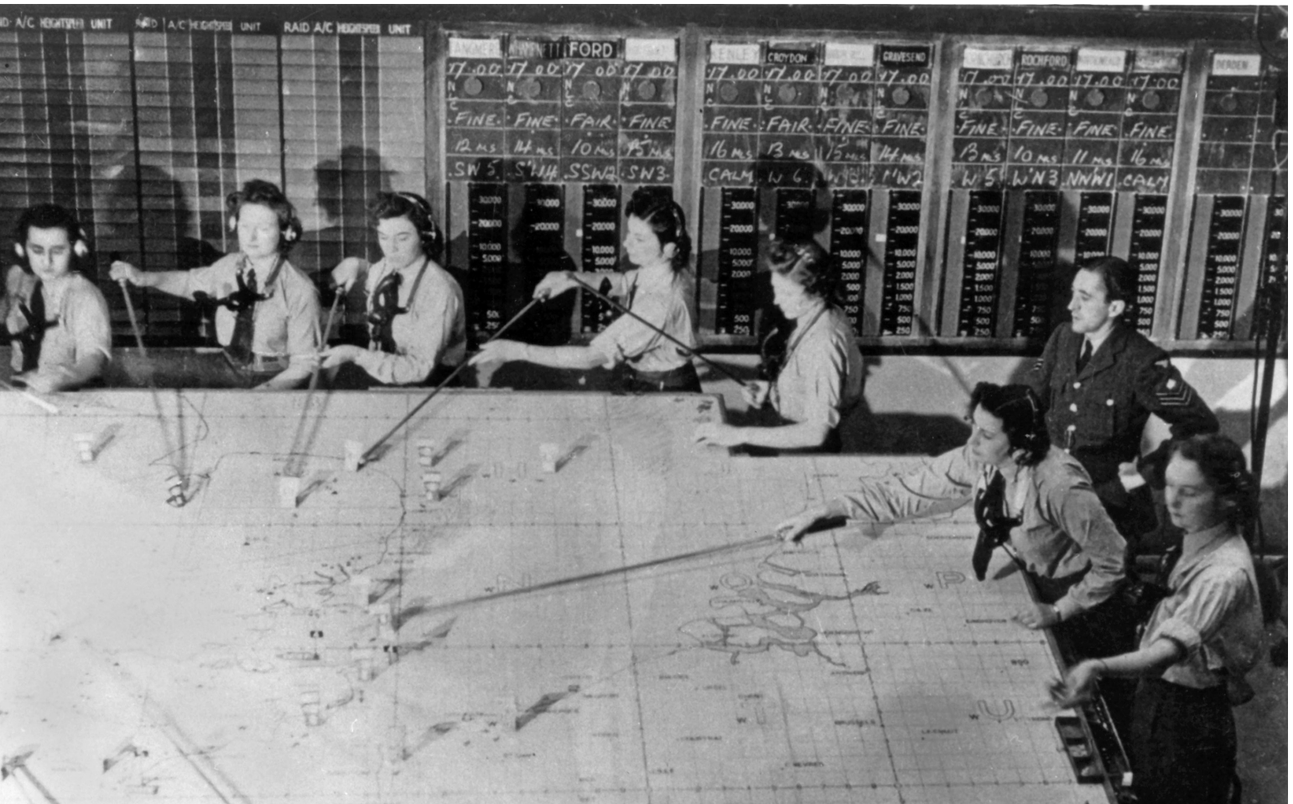
It's uncertain that the Battle saved Britain from invasion, for two reasons. First, although Hitler's generals drafted the plan for Operation Sea Lion, his willingness to commit to the world's largest amphibious operation is dubious. The Fuhrer believed in a bond among Anglo-Saxons, and his geo-strategic goal was the destruction of the Soviet Union. It seems more likely that Hitler hoped the threat of invasion would compel a cease-fire with Britain, freeing him to concentrate eastward.

Second, even granting the will, Germany lacked the ability to conduct "Overlord in reverse." With too few amphibious craft—especially those with bow ramps to offload heavy vehicles—Hitler would have needed to seize one or more major ports intact. That was extremely unlikely, even assuming that the Wehrmacht achieved both air and naval superiority.

But one thing is clear. Radar—a new, still-evolving technology—emerged a major player on the global stage. It permanently changed the way air operations were conducted, spreading its electronic ripples throughout the world's air forces, navies, and armies.

Yet for all the focus on the first radar war, other factors were essential. The most overlooked was communication—not only reliable two-way radio, but secure phone lines for coordination of Britain's overall defense network. In that regard, Guglielmo Marconi and Alexander Graham Bell were as important as Robert Watson-Watt.

Other factors were technical and organizational: high-performance fighter aircraft, high-octane fuel to propel them, bases and maintenance, and an integrated air-defense establishment. All predated the onset of war, some by narrow margins.




**The RAF's ability to gather information from radar sites, but more importantly from aircraft spotters scattered throughout the countryside, allowed them to plot the exact position of enemy forces in real time. So, their fighters wasted little to no time getting into the fight. (Photo courtesy of EN-Archive)**

## Background to War

Britain had hard experience with aerial bombardment from the Great War. Zeppelin raids received most of the coverage but heavy bombers posed a more serious threat. In 1917-1918 speed of communication was important in countering the Gothas and Giants, even though the bombers seldom saw 80mph on the gauge. But Metropolitan London allowed police constables to claim priority on phone lines to provide current information on raiders' location and direction of flight. Thus, even though technically limited, the basis for defending England from air attack in 1940 was laid two decades earlier.

After the "war to end wars" Britain, and most of the world, naively accepted that there would be no second world war. Forces in Germany, Italy, and Japan dictated otherwise, but liberal optimism insisted otherwise for nearly 20 years.

In 1938, Adolf Hitler rode the crest of history's wave, sweeping all before him. Elected Germany's Fuhrer five years before, in March 1938 he pulled off the successful Anschluss, bringing Austria into Greater Germany.

Thus emboldened, Hitler regarded Czechoslovakia's ethnic Germans as part of the Reich. Britain and France, unwilling to risk another war, abandoned the Czechs at the Munich Conference. On September 30, 1938, Hitler signed the agreement formalizing annexation of the Sudetenland. The pact concluded Hitler's "last territorial claim" in Europe. Without bloodshed he had added 10 million people and 42 million square miles to his realm.

While historians largely condemn British Prime Minister Neville Chamberlain for appeasing Hitler, some note that the RAF badly needed the extra time to prepare. That Chamberlain was played a fool by Hitler is beyond doubt, but the dismemberment of Czechoslovakia gave Britain a precious 11 months to begin making up for nearly two decades of naive optimism and calculated neglect. After war was declared in September 1939, another 10 months passed before the aerial storm broke over southern England. Those 21 months, purchased at the expense of Czech independence, which proved crucial for the Royal Air Force.

PHOTO COURTESY OF JOHN DIBBS/PLANEPICTURE.COM

## Before the Battle

Despite London's apathy, the RAF began preparing for modern war as early as 1925 when Air Defense Great Britain was established with subordinate Fighting Area, Inner Area, and Bombing Area commands. Though lacking in modern equipment, ADGB integrated fighters and AA guns, forming the essential base for what was to come.

That arrangement was replaced in 1936 with the wartime organization including Fighter Command, Bomber Command, Coastal Command, and others.

Named to lead Fighter Command was Air Marshal Hugh C.T. Dowding—a classic example of the right man in the right place at the right time. With exceptional expertise, he was extended in the position twice, leading up to the Battle. His influence was incalculable: he oversaw integration of communications, the command and control system, and radar, and brought the Hurricane and Spitfire into service.

Meanwhile, fighter headquarters at Uxbridge west of London needed telephone communication with its outlying sector offices. One of the important actions was laying phone lines dedicated to the air-defense mission, though the network was administered by the Post Office, leading to occasional administrative conflicts.

After Munich, some far-sighted RAF officers realized that German bombers inevitably would penetrate English airspace. In a matter of days Squadron Leader Raymond Hart established the first "filter room" with a large plotting board at Bentley Priory in greater London, establishing the format for others to come.

## Radio

Controlling airborne fighters was essential to a successful defense, but technology lagged. The RAF began short-wave direction-finding tests in

## THE INDISPENSABLE MAN

History produces very few indispensable people—those whose influence on progress or events proved unique. In aviation, not even the Wrights were indispensable because if they had not solved the riddle of the ages, others would have within a few years.

Hugh Caswall Tremenheere Dowding was the indispensable man in the Battle of Britain.

Born in Scotland in 1882, the very young Dowding graduated from military academy and joined the artillery in 1900. Drawn to flying, he earned the 711th pilot certificate granted by the Royal Aero Club in December 1913. Eight months later he flew to France.

For two years Dowding served with four squadrons, commanding one, while surviving the Fokker Scourge. In 1916 he was promoted to lieutenant colonel, commanding two wings including one in combat. In 1917 he became a 34 year old brigadier general, but in the postwar RAF he reverted to group captain, a colonel equivalent.

Becoming an air commodore in 1922, Dowding participated in the Iraq "air control" program, a rare example of a successful aerial counter-insurgency. Despite his reserved, often remote personality that gained him the nickname "Stuffy," he was physically active, winning Britain's first slalom championship.

Throughout the 1920s Dowding rotated between "home establishment" and the Middle East, rising to air vice marshal in 1929. During the early 1930s his work on the Air Council overseeing supply and research familiarized him with advancing technology, leading to significant benefits a few years downstream. Attaining full air marshal rank in 1933, he was selected for his life's work, establishing Fighter Command within the new air defense organization in 1936.

Dowding's foresight marked him as the right man in the right place at the right time. Contrary to the conventional wisdom, he doubted that "the bomber will always get through." Recognizing the potential of merging multiple technologies, he wedded radio, telephones, radar, and high-performance monoplane fighters into the world's first true air-defense network. He brought the Hawker Hurricane and Supermarine Spitfire to operational status and lent his weight to the uncertain potential of radar. If Robert Watson-Watt is truly the father of radar, his cooperation with Dowding represents one of history's great personal alliances.

Dowding's ability was recognized in being extended twice as CinC Fighter Command: when the storm broke in 1939, Fighter Command was prepared for the impending Battle of Britain. But apart from his advocacy of technical preparation, he added a barely seen affection for his fliers, whom he fondly described as "my chicks." They included Pilot Officer Derek T.H. Dowding, a successful Spitfire pilot.

As often happens, no good deed goes unpunished. In November 1940, a month after the Battle he was removed from his command, victim of political rivals within the RAF. He spent time in America examining new aircraft and finished his career in the personnel branch, retiring in 1942.

Though twice knighted and granted a peerage, Dowding remained bitter the rest of his life. His removal, shared with Air Vice Marshal Keith Park commanding the vital No. 11 Group, spoke poorly of Great Britain's gratitude to the leaders of "The Few." Dowding died in 1970, age 97. (Photo courtesy of EN-Archive)


An RAF Hurricane against the white cliffs of Dover: the portrait of a brave nation struggling for its survival. (Photo by John Dibbs/ planepicture.com)

1928 when the Signals Branch cooperated with Marconi Wireless Co. to produce a 50 to 75-meter wavelength effective to perhaps 50 miles.

However, the formation leader needed to broadcast almost continuously for the ground station to maintain a bearing. But information on a target formation came from ground observers whose updates were provided via a radio controller, requiring a break in the fighter's transmission.

Another breakthrough came circa 1938 with "automatic transmissions" from fighters, freeing pilots for more urgent tasks. Sometimes confused with the later radar transponder—"identification friend or foe"—the high-frequency "Pip-squeak Fighter Location System" only identified a small number of RAF fighters. Electronic interrogation of radar blips came later.

Pip-squeak was placed in at least two aircraft in each sector station squadron. Mated to the standard HF radio, it transmitted for 14 seconds each minute, permitting controllers to track a squadron or flight leader's aircraft—and presumably those with him.

Each sector had three direction-finding (D/F) stations that plotted Pip-squeak cross bearings. The information was relayed to the sector control room on dedicated land lines. Then the triangulated position was placed in the appropriate geographic grid on the sector's situation map.

Reliable voice radio was critical to effective fighter direction, and the RAF began testing the TR9(HF) AM radio in 1932, affording increased range over previous models: 35 miles air to ground and 5 miles air to air.

Clearly the defenders needed to make interceptions at distances beyond the 35-40 mile range of the TR9. So in January 1937, the Air Ministry issued a requirement for a 100-mile range with aircraft at 5,000 feet. About that time the TR9's limited range was overcome by using mobile radio relay stations 30 to 40 miles "upwind" of the sector station.

In the late '30s the Royal Aircraft Establishment began working on UHF sets, expecting an operational date in 1942. But the project went far better than expected, with early sets deployed in January 1937. By late 1939, Nos. 11 and 12 Groups (covering London and the Midlands) were fully equipped with ground transmitters, compatible with about 250 fighters. The new TR1133 sets provided a 140-mile range at 20,000 feet air-ground and an impressive 100 miles air to air. However, RAF squadrons based in France reverted to TR9s to avoid the risk of RAF communications being compromised by a captured aircraft.

## Fighters

In 1935 the RAF began an expansion program, growing in numbers and capabilities. Three years later, the RAF and Royal Navy possessed a little over 2,000 "first line" aircraft (including many biplanes) with about 1,500 in the "Metropolitan Air Force" based in Britain. That was twice the total strength since expansion began and nearly three times the previous number "on Home Establishment."

But fighters remained the domain of biplanes with Gloster Gauntlets and Gladiators the common types. In fact, the "Glad" only entered service in early 1937—the same year as the Hawker Hurricane.

The RAF received its first wartime fighters in the two years before hostilities began. In December 1937, No. 111 Squadron exchanged its Gauntlets to become the first Hurricane unit. Over the next 20 months, 17 more squadrons converted to the "Hurribox" with production averaging about 25 per month.

Six months later, in June 1938, No. 19 Squadron—also with Gauntlets—welcomed the first Spitfires. It was a revolutionary transition, from a 230-mph two-gun biplane to a 350mph eight-gun monoplane.

At the time, the RAF used 87-octane fuel, which limited Merlins to about 3,000rpm. The Air Ministry asked Esso to develop 100-octane gasoline, which was produced but not in sufficient amounts. However, shortly before the war, growing quantities arrived from Dutch Shell. With 100-octane the Spit and Hurricane began reaching their potential: boost was nearly doubled, yielding 300 additional horsepower. Because there was seldom enough high-octane fuel, at first it went almost exclusively to Merlin squadrons, arriving in quantity barely in time—during the spring of 1940.

In January 1939—eight months before the war—the RAF numbered 135 squadrons including 74 bomber and 24 fighter plus 19 auxiliary squadrons (11 fighters). According to one survey, less than 40% of the units were judged "at readiness" owing to aircraft transition, spares, or maintenance.

As Fighter Command hastened to merge the disparate parts of the air-defense network, the clock was running.

## Radar

In 1934 the British experimented with sound detection for early warning, but technology lagged. Meanwhile, "radio detection and ranging" showed exceptional promise, emerging as radio detection finding (RDF). An RAF committee consulted Robert Watson-Watt, a noted electronics authority descended from the inventor of the steam engine. Working with a handful of colleagues, in 1935 he demonstrated that "aeroplanes" passing through a radio beam interrupted the signal strength, suggesting that radar could identify aircraft from a considerable distance. The next year capability rocketed, from 16 miles to 60. The Air Ministry was convinced.

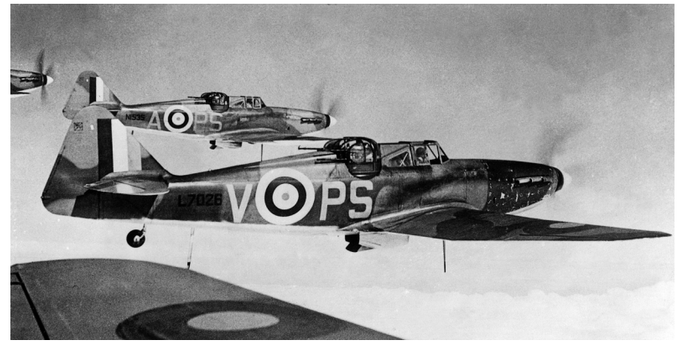
Knowing that the Luftwaffe would come at night, the RAF pushed hard to deploy an all-weather early warning capability. The first three stations were operational in 1937, beginning the "Chain Home" network that by September 1939 grew to 21 stations on England's southeast coasts. The CH network was expanded throughout the war, covering most of the island's eastern and southern approaches.

Radar became essential for effective air defense in the fourth decade of the 20th century. Whereas Gothas had cruised English skies making 78mph in 1918, 22 years later Heinkels, Dorniers, and Junkers bore down on Kentish targets two or three times faster. Moreover, the 1940 bombers flew from some of the same bases as the big biplanes had, vastly reducing the defenders' response time.

Chain Home was set on masts 360 feet tall, with a transmitter and receiver mast at each site. High and low-altitude radars were integrated to give coverage roughly from 2,000 feet upward at about 35 miles. It was not perfect, but Chain Home was a quantum leap in military technology.

However, CH radar only provided reasonably accurate range and bearing of the blip. Altitude was far less reliable, with errors of thousands of feet. Sometimes operators had to refer to "fade charts" based on peacetime tests with various aircraft appearing and disappearing at certain altitudes depending on the radar horizon. The charts were only approximately accurate but gave controllers a starting point.

PHOTO COURTESY OF STAN PIET



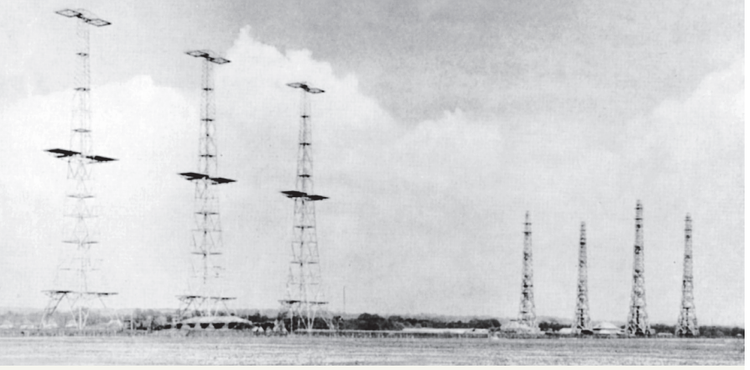

## BOULTON-PAUL DEFIANT

### *Seemed like a good idea at the time*

**DOOMED FROM THE START,** the concept of a "turret fighter" as a bomber interceptor was evident in the RAF's Bolton-Paul Defiant and the naval Blackburn Roc. Both went operational in 1939 but their two-man crew with four-gun armament in a turret added weight that reduced performance.

First flown in 1937, the Defiant was hailed as a day and night fighter with a Merlin III that propelled the aircraft at the optimistic figure of 300mph. More than 1,000 Defiants were delivered, but they ran up against the "reality wall" in combat. Despite impressive early claims, the "Deffie" could not compete with single-engine opponents. Defenseless from the front, five and six Defiants at a time were lost to Messerschmitt Bf 109s.

Two Defiant squadrons flew in the Battle of Britain but sustained unsupportable losses. Before 1940 ended, Defiants were committed to night interceptions, and performed tolerably well until Bristol Beaufighters became available.



The Chain Home radar installations lined the coast but only saw a narrow arc into the Channel: once the aircraft passed inland they were lost to radar. The antennae farms became prime targets for bombers and Stukas. (Photo courtesy of EN–Archive)

## HUMAN EYES AND "THE TIZZY ANGLE"

Lt. Col. Adolf Galland, commanding JG. 26, compared British and German situational awareness: "We had to rely on our human eyes. The British fighter pilots could rely on the radar eye, which was far more reliable and had a longer range. When we made contact with the enemy our briefings were already three hours old; the British only as many seconds old—the time it took to assess the latest position by means of radar to the transmission of attacking orders from Fighter Command to the airborne force."

Because a typical German bomber group covered about four miles per minute, British radar controllers needed to "lead" the target much as a fighter pilot did, on a vastly greater scale. Thus, with "Pip–squeak" information on a fighter squadron's position relative to an enemy formation, a bearing or "vector" could be given in terms of a compass course to intercept at the desired point in time and space. Essentially the task was solving a three–dimensional triangle. Sir Henry Tizard, one of Churchill's scientific advisors, devised The Principle of Equal Angles, whereby controllers used the lines formed by the target and the fighter to derive the third leg—the "Tizzy Angle."

However, the problem was more nuanced than basic mathematics. Controllers had to know the friendly fighter's altitude relative to the bombers, and the climb rate for a flight or squadron. If the RAF fighters began below the enemy formation, failure to compensate for the reduced groundspeed would result in a "miss" astern of the target.

The inevitable post–mortem as Maj. Werner Molders describes an encounter to Maj. Adolf Galland. (Photo courtesy of John Dibbs/planepicture.com)

Despite Chain Home's success, the network necessarily looked seaward. Once German aircraft passed the coast, the British were electronically blind over most areas, relying upon reports from visual outposts.

The Observer Corps was largely composed of civilians with rudimentary training in aircraft recognition and altitude estimates. Inevitably the height figures passed to sector stations were wrong, but at least the reports provided basic information on enemy numbers and direction.

Among the defenders were Womens Auxiliary Air Force personnel, the best known being "plotters" in fighter control centers. One was 20-year-old Edith Heap, whose fiance' was Pilot Officer Dennis Wissler of No. 17 Squadron. She had the eerie experience of hearing the combat in which he died. During the Battle she worked at Debden, a sector airfield in No. 11 group, and recently told the Yorkshire Post:

"Any fool could do it. You just had to be accurate. I sat underneath the controller's desk and drew up a plot on a piece of tracing paper so he could see where to vector the aircraft to intercept the enemy.

"My information came from Uxbridge. RDF–radar—was top secret and we were told not to breathe a word about it to anyone. One girl went home and apparently talked to her parents. She got two years in Holloway jail."

Flight Lt. Charles MacLean was a sector controller who explained the system: "The whole theory of fighter defense was created to avoid 'standing patrols.' If you were guarding the country by having aeroplanes up all the time, you ran out of engine hours and you were on the ground when the attack occurred. So Dowding developed a system of reporting incoming raids. First, he used radar to plot the aircraft as they were approaching Britain and then he used the Observe Corps to spot them when they'd crossed the coast. All the information was fed to a filter room and then to an operations room where you got a picture of the developing raids plotted on a table. That picture would be three or four minutes old but it was sufficiently up to date to get the fighters off when they were really needed."

### The Numbers

At the beginning of the Battle in July 1940, Fighter Command counted 55 squadrons in Britain, having suffered serious attrition in France. Half of Dowding's strength was contained in 27 Hurricane squadrons with 18 Spitfires plus eight Blenheim fighter units and two Defiant outfits. The latter 10 squadrons were only marginally useful in daylight.

The vital area was No. 11 Group under Air Vice Marshal Keith Park, a WW I ace with 27 squadrons on nine bases in Southeastern England. To the west was No. 10 Group with 17 squadrons based on six fields, commanded by Air Vice Marshal Quintin Brand, a South African who had downed a Gotha in 1918. Immediately north of Park was No. 12 Group under Air Vice Marshal Trafford Leigh-Mallory, an accomplished service politician and dagger man. Throughout the battle he consistently refused Park's requests for immediate reinforcement, preferring to organize his 11 squadrons into "big wings" in accordance with the military concept of Mass. But assembling the wings took time that Park did not have, and No. 11's fields often received a pasting. Conversely, Dowding and Park could rely upon Brand.

Across the Channel lay two Luftwaffe air fleets: Luftflotte Two under Field Marshal Albert Kesseling in Belgium, and Field Marshal Hugo Sperrle's Luftflotte Three in France. Between them they counted 34 Gruppen (mostly with three squadrons) of Heinkel 111s, Dornier 17s and Junkers 88s plus nine Stuka Gruppen. Fighters were 25 Gruppen of Bf 109s and eight with 110s.

Long-range missions were flown by Luftflotte Five from Norway with four bomber Gruppen and one each with the 109 and 110 units, the former useless across the North Sea. In all, Reichmarshal Hermann Goring's three fleets totaled nearly 1,500 twin-engine bombers; 330 Stukas; 1,200 fighters; and some 280 miscellaneous types.

Thus, typical figures show the three engaged RAF groups with 900 fighters versus more than 3,000 German bombers and fighters plus a small Italian contingent from late October. In both the RAF and Luftwaffe operational rates hovered around 70 percent availability.

British histories declare the Battle ended on October 31, with combat almost every one of the 93 days. Since then pundits have argued over "the score" with little consistency on either side. German losses are subject to interpretation owing to the Luftwaffe's unusual method of accounting. An aircraft that did not return, or crashed on landing, was 100% loss. But varying degrees of damage were assessed from 5 to 95%. A typical figure is 1,800 to 1,900 German planes written off with 60% or more damage, and about 2,700 Fliegern killed or 900 captured.

RAF casualties seem more definite: usually 1,100 fighters (plus some bombers and miscellaneous types) and 520 Fighter Command pilots and aircrew. The RAF over claimed by at least 52%; the Luftwaffe by about the same ratio with some 3,050 credited victories. The eight Bf 109 wings claimed over 1,700, led by Lt. Col. Werner Molders' JG 51 with 417 credited.

The Battle of Britain was the first victory for radar, but not the last. Four years later it emerged full-grown in the naval arena, again enabling a decisive victory for the defenders when American carrier task forces became nearly immune to conventional air attack. ✠

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*Battle Over Britain (1969) by Francis K. Mason.*
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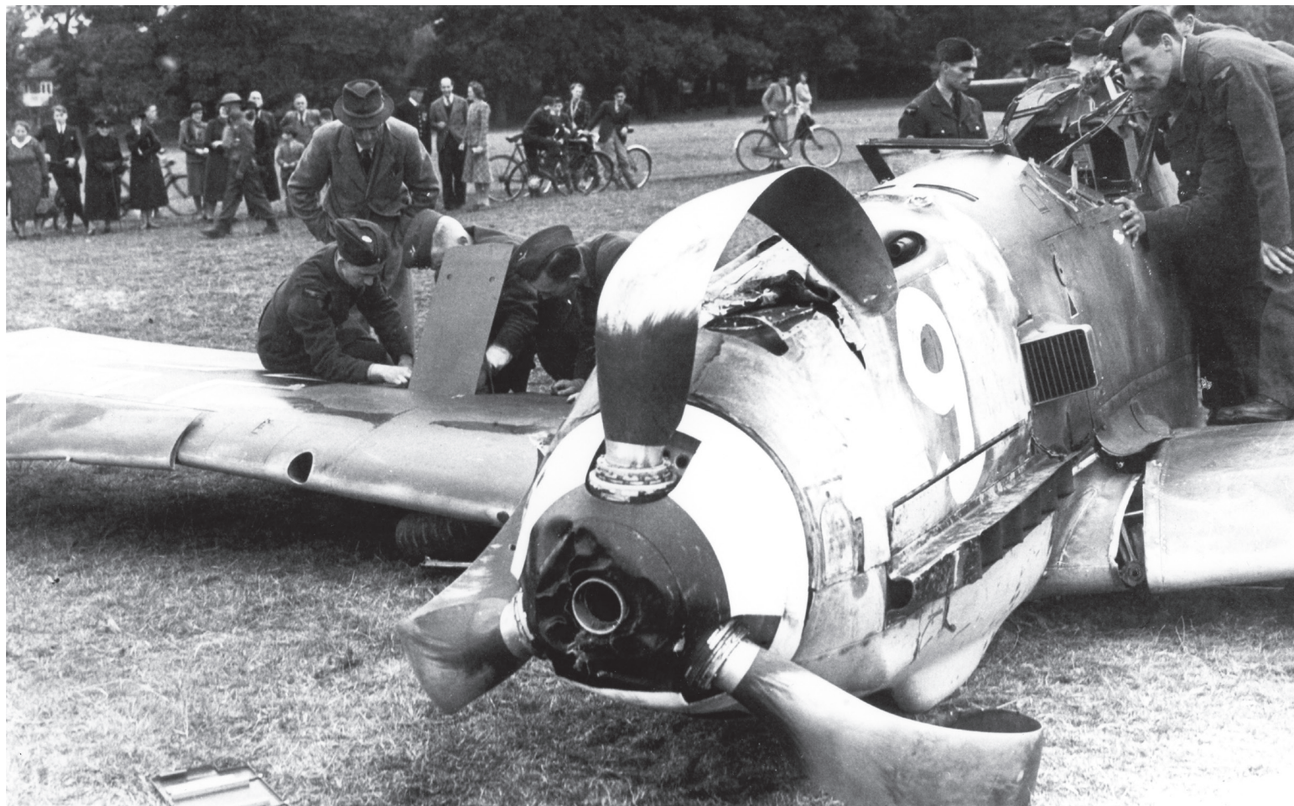

With dogfights in progress almost every day for months, Britain's landscape was dotted with downed German aircraft, like this Bf 109E. Some of them were repaired and flown by RAF test units to gain tactical information on them. (Photo courtesy of Stan Piet)