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Vickers Wellesley variants by Norman Barfield

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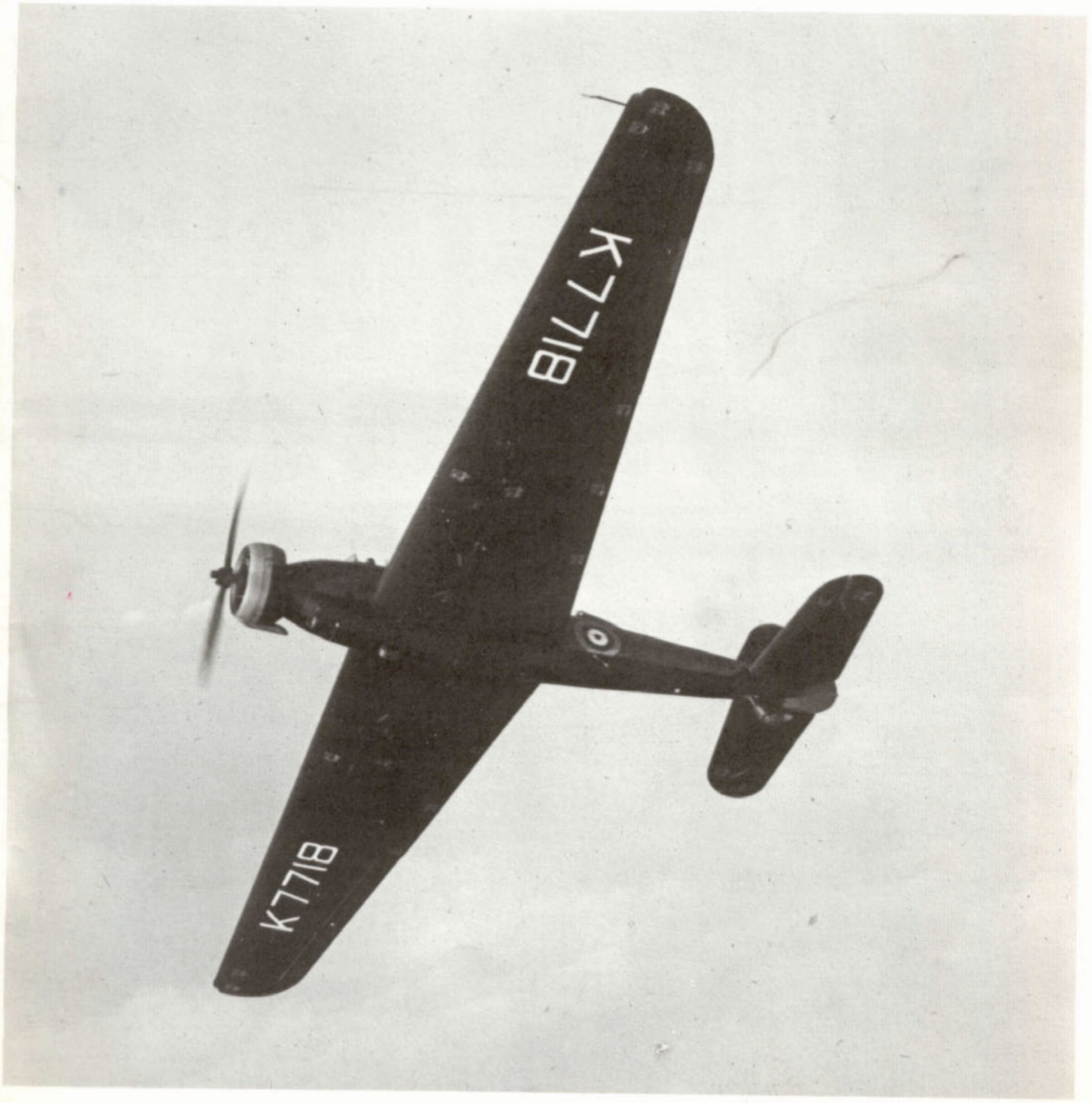
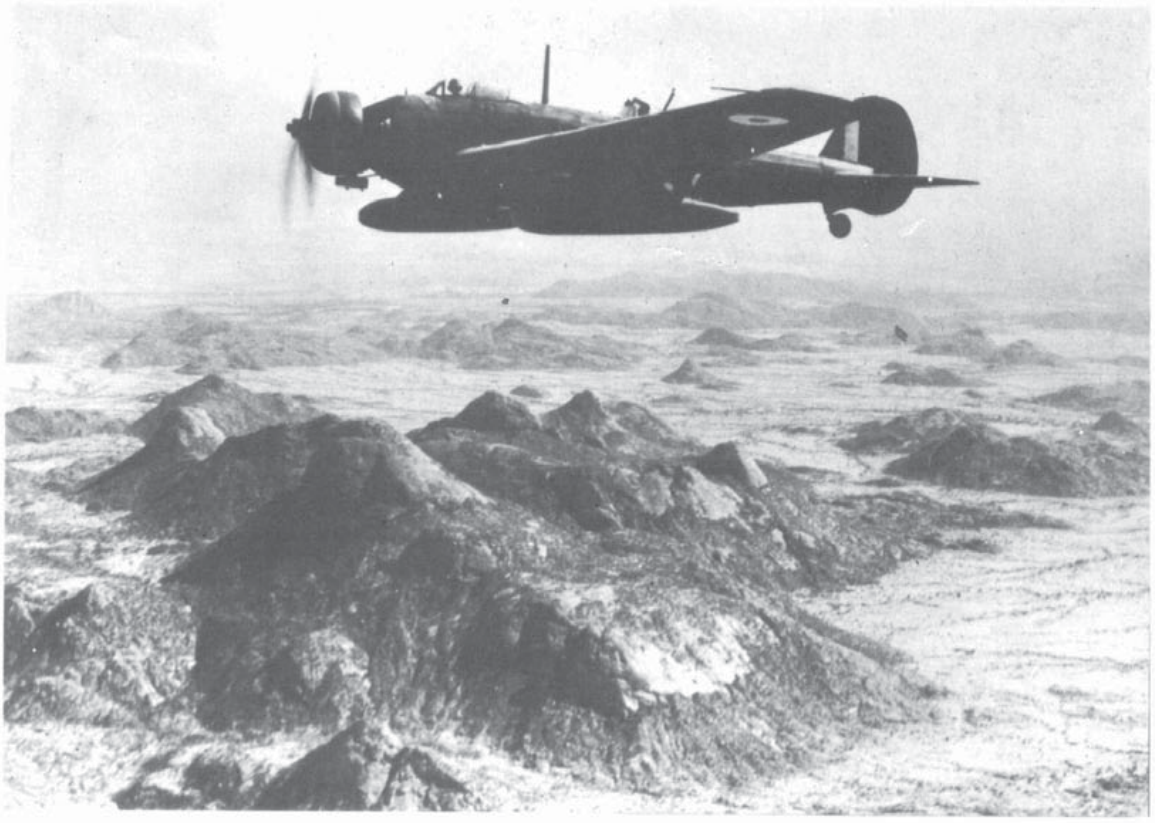




Typical of the inhospitable terrain encountered during the 1940–41 E. African campaign against the Italians. This is the only known air-to-air photograph to show the Vokes air filter under the motor cowling. The pilot's contemporary 'bone-dome' is the traditional sola topi (topee). In front of the windshield is the equally traditional bead of the ring-and-bead gunsight.
(Photo: British Official via 'Flight International')

Vickers Wellesley variants

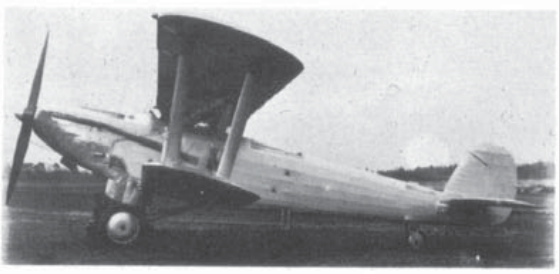
by Norman Barfield, M.Sc., C.Eng., A.F.R.Ae.S., M.I.Mech.E., M.A.I.A.A.

During the East Africa Campaign, June 1940 to November 1941, the Vickers Wellesley of the Royal Air Force (R.A.F.) was the main Allied strategic bomber and the only R.A.F. aircraft type to operate throughout the 18-month action against the Italian forces.

From start to finish, the Wellesley played a major role, performing very creditably and making many unescorted raids deep into enemy territory.

The Wellesley had briefly gained fame in 1938 because of an epic, world record, long-distance flight which was to remain unchallenged for seven years. More important though, the Wellesley introduced the Royal Air Force to a progression of more than 12,000 Vickers' aircraft incorporating the unique Barnes Wallis-conceived geodetic or "basket-weave/lattice" structure. For, after the Wellesley came the two-motor bombers, the Vickers-Armstrong's Wellington[1] and Warwick and the four-motor bomber prototype of 1943, the Windsor[2].

The Wellesley was developed from the private-venture monoplane version of the Vickers tender to the 1931 Air Ministry Specification G.4/31 for a general-purpose landplane. It triumphed over the submissions of nine other British manufacturers to become a classical stepping-stone in the R.A.F.'s transfer from the biplane to the monoplane in the mid-1930s. Its aerodynamically "clean" lines and exceptionally wide-span wings (with a high aspect ratio of 8·8), combined with its lightweight but immensely strong airframe, well fitted the Wellesley to the multi-role active service it undertook in the early part of World War Two.



G-EBYX was a 2-seat freight and mail-carrying prototype, the Vickers Vellore, of 1928 which suggests the origins of the fuselage shape of the later, monoplane G.4/31 and Wellesley. (Below) The newly (1932) completed Vickers M.1/30 torpedo-bomber at Brooklands before application of military markings and RAF serial S1641.
(Photos: Vickers (Aviation) Ltd.)

[1] See Profile No. 125: Wellington I & II; and No. 229: Warwick Mks. I-VI—which also contains photo of Windsor.[2]

Origins and Predecessors

Vickers Ltd. began its lineage in 1911 with an advanced series of monoplanes—in this case generated from an original French design, attributed to R.E.P. (Robert Esnault-Pelterie). However, this bold initiation soon gave way (in 1913) to the then more practical[1] biplane that formed the basis of the Vickers Fighting Biplane No. 5 or F.B.5 (the popularly-named "Gunbus") single-seat pusher fighter of the first years of World War One.

Although the Company had built several braced monoplane types from 1926 onwards, it prudently progressed in parallel both the monoplane and its well-tried biplane form (of nearly two decades of fighters, bombers and transports) when tendering to Air Ministry Specification G.4/31 which ultimately generated the Wellesley bomber.

Specification M.1/30

The real starting point in the evolution of the Wellesley was the Vickers tender (Vickers Type 207) to the Air Ministry Specification M.1/30 for a maritime (shipborne) torpedo-bomber successor to the Blackburn Ripon. Issued in March 1930, Air Min. Spec. M.1/30 resulted in three companies being awarded one-off competitive prototype contracts: Vickers built its Type 207 (military serial S1641); Blackburn constructed its B-3 (serial S1640) and Handley Page produced its H.P.46 (serial S1642)[2].

Combining the well-proven biplane form of the Company's Vildebeest torpedo-bomber with an 825 h.p. Rolls-Royce H.10 water-cooled, 12-cylinder, upright-Vee in-line engine[3], the Vickers M.1/30 possessed a considerable advantage over its predecessors in the incorporation of a new, lightweight structural concept in the wing spars. The exploitation of light-alloy (Duralumin) structures in this instance brings Barnes Wallis into the picture.

Following the disastrous loss of the British Government-sponsored R.101 in October 1930, liquidation was the fate of the commercially-backed Airship Guarantee Company which had been responsible for the successful 100-passenger Vickers R.100. Its designer was Barnes Wallis and, with the authorities no longer interested in promoting airships, he subsequently joined Vickers (Aviation) Ltd. at Weybridge (Surrey) as Chief Structures Designer. As such, he worked alongside R. K. (Rex) Pierson, Chief Designer, who had been responsible for virtually all the Vickers aircraft types up to that time.

In the Vickers tender for the M.1/30 Specification, Wallis contributed his considerable knowledge of light-alloy structures and his talents in this field soon proved to be a natural complement to the flair and ingenuity of Pierson.

The unusual lightness of the Vickers M.1/30 design tender was claimed to have been effected "by the incorporation of structural methods similar to those recently used so successfully (1929-30) in H.M.A. R.100." This close affinity to airship practice was especially evident in the Duralumin wing spars.

Unfortunately, the Vickers M.1/30 (S1641)—first flown on January 11, 1933 by Chief Test Pilot J. ("Mutt") Summers—was written off on November 23, 1933, because of structural overload during a high-speed dive.

The cause of this accident to S1641 was eventually traced to a distorted tailplane incidence jack. One important result of this failure was a complete reassessment and revision of the tailplane stressing formulae of AP.970—the official Air Publication 970 *Handbook of Design Calculations and Requirements*—following detailed investigations of tailplane stiffness factors at the Royal Aircraft Establishment (R.A.E.), Farnborough (Hampshire).

However, Wallis in no way lost heart or confidence in his ideas for lightweight structures. Indeed he was spurred on to evolve his unique geodetic structural concept for the next Vickers design.

Specification G.4/31—The opportunity for Wallis to exploit this concept was presented by the evident potential of the Air Ministry Specification G.4/31 of July 1931.

This was the hey-day of the general-purpose (today called "multi-role") aircraft and the G.4/31 Specification—for a single-engine, general-purpose bombing and torpedo-carrying aeroplane—was seen as a big opportunity for the aircraft industry and was taken up in strength.

Operational role requirements for G.4/31 included light bombing by day and night, army co-operation, dive-bombing, land reconnaissance, photography and casualty evacuation. (These were further extended in October 1931 to include the additional roles of torpedo-bombing and coastal reconnaissance.)

Keynotes of the Specification were good load-carrying capability, reliability, short take-off and landing and a good view for the pilot. There was an expressed preference for an air-cooled radial engine and the 650 h.p. Bristol Pegasus IM3 (the developed 600 h.p. Mercury V) was selected.

The outstanding versatility implicit in Specification G.4/31 represented a bold challenge to designers and the prospects of large orders elicited submissions from nine companies including Fairey and Westland, whose respective Gordons and Wapitis the successful design proposal would eventually replace.

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[1] One "practical" consideration was the British War Office's lack of confidence in monoplanes following some accidents in 1912. For five months, from September 1912, Military Wing pilots were not permitted to fly monoplanes in the Royal Flying Corps.—Editor

[2] Both the Vickers and Blackburn prototypes were referred to within the respective companies simply as M.1/30.

[3] Later named Buzzard IIIMS (moderately supercharged) and forerunner of the Rolls-Royce "R" fitted to the Schneider Trophy-renowned Supermarine S.6 and S.6B seaplane racers.

Vickers G.4/31 Proposals

While the Air Ministry evidently favoured the biplane, Wallis envisaged a monoplane solution. This was motivated by his growing conviction that this more modern and ambitious layout was far better suited to establishing the proof of his geodetic structural conception which he believed made available to designers an entirely new method of airframe construction for the first time since the advent of practical military aircraft during World War One.

Consequently, the Vickers design team began by progressing three different G.4/31 proposals. Two were monoplanes and one—to acquiesce to the Air Ministry preference—was a biplane.

The first monoplane design was of low-wing layout, powered by the Pegasus engine, and with open cockpits and a fixed undercarriage. The second was of similar layout but powered by the Rolls-Royce Kestrel IIIMS upright-Vee inline engine in a pointed nose cowling—as in the M.1/30 but with an underslung radiator. The third was for a Pegasus-powered wide-span biplane—reminiscent of the company's earlier Vespa army co-operation type.

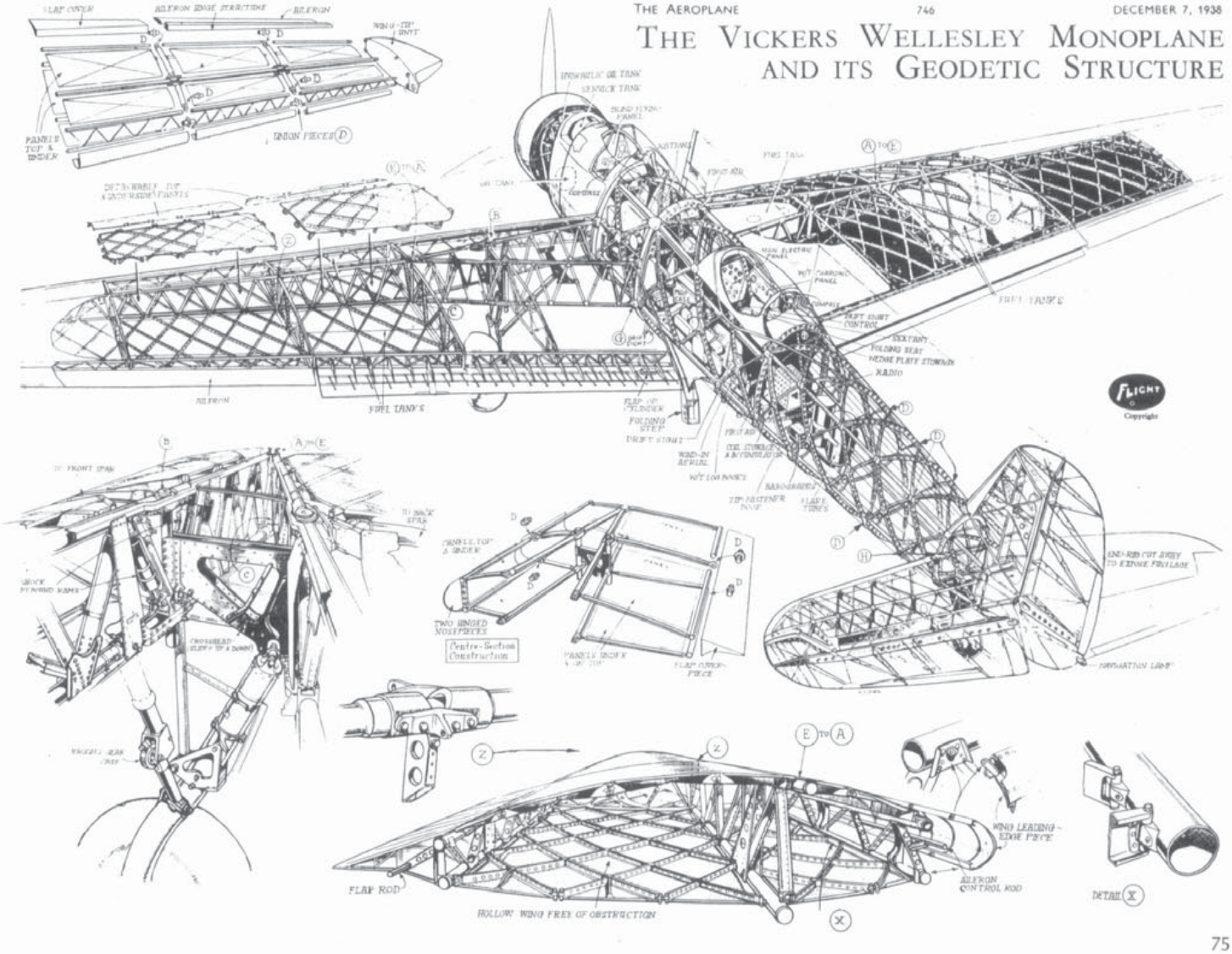
The two monoplane studies were designated Vickers Type 246 while the biplane was Vickers Type 253. Predictably, of these three choices, the Air Ministry selected the biplane Type 253 and, in April 1932, Vickers received a prototype contract.

Wallis Geodetic Structural Principle

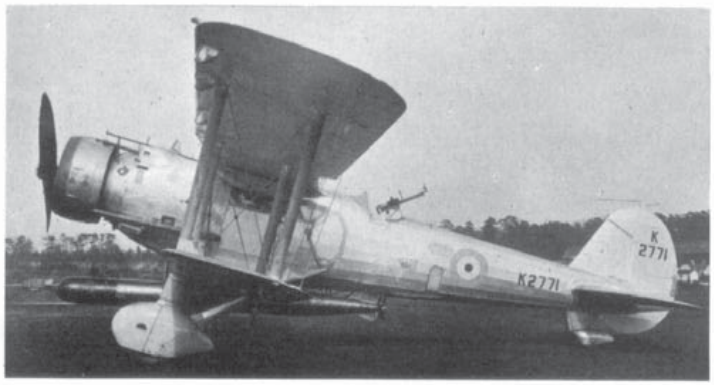
The slim oval-section fuselage of the Vickers Type 253 (G.4/31) biplane incorporated a unique Wallis-invented structural concept. This consisted of four light-alloy (Duralumin) longerons (in sections with screwed lightweight joints as in the M.1/30) with spiral channel section members wrapped around them and running in opposing directions to describe a lattice formation.

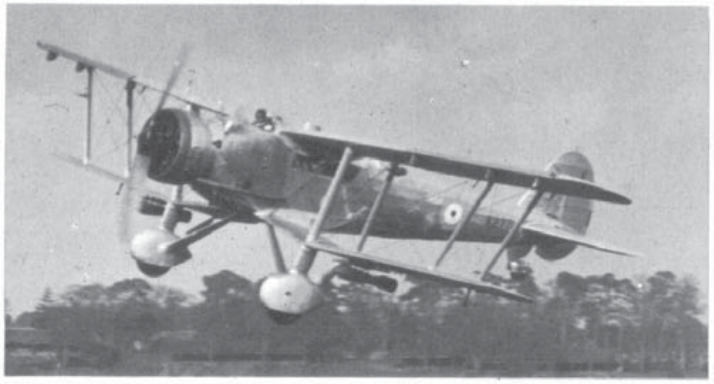
This so-called "geodetic"-type fuselage represented a significant advance over his lightweight structural concept of the M.1/30. (The wing of the G.4/31 biplane was of conventional Vickers construction as described later.)

Wallis' objective was to achieve a fundamental reduction in weight and a consequent improvement in the strength/weight ratio for a fabric-covered structure. This departure from the monocoque principle of airframe structural design—which had been established for more than a decade—was a direct outcome of his airship design experience—from the arrangement that he had adopted for the "wire



Wellesley in cutaway perspective; a 1938-period drawing in 'The Aeroplane' by the late James Clark. (Copyright: 'Flight International')





Two views of the original G.4/31 contender from Vickers in 1934, the Type 253 (RAF serial: K2771) with different stores; a standard 18-inch torpedo and two underwing 250-lb. bombs.
(Photos: Vickers)

netting" that contained the gas bags of the R.100.

At this point it is appropriate to describe the principle of geodesy and its adaptation to aircraft construction. A geodetic line is defined as the shortest line between two points on the surface of a sphere and is known in global navigation as a "great circle" route. As adopted by Wallis in lattice form to aircraft structural design, this principle resulted in an ideal form of load balance and "fail-safe" combination.

In the tubular fuselage of substantially single-degree curvature, the arrangement consisted of two helices running in opposite directions but joined at each intersection such that one set of members was in tension while the other was in compression and the curved diagonal latticework (along the lines in which the principal forces set up in flight could be shown to act) absorbed all loads by stress equalization. Consequently, the resulting structural system replaced the conventional primary and secondary members with a system of main members only which was self-stabilizing and did the work of the shell of a normal monocoque without the need for internal load-carrying structure. The Wallis system also dispensed with stressed-skinning—and fabric covering was used.

The chief advantages of this type of structural design were the ability to adopt a near ideal streamlined shape while simultaneously providing maximum unobstructed internal space.

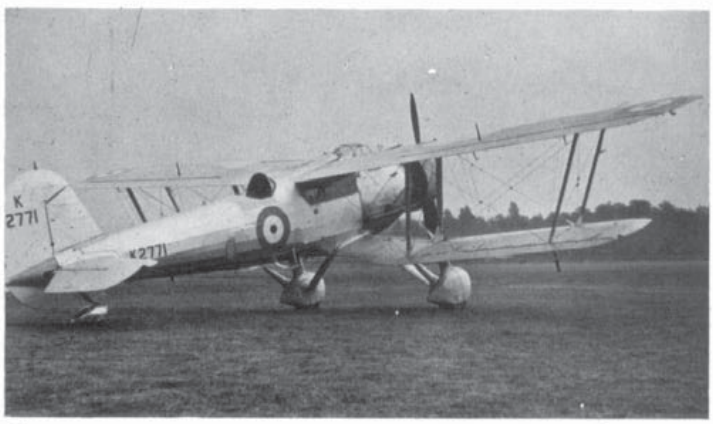
Hitherto untried in aerodynes (heavier-than-air aircraft), the adoption of the Wallis geodetic system was a bold step in the much smaller and more complex structure of a fixed-wing aircraft —especially in such a vital new tender. The accommodation of cut-outs, such as cockpits doors, gun turrets and—later, in the Wellington —bomb compartments, needed specially reinforced boundary frames. Nevertheless, Vickers continued to finance the system through the difficult and expensive development stages and the reward for their confidence is now a highlight of military history.

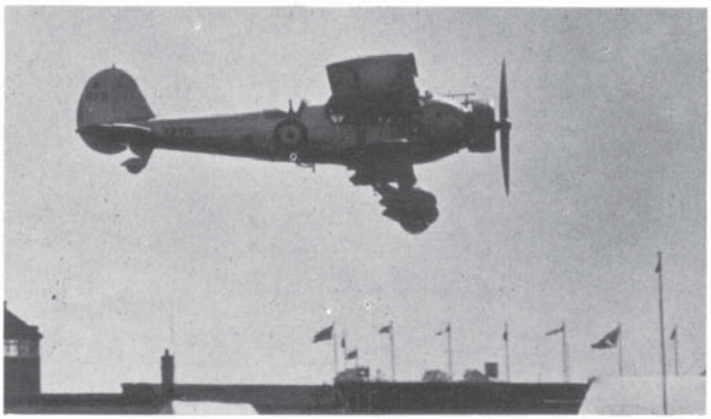
The initial wing aerofoil shape of the Vickers G.4/31 biplane was an adaptation of the R.A.F. (Royal Aircraft Factory) 34 section as used in the M.1/30. The structure consisted of a single-spar system with what were called "co-planar" struts—single strut outer bays with self-balancing torsional bracing by an inverted-Vee pyramid of two struts to the inner bays. However, a two-spar wing of well-established R.A.F. 15 aerofoil section, with two struts to each bay (and a thickened centre-section to accommodate the fuel tanks as on the Vildebeest), was eventually accepted by the Air Ministry in August 1933. This was because of the unwillingness to risk the lesser-known characteristics of the R.A.F. 34 section and possible adverse affects on the stabilizing behaviour of the tail surfaces, bearing in mind the M.1/30 accident.

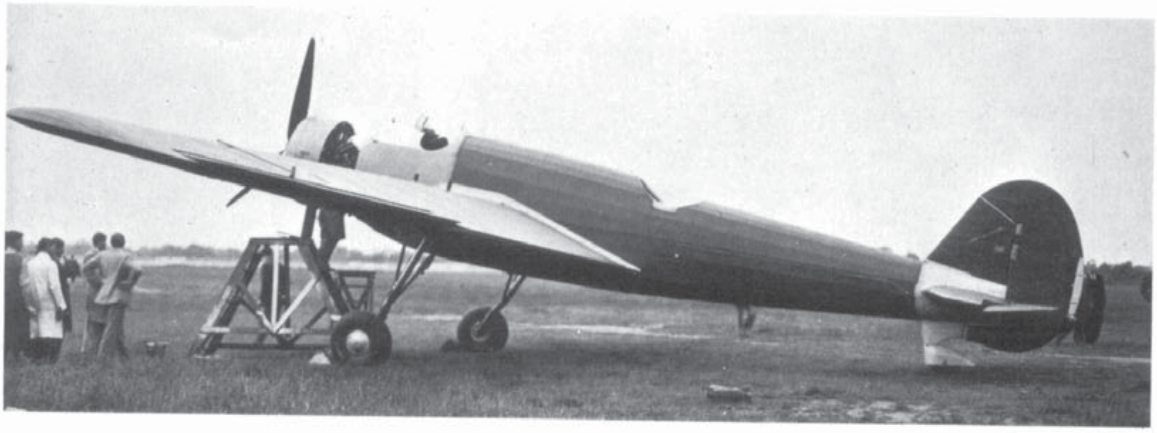
Inspected in mock-up form in the spring of 1933, the ungainly-looking Vickers Type 253 (serial K2771) biplane was the first of the official G.4/31 prototypes to fly. Powered by a Bristol Pegasus IIM3 engine, driving a 13 ft. 2 in. diameter two-blade wooden propeller, K2771 was first flown by "Mutt" Summers (solo) from the Vickers factory aerodrome of Brooklands on August 16, 1934.

In final configuration, the biplane Type 253 (K2771) was accorded an enclosed cockpit for the pilot, the original open state having been marked down as 'cold and draughty'.
(Photo: Vickers)

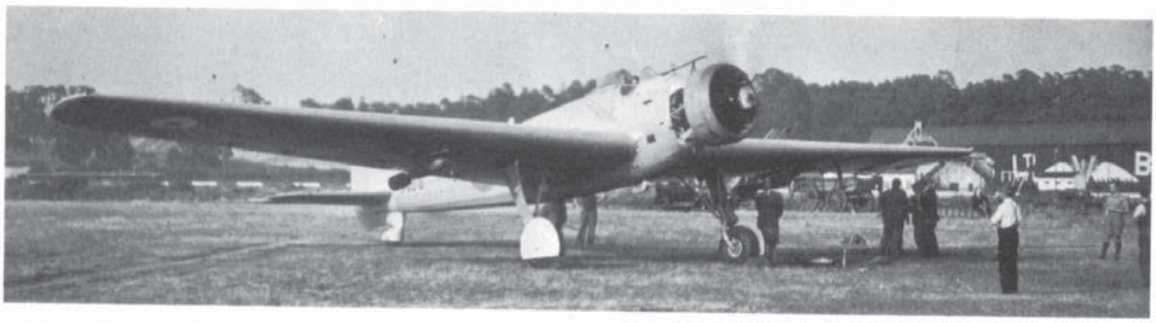
The biplane Type 253 (K2771) at the annual RAF Display at Hendon in June 1935. The numeral '6' identifies this G.4/31 contender as a temporary resident in the 'New Types Park'.
(Photo: Vickers)







The Vickers PVO-9 or Type 246, the prototype which was to lead to the later Wellesley, is seen here at Brooklands in June 1935 with open cockpits, no markings and covered wheel wells and temporary fixed main undercarriage. (Photo: Vickers)



The same PVO-9 (and carrying this as a Class B registration, strictly-speaking only '0–9', on the rear fuselage) later in 1935 with pilot's canopy and bomb carriers added and the Vickers-designed main undercarriage in fully retractable state. The port wing has a rack for three 10-lb bombs outboard of the single 250-lb. bomb. (Photo: Vickers)

Test flying with a range of experimental modifications was carried out by Vickers at Brooklands and by the R.A.E. at Farnborough. After the engine had been changed to the 690 h.p. Pegasus IIIM3 in February 1935, the aircraft was delivered to the Aeroplane and Armament Experimental Establishment at Martlesham Heath (Suffolk) for official trials on April 13, 1935. Handling was considered good except for the elevator which was stiff at low speeds. The open cockpit was cold and draughty, hence it was enclosed by a rearwards-sliding canopy. Otherwise the aircraft was considered satisfactory.

The G.4/31 Competition

The nine prototypes that materialized in the G.4/31 competition for the new standard general-purpose type for the R.A.F. were: the Armstrong Whitworth A.W.19; the Blackburn B-7; the Bristol Type 120; the Fairey G.4/31 Mk. 1/2[1]; the Handley Page H.P. 47; the Hawker PV-4; the Parnall G.4/31; the Vickers Type 253; and the Westland PV-7. All were biplanes except for the H.P.47 which was a cantilever low-wing monoplane and the Westland PV-7 which was a braced high-wing monoplane.

The G.4/31 competition results were set down in an A. & A.E.E. report prepared at the end of May 1935 and the competition finalized with a visit to Martlesham Heath by Air Vice-Marshal H. C. T. Dowding (later Lord Dowding of Battle of Britain fame) on May 29, 1935.

The ultimate choice was the Westland design. However, the Air Staff over-ruled this recommendation because they considered that the inadequate wing torsional strength that had resulted in the loss of the Westland prototype had not been overcome. Consequently, the first choice became the Vickers Type 253 biplane and an order was placed for 150 for the R.A.F.

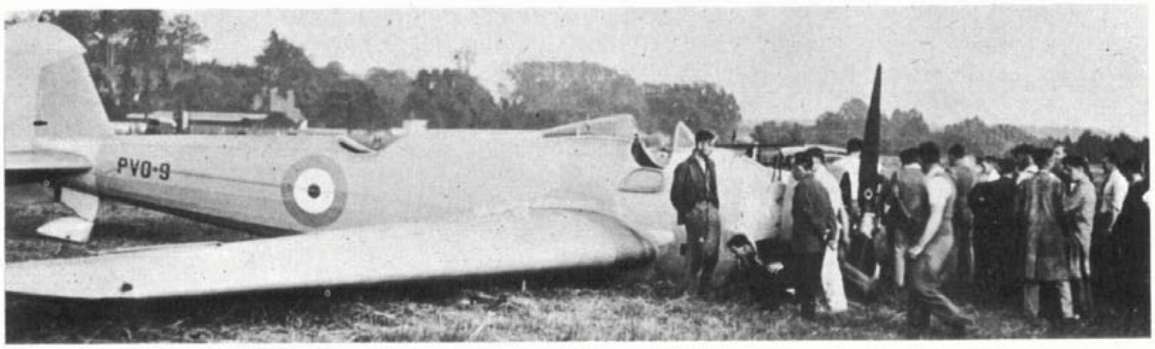
Vickers Prefer the Monoplane

While detail design work proceeded with the Type 253 biplane that had secured the contract, the Vickers team was still so convinced of the potential superiority of a monoplane approach to the G.4/31 Specification that it continued its Type 246 design—with its more fully developed geodetic structure and long-span, fully-cantilevered wings—in parallel as a private venture.

This conviction eventually became reality when, at a Board meeting on April 12, 1932, the Company decided to build the monoplane alongside its official biplane submission.

Wallis believed that high speed and long range could best be attained by the monoplane with a carefully shaped low resistance form of wing and body. He advanced that the essential features should be: An aspect ratio of not less than nine or 10; a thickness/chord ratio at the wing root of not more than about 17%; great stiffness and torsional rigidity of the wing and fuselage; and, very light structure weight. He reasoned that the weight of a wing of constant area and wing loading varied at a rather greater rate than the square of the aspect ratio when the thickness/chord ratio at the wing root was held constant. However, prevailing structural design techniques meant that a wing of aspect ratio nine would weigh approximately three times as much as one of aspect ratio six. This, Wallis said, was the reason why most of the stressed-skin type monoplanes at that time did not exceed an aspect ratio of six or seven. In

[1] From which stemmed the famous Fairey Swordfish.



The smaller photo shows the prototype PVO–9 on July 25, 1935, which, as mentioned in the text on the opposite page, suffered a main undercarriage leg malfunction and resulted in a successful emergency landing at Brooklands. The 250-lb. dummy bomb is still securely in position under the starboard wing.
(Photos: Vickers)

his opinion, progress in performance was thus rapidly becoming blocked by structural limitations, and to get out of this *impasse* the success of the geodetic technique in the biplane fuselage led Wallis to adopt this unique concept for the entire airframe of his monoplane design. Its much cleaner shape promised substantially reduced drag and the thick-section high aspect ratio wing an outstanding lift/drag ratio as well as the much lower weight.

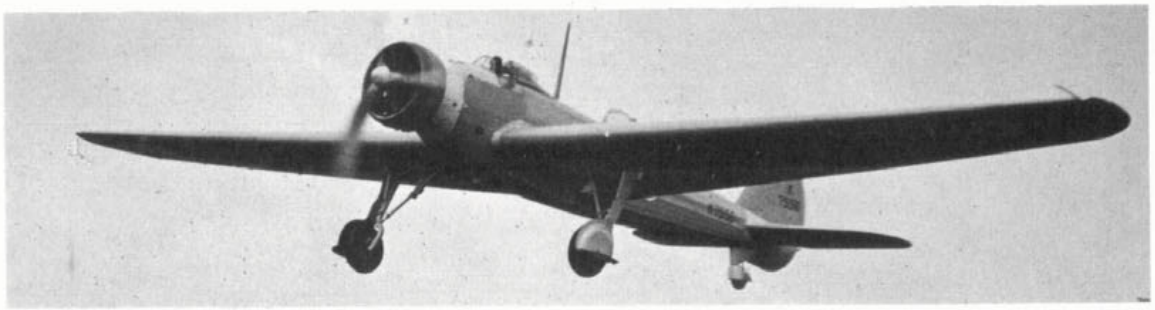
The Vickers Type 246 monoplane thus became the most advanced of all the designs that ultimately emerged from the G.4/31 Specification.

A measure of the strength/weight ratio of the geodetic system was given by the official record of tests carried out by the R.A.E. on the fuselage of the Wellesley; and then compared with an orthodox type of structure of identical specification requirements. They showed that the geodetic structure, although only two-thirds of the weight, was more than twice as strong

in flexure and nearly twice as stiff in torsion as the conventional type.

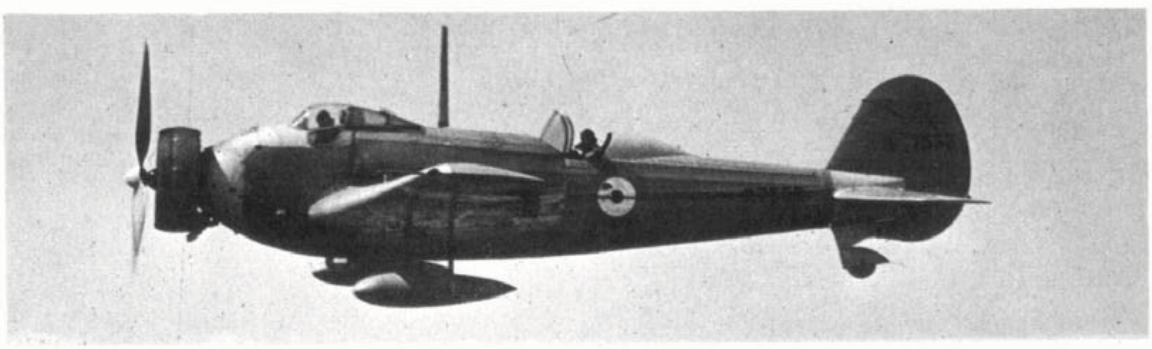
Performance of the Vickers G.4/31 monoplane proved that, for a given power and comparable specification, it could carry heavier loads faster, farther and higher than aircraft embodying the generally prevailing type of construction.

Carrying the Society of British Aircraft Constructors (S.B.A.C.) registration 0-9 (a Class B type registration) the elegant new Vickers two-seat, low/mid-wing monoplane was first flown at Brooklands by "Mutt" Summers on June 19, 1935. The next day it was flown again, but this time with Wallis as passenger. The cost of this



Following the Brooklands' undercarriage incident illustrated above, the PVO-9 was repaired and modified to become the Type 281 or pre-production Wellesley; now having exchanged the Class B registration for the RAF serial K7556. The fixed-pitch three-blade metal propeller fitted at this time was a Fairey-Reed unit now more readily associated with the Fairey Swordfish. Noteworthy are the upward-hinged main undercarriage leg covers; as in the cases of the Hurricane and Spitfire prototypes, this hinged section was soon discarded.
(Photo: Vickers, ref. 4890–A)

K7556 showing off the wide sweep of the high-aspect ratio wings which now support the earlier form of bomb panniers under the mainplanes.
(Photo: 'Flight' ref. 12782S)



With K7556's Bristol Pegasus throttled well back to formate on the slower photographic aircraft, the shape of the Fairey-Reed metal propeller blades are clearly visible. By any standards, the radio aerial mast appears to be massively out of proportion to the otherwise slimly compact lines of the pre-production Wellesley.
(Photo: 'Flight', ref. 12780–srs.)

prototype, built entirely at Vickers' risk, was £30,271.

Comparative trials of the two Vickers G.4/31 designs quickly revealed the predicted difference in their respective performances and it soon became clear that the monoplane was markedly superior to its biplane partner. It had a better all-round performance at a higher all-up weight. Although the same engine was used, the airframe was lighter and hence the payload was greater. This evident disparity between the two types was too obvious to be ignored and an official reappraisal was thus inevitable.

The Monoplane Prevails

The tenacity of Sir Robert McLean, the indefatigable Chairman of Vickers (Aviation) Ltd.[1], carried the day with this incontrovertible evidence. His persistence overcame the innate conservatism of the Air Ministry officials who were ultimately persuaded to cancel the original biplane contract in favour of the monoplane.

Vickers' clear conviction of the superiority of its monoplane is evident from the following extract from the letter that Sir Robert McLean sent to Air Vice-Marshal Dowding on July 5, 1935:

"I suggest to you that it might be better to reduce these orders in numbers (for the biplane) and in their place go into production of the monoplane as soon as tooling-up can be completed. Meantime, and until you can decide whether we shall be allowed to switch over from the biplane to the monoplane, I do not wish to proceed with work on the biplane because, in my view, it is not a modern machine."

Accordingly, on September 10, 1935, Vickers was instructed to drop the biplane and the original order for 150 biplanes was changed to 79 monoplanes. Principally because of the outstanding range capability, these were to be long-range medium bombers—to Air Ministry Specification 22/35—the general-purpose and torpedo-carrying requirements of the original G.4/31 Specification having been dropped. (The latter role was re-assessed later but still not adopted.)

The type name "Wellesley" was chosen after Arthur Wellesley, the great British soldier of the early 19th century who was later created Duke of Wellington and known as "The Iron Duke" because of his reputation as a rigid disciplinarian. The appellative relationship between the Vickers Wellesley and its illustrious successor the Wellington is thus obvious. This also began the Vickers fashion of naming Wallis-geodetic designs with the initial "W".

While Vickers G.4/31 monoplane (0-9) had thus become the forerunner of the production Wellesley bomber, its biplane prototype (K2771) proved to be the sole example. After the G.4/31 competition, K2771 was fitted with a Micarta propeller—which had already been flown for 100 hours on a Vildebeest at the R.A.E. —and then flown for a further 11 hours with this propeller by the end of January 1936. The aircraft subsequently went to the Bristol Aeroplane Company at Filton where it spent several years as a flying engine test-bed, ending its days there in 1941.

Developing the Wellesley

Wellesley development was not without incident. The Type 246 prototype sustained a forced landing at Brooklands on July 25, 1935. During flight testing of a prototype variable-pitch propeller, it became impossible to lower completely the left-hand leg of the manually-operated retractable undercarriage (Vickers first such design) because of damage from mechanical misalignment during raising on take-off by R. C. Handasyde, the flight observer. However, a successful belly-landing was made with little resulting damage.

Extensive modifications were subsequently incorporated to enable the aircraft to become the pre-production Wellesley (Vickers Type 281) now carrying the serial number K7556, having been purchased by the Air Ministry. Notable changes were the enclosure of the cockpits with Perspex hoods, a hydraulically operated undercarriage to replace the original manual type, and a wider-chord rudder. The later Bristol Pegasus X engine was fitted, together with a Fairey-Reed fixed-pitch, 3-blade, metal propeller, but the Bristol-Townend ring and exhaust collecter of 0-9 were retained.

A most noticeable new feature was the fitment of streamlined underwing panniers to serve as containers for the aircraft's 2,000 lb. (four 500 lb. or eight 250 lb.) bomb load. These panniers were used in order to avoid discontinuity in the geodetic structure of the wings or fuselage for bomb-bays, to provide stress relief to the main wing, and avoid the aerodynamic interference of the traditionally "close-hung" bomb clusters.

In March 1936, K7556 went to A. & A.E.E. at Martlesham for type and development trials from which stemmed considerable further refinement. Production-type wings were fitted and the hydraulic system was extended from the basic undercarriage circuit to embrace the Schrenk-type flaps and the Vickers-developed bomb-slips. Electrical services were also incorporated for lighting, gun-heating, bomb-gear control, undercarriage and flap indicators, fuel gauges and camera operation. A revised tailwheel was also fitted.

The unique nature of the geodetic construction of the Wellesley still demanded considerable structural and metallurgical research and testing, and development of production techniques for fabricating the multiplicity of curved channel members. This work was also vital in convincing

[1] Vickers Ltd. (Aviation Dept.) became a subsidiary Company, Vickers (Aviation) Ltd., in July 1928.

the Air Ministry of the efficiency of the revolutionary Wallis-designed airframe.

Stemming from a rudimentary hand-operated forming machine for light-gauge Duralumin components used hitherto, Vickers developed sophisticated power-driven machines to enable production of the curvilinear geodetic members more quickly and accurately. This ingenious machinery has been in constant use at Weybridge ever since and is today still producing fuselage frame sections and similar components for the B.A.C. One-Eleven and Concorde airliners.

The success of all this work led Vickers to persist with the geodetic type of structure while other manufacturers elected to develop the stressed-skin principle—which was still at an exploratory stage, especially in British aircraft design.

The higher structural and aerodynamic efficiency and the substantially lower weight of the Wellesley, combined with the mastery of the production problems, enabled the Wallis concept to win the day.

Extolling the virtues and the evident success of his unique concept in creating an aircraft of exceptional load-carrying capacity and radius of action, Wallis wrote:

"The Wellesley is constructed on an entirely new principle—the Vickers-Wallis 'Geodetic' system.

"All parts of the structure are formed as geodetics in the streamline shape of the fuselage, and also in the curved profile of the wings . . . This method of aeroplane construction is the most important contribution to aircraft engineering since the completion of the first successful metal aircraft. For example, it permits each wing to be hollow and entirely free from any kind of obstruction—the additional space thus gained can be utilized for extra tankage or other loads, and the complete structure is one of extreme lightness combined with great strength and rigidity, thus making possible a range and load carrying capacity that has hitherto been considered unattainable."

Added to this was a text that was to characterize so many of Wallis' revolutionary transport concepts in the years to come:

"The range would be sufficient to fly to any part of the (British) Empire without landing on foreign soil to refuel" he said. The epic world long-distance record flight of the Wellesley in 1938 (described later) was high testimony to the realism of this objective.

A classical stepping stone in the R.A.F.'s massive expansion scheme of the mid-1930s, the Wellesley was truly revolutionary. Its elegant layout with enclosed cockpits, fully-cantilevered monoplane wings and fully-retractable landing gear—which was unusual for a long-range medium bomber—combined with an incredible 40% weight-saving in the structure gave the Wellesley unmatched load-carrying and long-range capability for its day and a major technical advance over its predecessors.

With a disposable load of around $1\frac{1}{3}$ times its own weight the Wellesley carried twice the average percentage disposable load of its contemporaries. Additionally, its high aspect-ratio wings decreased take-off run and increased cruising range.

As well as its exceptional adaptability in R.A.F. service, the Wellesley went on to bequeath a prescient heritage to the contemporary twin-engined Vickers B.9/32 that eventually became the Wellington.

Further amendments were made in the Wellesley production contract in August 1936. The 925 h.p. Bristol Pegasus XX was adopted as the standard production engine resulting in a maximum speed of 213 m.p.h.

Concurrently, the Wellesley was chosen as a test-bed for the evaluation of the Hercules engine, Bristol's new air-cooled sleeve-valve radial, that went on to become such an outstanding success during World War Two and afterwards. The aircraft used for this conversion (Vickers Type 289) was K7772.

The Production Wellesley

The initial production standard aircraft (Vickers Type 287) was officially named Wellesley and carried an operational crew of two—pilot and gunner. The pilot was accommodated in an enclosed cockpit in line with the leading-edge of the wing. The gunner was situated further aft, behind the wing trailing-edge within a streamlined compartment, the glazed portion of which was retractable to enable him to use his aft-facing 0·303 in. Vickers "K" gun. A 0·303 in. Browning machine-gun was also fitted in the leading-edge of the starboard inner wing.

Key to colour side views

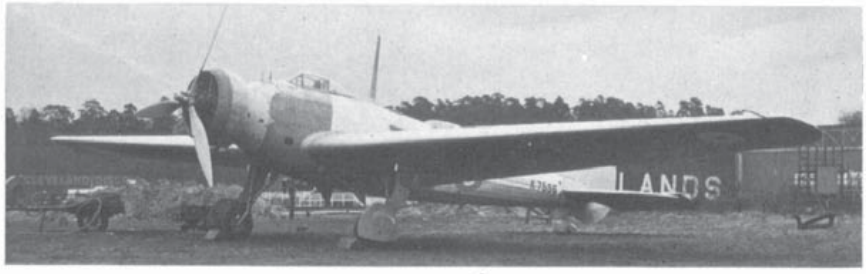
1 *K2771, the Vickers Type 253 biplane Air Ministry Specification G.4/31 competition contender, powered by a 635 h.p. Bristol Pegasus IIM3 air-cooled radial engine. Period: August 1934.*

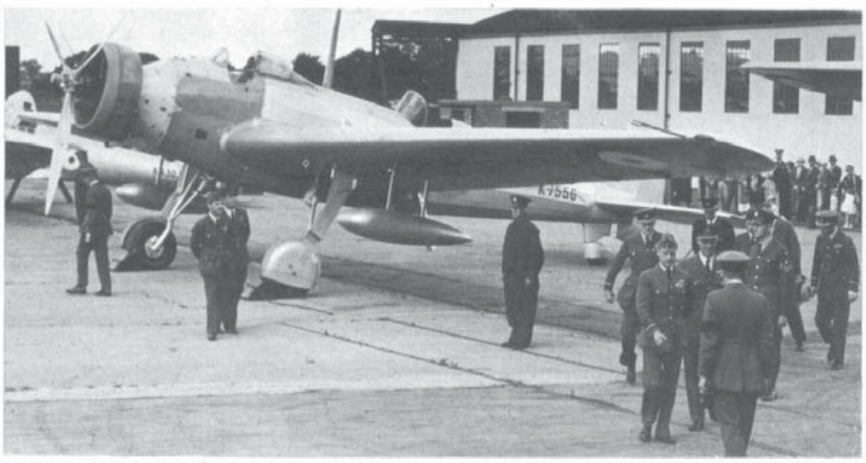
2 *PVO-9, the Vickers Type 246 private-venture G.4/31 contender—from which the Wellesley was the outcome—powered by a 750 h.p. Bristol Pegasus IIIM3 engine. Period: June 1935.*

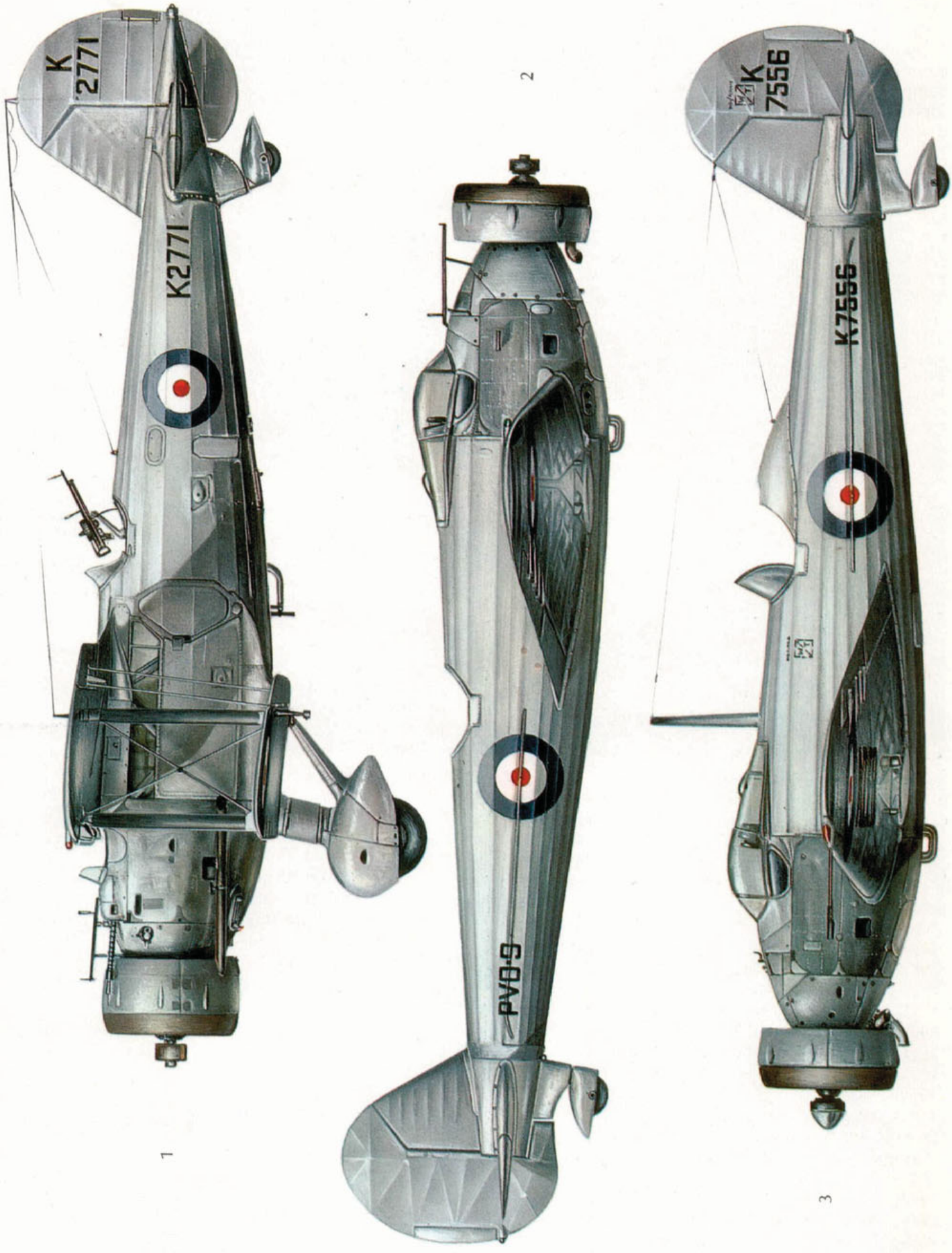
3 *K7556 conversion of PVO-9 purchased by the Air Ministry to become the pre-production Wellesley (Vickers Type 281) to Air Ministry Specification 22/35, powered by an 820 h.p. Bristol Pegasus X radial. Period: 1935.*

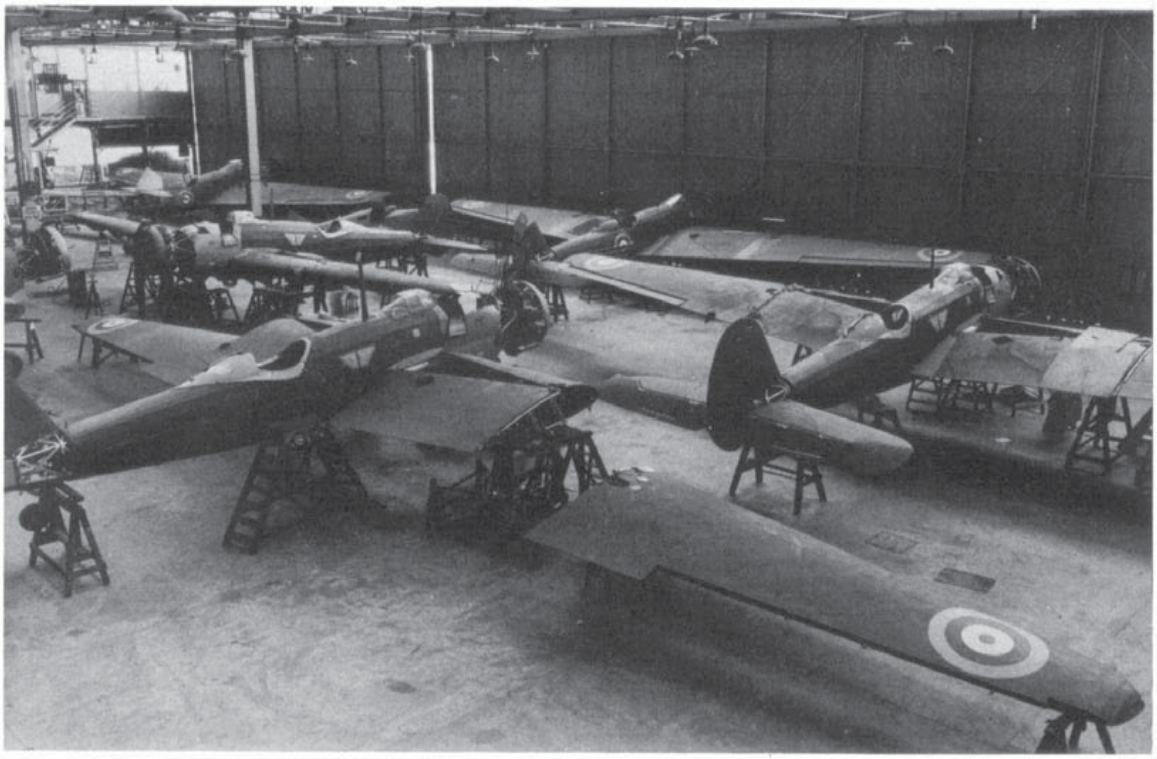
Two more views of the Type 281 pre-production Wellesley. The bigger photograph shows HM King Edward VIII on his first and only official visit to A&AEE, Martlesham Heath in 1936. He wears the new-style forage cap. In the background is the prototype Fairey Battle (K4303) and the tail of a Bristol Blenheim. The original Fairey-Reed fixed-pitch propeller has been exchanged for a de Havilland (Hamilton Standard licence) variable-pitch unit.
(Photo: Charles E. Brown)

The smaller photograph above was taken at Weybridge/Brooklands after the A&AEE tests when K7556 was modified to Type 287 production standard with Pegasus XX and bigger cowling with absence of cylinder head 'blisters'. The mainplane is also to production standard without the former quadruple covers to the aileron actuator arms.
(Photo: Vickers)

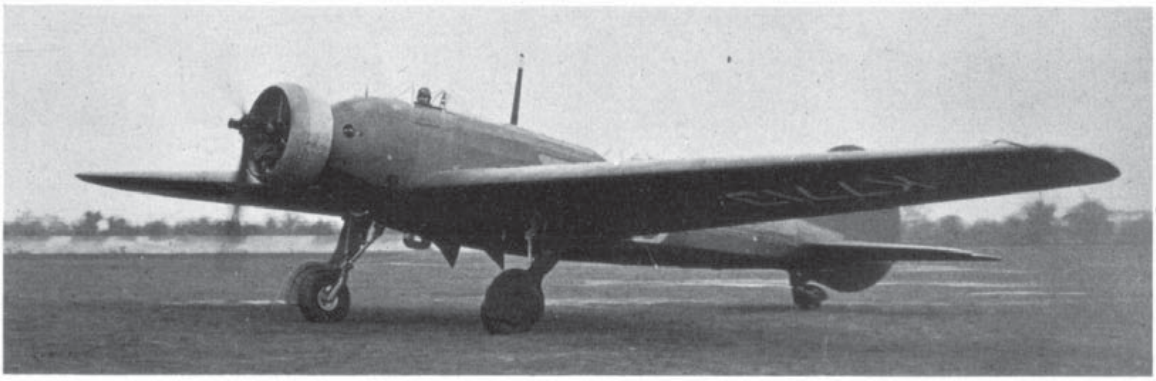








Final assembly shop at Weybridge in 1937. In the foreground are K7744, K7746 and K7747. Eagle eyes might just locate the uncovered rear fuselage of a Vickers Vildebeest and a Miles M.3A Falcon Major.
(Photo: Vickers)



K7713 was the first production Type 287 Wellesley to Air Ministry Specification 22/35 (which superseded specification G.4/31), and was delivered to A&AEE for evaluation trials on March 4, 1937. As yet, the smooth cowling is unpainted. "Mutt" Summers is at the controls.
(Photo: Vickers, ref 4947B)

The pilot aimed using a ring-and-bead sight.

The first production Wellesley (K7713) was flown from Brooklands by "Mutt" Summers on January 30, 1937 and was delivered to A. & A.E.E., Martlesham on March 4, 1937 for type tests by Vickers test pilot Flying Officer Jeffrey Quill.

The third production aircraft (K7715) was delivered by Quill to No. 76 (Bomber) Squadron at R.A.F. Station Finningley (Yorkshire) on March 22, 1937 for Service trials.

(This Squadron had been derived from the "B" Flight of No. 7 Squadron which broke away in April 1936 to provide the nucleus of the new Squadron in April 1937 for the introduction of the Wellesley.)

This was a significant milestone in the history of the Royal Air Force; it was the first of more than 12,000 "geodetic types" to join the strength of the R.A.F. during the next nine years.

A total of 176 Wellesleys was produced at Weybridge between January 1937 and May 1938—that is, at an average rate of more than 10 aircraft per month—equipping five medium-bomber squadrons in the United Kingdom and four more in the Middle East.

No. 77 (Bomber) Squadron was also formed at Finningley in June 1937 with Wellesleys which were operated there for a month before the squadron was moved to Honington (Suffolk) until July 1938 and then to Driffield (Yorkshire) until November 1938. The other "Home" squadrons to receive Wellesleys were Nos. 35 and 207 (Worthy Down, Hampshire) and 148 (Scampton, Lincolnshire and Stradishall, Suffolk).

Soon afterwards, Wellesleys also joined Nos. 14, 45, 47 and 223 Squadrons in the Middle East.

An early wing strength deficiency resulted in the first eight production Wellesleys being restricted to a maximum speed of 200 m.p.h. until the mainplanes had been strengthened by Vickers—to the standard which all subsequent aircraft were built (Vickers Type 294), permitting a maximum speed of 264 m.p.h.

A further problem experienced was vibration when diving with bomb containers open. As a logical outcome, the leading-edges of these doors were cut back in an attempt to overcome the problem but it was their complete removal that eventually cured the problem—with no significant effect on drag.

Long-Range Development

To investigate the Service problems associated with the increasing need for very long-distance flying by the R.A.F., a Long-Range Development Unit (L.R.D.U.) was formed with Wellesleys at Upper Heyford (Oxfordshire) in January 1938. The L.R.D.U. was placed under the command of Wing-Commander O. R. Gayford, D.F.C., A.F.C. —who had already made a World-Record Long-Range Flight in 1933 by flying 5,309 miles non-stop from Cranwell (Lincolnshire) to Walvis Bay in South-West Africa in the second special experimental Fairey Long-range Monoplane (K1991).

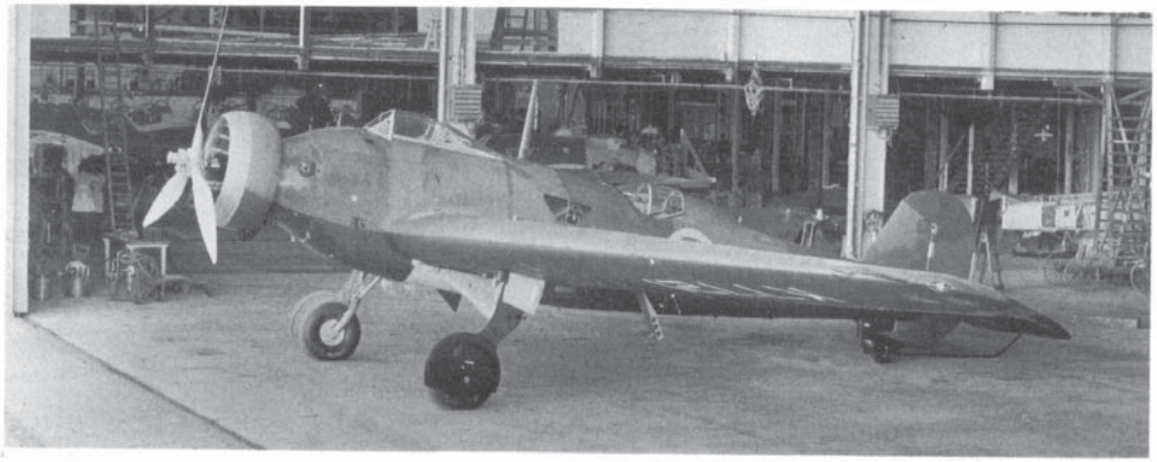
An operational technique just beginning to be seriously evaluated by the R.A.F. for long-range aircraft at this time was the emergency jettisoning of fuel. This was required to enable the reduction of aircraft load to a level where a safe re-landing could be made if an early problem developed at the beginning of a long-range flight with a very large fuel load on board. The development of this technique was an early task of the Wellesley L.R.D.U. flight. The provision of fuel jettisoning has since been widely adopted on both military and commercial aircraft.

Much special effort was devoted to the progressive development of the Wellesley for very long-range flight with the ultimate objective of challenging the world record for distance in a straight line, held at that time by the U.S.S.R. This eventually received official sponsorship and was greatly helped by the enthusiasm of the Bristol Aeroplane Company in the development of the Pegasus engine.

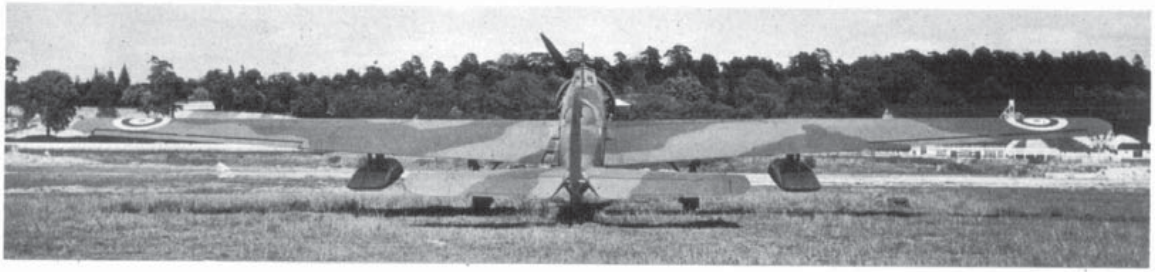
The fifth production Wellesley (K7717), played a major part in the development of the special features for long-range operation (Vickers Type 292). After being allocated to Nos. 7 and 148 Squadrons, K7717 was temporarily transferred to No. 45 Squadron in Egypt to complete the tropical trails of the Pegasus XVIII engine.

The aircraft was later returned to the U.K. for use as the development vehicle for long-range operation and as an engine flying test-bed for the 1,010 h.p. Pegasus XXII which was specially developed for the long-range Wellesley. It was first flown with this engine on January 21, 1938 by Captain Cyril Uwins, Bristol's well-known chief test pilot. Four days later he made a seven-hour test flight and subsequent flight development was devoted to refinement of the most economical cruising fuel consumption.

The 1,010 h.p. Pegasus XXII engine had a slightly higher compression ratio than the 925 h.p. Pegasus XX in the standard production Wellesleys



At Weybridge, K7721, the ninth production Wellesley is photographed on April 29, 1937, just inside the shed and showing off an unpainted DH/Hamilton Standard v-p. propeller unit. K7721 ultimately went to No. 148 (Bomber) Squadron and was written-off by crashing into a haystack on final approach, December 16, 1937.
(Photo: Vickers, ref. 4955K)



Temperate green and brown camouflage blends well with the scene at Brooklands in 1937. One of the early production Wellesleys awaiting delivery to an RAF bomber squadron in the summer months.
(Photo: Charles E. Brown, ref. 5693–2)

Study in cloudscapes. Previously illustrated in the shed, K7721 now displays the production-standard bomb containers providing space for two 500-lb or four 250-lb bombs in each pannier.
(Photo: Charles E. Brown, ref. 5693–14)


L
2706
W

Bearing the unit badge of No. 14 (Bomber) Squadron, Royal Air Force, RAF Station Amman, Transjordan, 'W-for-William' (L2706) was the 166th production Vickers Wellesley Mk. I. The colour scheme and markings are applicable to 1938. The squadron motto: 'I spread my wings and keep my promise' is particularly apt in view of the remarkably high aspect-ratio (8.8) of the mainplane. *N.B.*: Vokes/carburettor air/cleaner and sand filter under engine cowling was applicable to 1940-41 East African Campaign.

but a smaller supercharger because of the 10,000 feet operational height limit fixed for the long-range record flight attempt in order to achieve the optimum cruising fuel consumption. Automatic boost and mixture control were also incorporated to further refine engine performance and fuel conservation by avoiding fuel wastage with manual control and engine damage from over-weak mixture. This device was subsequently fitted to many other operational aircraft with marked benefits.

This Wellesley (K7717) was also used to prove the fuel jettisoning system. Later, this work was continued by the R.A.E. at Farnborough with another Wellesley (K7740)—which was also fitted with the inter-cockpit glazed canopy that led to the popularly-inspired but entirely unofficial designation of "Wellesley Mk. II".

Five more standard Wellesleys (L2637, L2638, L2639, L2680 and L2681) were converted for the L.R.D.U. Notable among the technical changes made to the airframes were: The deletion of all military equipment; accommodation for a third crew member (navigator); introduction of an R.A.E.-type automatic gyro-pilot; installation of a special two-way radio; fuel (100-octane lead-free petrol) capacity increased from the normal 485 Imperial gallons to 1,255 Imp. gal. (which was later further increased to 1,290 Imp. gal. by deletion of the crew baggage); oil capacity increased to 60 Imp. gal. and a strengthened undercarriage with heavier tyres.

The extra fuel tanks incorporated jettison-valves, the extra oil tanks were associated with a tropical oil radiator, and the incorporation of the navigator's position was facilitated by a slight increase in width in the forward fuselage and a sleeping bunk and small library of light literature were also fitted.

Powerplant changes included: Baffles added between the engine cylinders; addition of a N.A.C.A.-type long-chord cowling with controllable gills to reduce drag and improve cooling (developed by Bristol on K7717); substitution of the Rotol variable-pitch constant-speed propeller in place of the de Havilland/Hamilton Standard two-pitch type; an engine-driven vacuum pump added for the operation of instruments; and an additional hydraulic pump for undercarriage actuation (the existing one being adapted to the propeller operation gear) driven from the rear of the engine by Cardan shaft.

World Long-distance Record

As a prelude to the attempt on the world long-distance record, four of the five long-range Wellesleys of the L.R.D.U. (L2638, L2639, L2680 and L2681) under the command of Squadron Leader R. Kellett, left Cranwell (Lincolnshire) on July 7, 1938 to fly to the Middle East. In 32 hours flying time, 4,300 miles were covered at 10,000 feet with an average ground speed of 135 m.p.h. —from Cranwell via a point between Kuwait and Bahrain on the Persian Gulf to land at Ismailia in Egypt, from where the eventual record flight was to start. This was the longest non-stop flight in formation up to that time.

After final preparation at their home base at Upper Heyford these aircraft returned to Ismailia on October 25, 1938.

The aircraft and their crews were:

No. 1 (L2638)
Pilot and Flight Leader:
Squadron Leader R. Kellett.
Second Pilot and Navigator:
Flight Lieutenant R. T. Gething.
Unit Signals Officer:
Pilot Officer M. L. Gaine.

No. 2 (L2639)
First Pilot:
Flight Lieutenant H. A. V. Hogan.
Second Pilot and Navigator:
Flight Lieutenant R. G. Musson.
Wireless Operator and Mechanic:
Sergeant T. D. Dixon.

No. 3 (L2680)
First Pilot:
Flight Lieutenant A. N. Combe.
Second Pilot and Navigator:
Flight Lieutenant B. K. Burnett.
Wireless Operator and Mechanic:
Sergeant H. G. Gray.

The Signals Officer of No. 1 aircraft and the wireless operator/mechanics in the other aircraft were also qualified pilots.

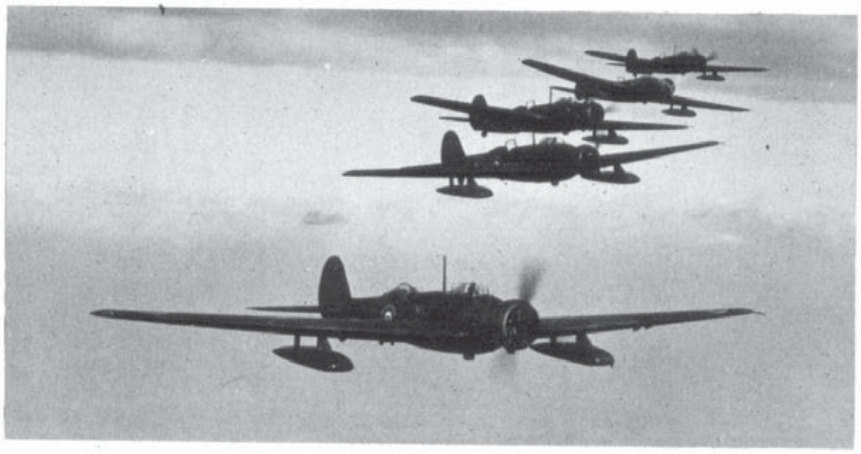
Each aircraft carried around four tons of fuel —nearly half the gross weight at take-off of 18,400 pounds which was an overload of 7,900 pounds (71%) compared with the standard service Wellesley. This exceptional lifting capability was further rewarding testimony to the efficiency and success of the high aspect ratio wings and immensely strong structure of the Wellesley.

The objective was to break the existing World Record of 6,306 statute miles (10,146 kilometres) established by the Soviet Union between Moscow and San Jacinto (California) on July 11, 1937. To eclipse this record, the R.A.F. Wellesleys had to fly at least 100 kilometres (62·14 miles) further—making a total distance of 6,368 miles.

In addition to stating the minimum distance by which a previous record had to be exceeded, the Fédération Aéronautique Internationale (F.A.I.) also required that the aircraft concerned should carry two sealed barographs and that seals should be placed on the airframes, engines and petrol tanks. The British Royal Aero Club effected the necessary arrangements for this action to be taken by the Royal Aero Club of Egypt—which also officially observed the departure of the aircraft.

Ismailia was chosen as the starting point for several reasons: there would be better weather there in November than in England and a longer and drier take-off run would be available (a

(Right) Awaiting delivery to RAF bomber units is this batch of six mid-production Wellesleys (L2652 to L2655 and L2657 and L2658) in the winter of 1937; 111 were ferried to RAF and experimental units that year.
(Photo: Vickers, ref. 4996J)



special runway was built for the record attempt) and it would enable a Great Circle course to be taken, chiefly over British Commonwealth and diplomatically friendly territories and without crossing the Himalayas, so that the calculated range would terminate in Australia. The Anglo-Egyptian political relationship was also a key reason for the choice.

In addition to the special modifications to the aircraft an elaborate en-route communications network was also set up. The Air Ministry arranged for Service and Commercial wireless stations to keep a special watch for signals from the aircraft which were to be transmitted at regular intervals. The principal direction finding stations used were Shaibah, Jask, the India Coasts, Malaya, Timor, Darwin and Cloncurry. Three naval vessels—H.M.S. *Deptford*, H.M.I.S. *Investigator*, and H.M.A.S. *Swan*—were also stationed in the Arabian Sea, Bay of Bengal, and Timor Sea respectively, to act as operational links in the communications chain. During the night they were also to operate their searchlights to provide an additional navigational aid for taking bearings.

The official narrative of the record flight, as telegraphed from Port Darwin in Australia by Squadron Leader Kellett, is perhaps the most graphic account of this epic achievement:

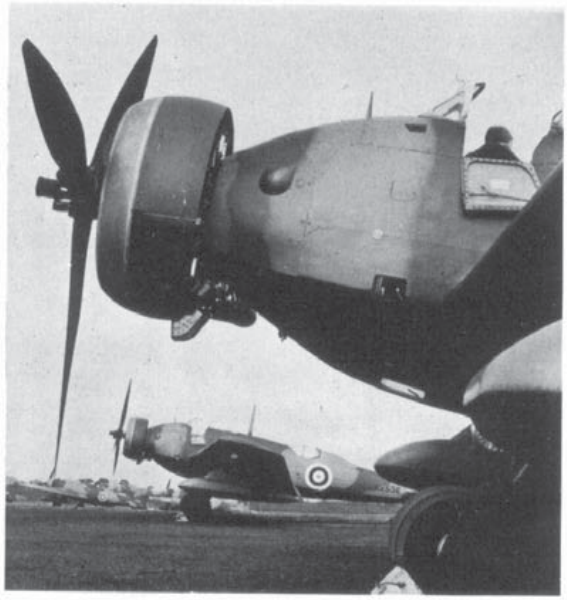
"The Royal Air Force Long Range Flight, consisting of three Wellesley aeroplanes, left Ismailia, Egypt, at 0355 hours G.M.T. on November 5, 1938, for Darwin in an attempt to beat the world's long distance record of 6,306 miles held by the U.S.S.R. Conditions for the take-off were good, with a light breeze of 5 m.p.h. blowing slightly across the prepared runway. The aircraft took off individually, and no difficulty was experienced by any of the aeroplanes in either take-off or climb. The average run was about 1,200 yards with an all-up weight of 18,400 pounds.

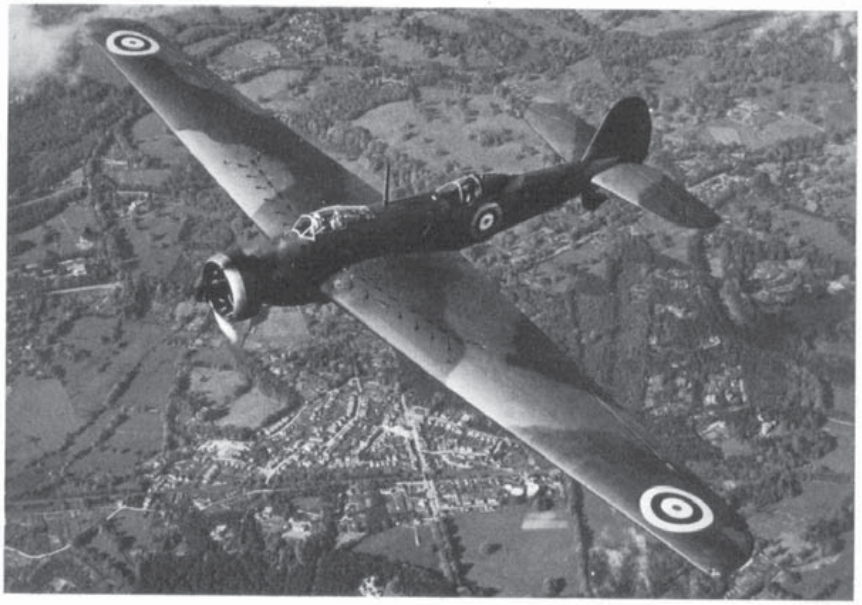
"We turned straight on to our course and climbed to 10,000 feet. This height was reached about 45 minutes after the take-off and maintained throughout the flight. We had hoped to obtain a following wind of useful strength as far as India, but after this the prospects were that there would be light adverse winds until the Australian end of the route was reached. As it turned out, we obtained little or no help from the wind for the first 12 hours, and adverse winds were experienced for the rest of the route. Over Arabia, unusually cloudy conditions were met with, and the bumps experienced were unpleasant under our heavily loaded conditions.

"The Persian Gulf was reached after about six hours' flying, and darkness fell after the

In 1937, among the Home units of RAF Bomber Command to be equipped with Wellesleys was No. 148 (B) Squadron, RAF Station Scampton (in Lincolnshire). In the formation view, the wing attitudes suggest bumpy conditions. The nearest Wellesley provides a rare sight of the twin landing lights in only semi-retracted condition (under port wing). (Photos: 'Flight', ref. 15384S and Vickers, ref. 4964B)

(Below, right) During June 1937, this 14th early production Wellesley (K7726) was photographed over southern England. The black 'blobs' on the wing are footprints for ground-staff to use when walking on the geodetic ('basket-weave') surface. (Photo: Charles E. Brown)





aircraft had been ten hours in the air. After passing Jask the Moon gave us sufficient light for the Indian coast to be picked up after 14 hours' flying. Very little was seen of India owing to cloud, and we depended for course keeping on celestial navigation. The East Coast of India was reached at dawn on November 6 after 19½ hours' flying. A distance of 3,000 miles had then been covered.

"The weather began to deteriorate over the Bay of Bengal with headwinds and occasional thunderstorms. The Andaman Islands were picked up, and the flight was continued to the coast of Siam which was reached after 28½ hours in the air. Soon after crossing the Malay Peninsula the second night fell, a distance of 5,000 miles having then been covered. The position of Anambas Islands was observed by lights picked up half way across the South China Sea.

"For the next 1,200 miles flying conditions were exceedingly unpleasant; cloud, heavy rain and lightning were continuous, rendering wireless inoperative and navigation possible only by dead reckoning. When dawn came on the third day, November 7, we found we were approaching Macassar, at the southern end of the Island of Celebes. We were then within sight of breaking the Russian record of 6,306 miles, which we shortly afterwards did.

"On reaching Lomblen Island in the Dutch East Indies it was realized that No. 2 aircraft might not have a sufficient supply of petrol to cross the Timor Sea and to reach Darwin with an adequate margin of safety. A precautionary landing was therefore made at Koepang by this aircraft, and the other two Wellesleys continued their flight to Darwin, where we landed at 0400 G.M.T. on November 7. We had been just over 48 hours in the air. No. 2 aircraft, which had been refuelled at Koepang, arrived at Darwin a few hours later.

"The engines and aircraft behaved faultlessly throughout the flight, and they never caused us a moment's anxiety. The crews were comfortable throughout the flight and arrived quite fresh at Darwin."

Squadron Leader Kellett later also wrote a personal letter from Australia to Mr. Tommy Broome, Vickers sales manager and former test pilot, in which he said:

"The planes are in awfully good shape, the fabric bare and torn in places from rain otherwise as new and very clean. Two broken valve springs the only engine defect found, apart from routine adjustments. The automatics (autopilot) behaved splendidly in them all."

Sir Keith Smith, Vickers' representative in Australia—who with his late brother Ross Smith had made the world's first air journey from England to Australia in 1919 in a Vickers Vimy from the same factory as the Wellesleys; much of their flight being over almost the same route as that taken by Kellett's team—wrote to Vickers on November 9, 1938:

"The Wellesley Flight has been a magnificent success and has attracted tremendous attention out here. It was a most fitting answer to those critics who say that England cannot build aircraft to meet present-day requirements."

All three Wellesleys succeeded in breaking the existing record. The route that had been followed was not a true Great Circle as this would have involved flying over high mountains and long stretches of sea. The actual distance accomplished, however, was measured on a Great Circle route, and in order to exceed the Russian record by the amount stated earlier the British aircraft had to pass the southern end of Celebes in the Netherlands East Indies. By mutual agreement between their commanders (by means of their short-range two-way radio equipment) No. 2 aircraft (L2639) landed at Koepang (also Kupang; capital of west Timor) at 1213 hours on November 7 after covering a record 6,658·452 miles (10,715·448 kilometres)—only 500 miles short of the objective. L2639 took off from Koepang at 1600 hours and landed at Darwin at 1936 hours (NB: Local times).

Meanwhile the other two aircraft—L2638 and L2680—completed their records at Darwin—significantly at the airfield named after Ross Smith, commander of the famous Vickers Vimy flight of 19 years earlier.

These two Wellesleys had flown 7,158½ statute miles at an average speed of 149 m.p.h. and had beaten the Russian record by no less than 856 miles. Just how near they had been to running out of fuel is evident by the fact that No. 1 aircraft (L2638) had only 44 Imperial gallons remaining while No. 3 (L2680) had a mere 17 Imperial gallons.

The announcement of homolgation by the F.A.I. of this epic world record achievement was made by the Air Ministry on January 24, 1939 as 7,158·653 miles (11,520·421 kilometres).

The Wellesley record remained unchallenged for seven years—until November 1945, when it was beaten (at the third attempt) by a Boeing B-29 Superfortress of the United States Army Air Forces, weighing around 10 times the gross of the Wellesley and having four two-row radial engines each developing more than twice the horse-power of the Wellesleys single 1,010 h.p. Bristol Pegasus XXII.

The Wellesley record flight also gained the Britannia Challenge Trophy awarded by the Royal Aero Club for the most meritorious performance of the year by British airmen.

As well as the obvious pride to Britain in regaining one of the four "absolute" air records —Speed, Distance in a Straight Line, Distance over a Closed Circuit, and Height—this magnificent achievement by the Vickers Wellesley was probably of equal merit to that of the famous (Vickers) Supermarine S.6 seaplane racers in winning the coveted Schneider Trophy outright for Britain seven years earlier.

Key to colour side views

4 *L2638, first of the specially converted Wellesleys (Vickers Type 292) of the Long-Range Development Unit (L.R.D.U.) of the Royal Air Force—flown by Squadron Leader R. Kellett in the World-Record Long-Distance Flight from Egypt to Australia—powered by a 1,010 h.p. Bristol Pegasus XXII radial. Period: November 1938.*

5 *K7772, the 60th production Wellesley converted to become the engine flying test-bed for the 1,350 h.p. Bristol Hercules HE15 air-cooled sleeve-valve two-row radial engine (Vickers Type 289). Period: August 1937.*

6 *K7740, the 28th production Wellesley used for fuel jettisoning tests and also fitted with an inter-cockpit glazed canopy which led to the unofficial "Wellesley Mark II" designation. Powerplant was a 925 h.p. Bristol Pegasus XX radial. Period: 1938.*

Together these two outstanding Vickers aircraft achievements of the 1930s had a profound and lasting impact on the international aviation world—the Wellesley led to the ubiquitous Wellington bomber and the S.6 racing seaplanes precursed the immortal Spitfire fighter.

Military secrecy had continued to enshroud the unique structural design of the Wellesley for fear of revelation of its advantages to prospective enemies. "First official photographs of the secret geodetic construction" were not released publicly until this time, as witness the contemporary British aviation technical journals *"The Aeroplane"* of November 9, 1938 and *"Flight"* of the following day, and the first detailed illustrated descriptions appeared in these journals a month later.

War Service—The Middle East

In March 1938, when the Wellesley was reviewed for operational readiness in view of the impending war in Europe, 57 aircraft were home-based, the remaining 119 having been transferred for service in the Middle East—with Nos. 14, 45, 47 and 223 Squadrons.

Among the provisions made were the addition of a third crew-member position amidships within navigational equipment and a bombing position. This compartment was located between the pilot and gunner's positions and completely within the fuselage—but with beam windows. Under Vickers Type No. 402, K7748 was used for development of these modifications.

Wellesleys were replaced in the home-based squadrons of R.A.F. Bomber Command by Hampdens, Whitleys and Wellingtons. However, they went on to achieve notable operational success during the early stages of World War Two in the Middle East area—in the East Africa Campaign and, later, in the Mediterranean theatre.

Indeed, the Wellesley was the main Allied strategic bomber and the only R.A.F. aircraft type to operate throughout the East Africa campaign (June 1940–November 1941) in which it played a major role, performing very creditably and making many unescorted raids deep into enemy territory. Stiff fighter opposition was often encountered and heavy combat losses were suffered in the air and on the ground.

The first Middle East squadron to be equipped with Wellesleys was No. 45 at Helwan, Egypt, which received its first example on November 25, 1937. This squadron moved to Ismailia in January 1939. Its Wellesleys were mainly used for aerial policing in the area, but were replaced by Bristol Blenheims in June of that year.

The other three squadrons were all based in the Anglo-Egyptian Sudan at the outbreak of World War Two. When Italy entered the War on June 10, 1940, No. 14 Squadron was based at Port Sudan, No. 47 at Erkowit and No. 223 at Summit.

No. 14 Squadron received its original complement of Wellesleys between March and June 1938, which were used in Transjordan (from Amman) and from August 1939 in Egypt (from Ismailia) going back to Amman from December 1939 to May 1940 whence they moved down to Port Sudan in May 1940.

On June 11, 1940—the day after Italy entered the war—they made a highly successful bombing attack on Massawa airfield, destroying an estimated 350,000 gallons of petrol and damaging enemy aircraft and hangars. From then on No. 14 Squadron made further frequent raids on Massawa in addition to attacking other targets in Eritrea such as the strategic airfields at Gura and Asmara. In addition to the normal armament of the Wellesley described earlier, No. 14's aircraft were augmented by a ventrally-mounted 0·303 in. Vickers "K" gun on mountings of the Squadron's own design. Some aircraft were also later fitted with a twin-gun installation in the rear cockpit, again on mountings of No. 14 Squadron's own design. When the Squadron was re-equipped with Blenheim Mk. IVs in September 1940, its Wellesleys were progressively transferred to Nos. 47 and 223 Squadrons.

The Wellesleys of No. 45 Squadron, based at Ismailia, Egypt, were mainly used for aerial policing in the area, but were replaced by Blenheims in June 1939.

Based at Khartoum, Sudan, No. 47 Squadron received its Wellesleys in June 1939 and moved to Erkowit (which later became known as Carthago) in the Red Sea Hills of Sudan, in May 1940. Its first wartime attack was made against the airfield at Asmara, the capital of Eritrea, Italian Somaliland on June 11; and, in July, the Squadron made more raids on Italian-held airfields, notably at Azoza and Gondar. Many other enemy targets in Eritrea were also attacked, including Addis Ababa and No. 47 Squadron was also particularly active during the operations against Keren.

On October 16, 1940, eight of No. 47's Wellesleys detached to Gedaref airfield were burnt out after ground strafing by Italian *Regia Aeronautica* aircraft. A month later a detachment of the squadron operated from Khartoum and ultimately No. 47's headquarters unit moved there, with detachments at Kassala and Argordat making photographic reconnaissance and strikes on enemy gun positions and troop concentrations.

At the beginning of April, the Squadron moved to Asmara following its capture; thereafter using it as a base to mount bombing attacks on the fortress at Amba Alagi. After capitulation of this fortress a month later, No. 47 continued to operate over Ethiopia and dropping supplies to Allied troops at Dabarach until the final battle of the East African Campaign at Gondar on November 28, 1941. For most of the period, this was the only R.A.F. Squadron in the area; all other units being those of the South African Air Force.

1 *Detail of a section of the fuselage.*
(All photos: Vickers unless otherwise stated)

2 *Geodetic upper surface wing panelling.*

3 *Fuselage interior looking forward to the pilot's drop-back seat and 'spectacle' type control column.*

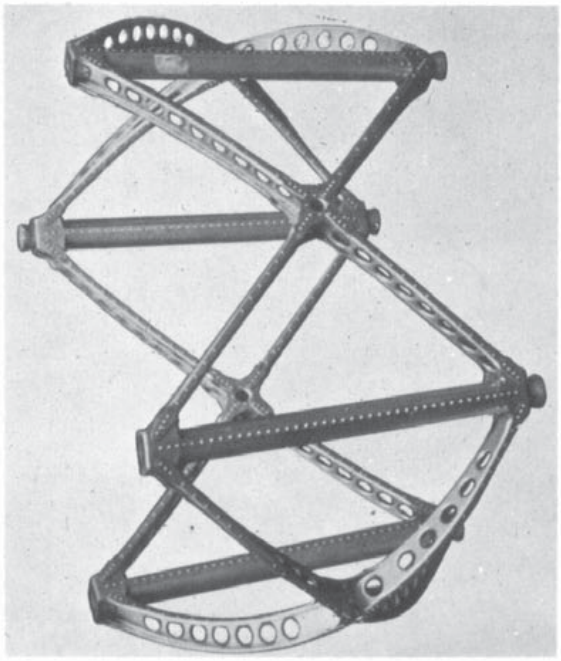
4 *The Barnes Wallis 'basket-weave' design began with the Wellesley. In the background is the original contender for the G.4/31 Specification, the Vickers Type 253 biplane, K2771.*

5 *The hydraulically-operated main undercarriage leg.*

6 *Rear fuselage assembly.*

7 *Squadron armourer of No. 76 (B) Sqn., RAF Finningley, Yorkshire, shows the method of winching up.*
(Photo: J. T. C. Long via Chaz Bowyer)

8 *Close-up showing the built-in step at the wing root used by the pilot and ground crews.*
('Flight', ref. 12403S)



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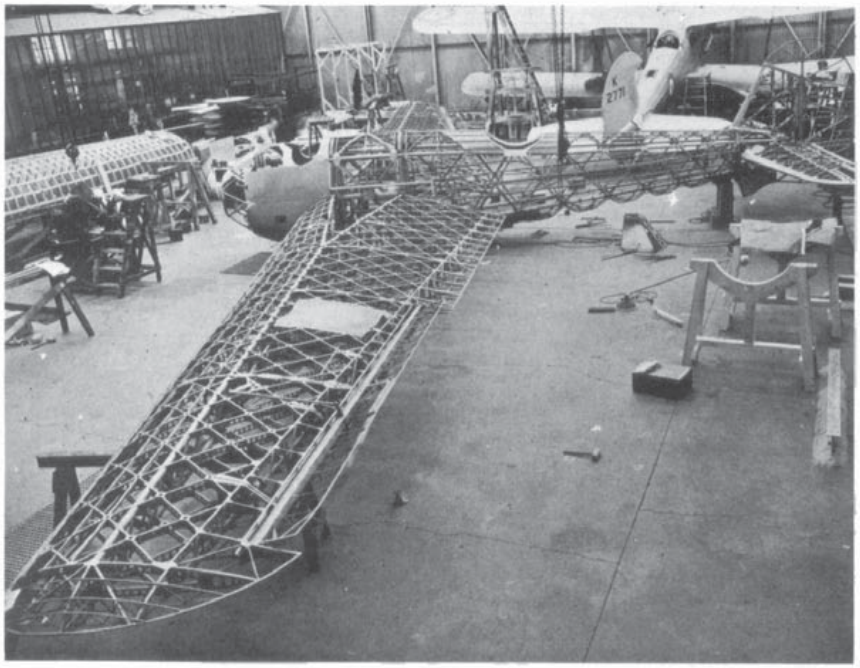

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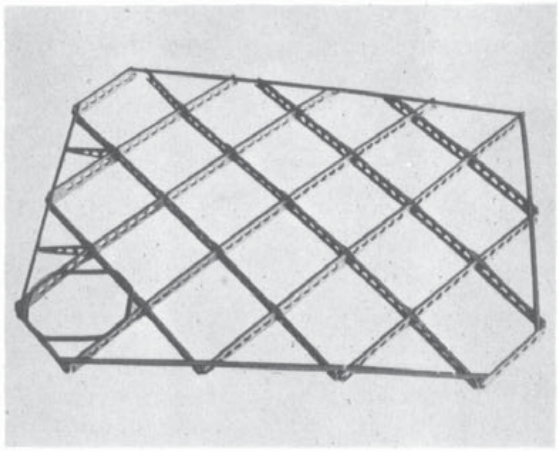

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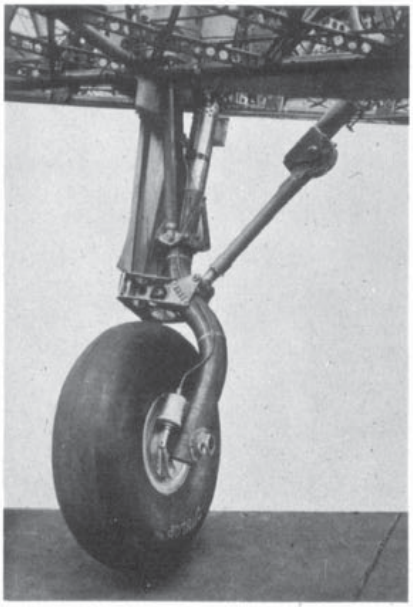

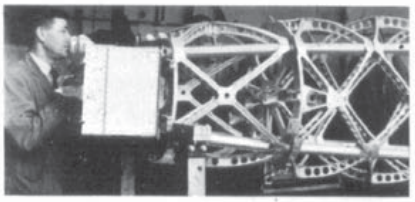

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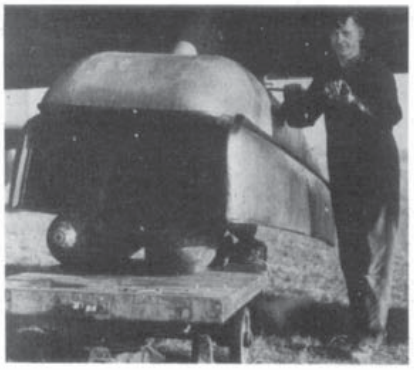

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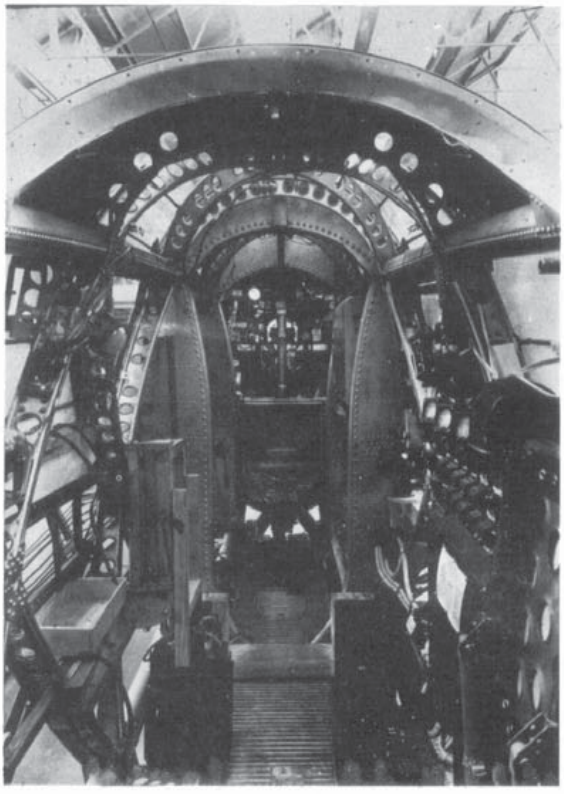

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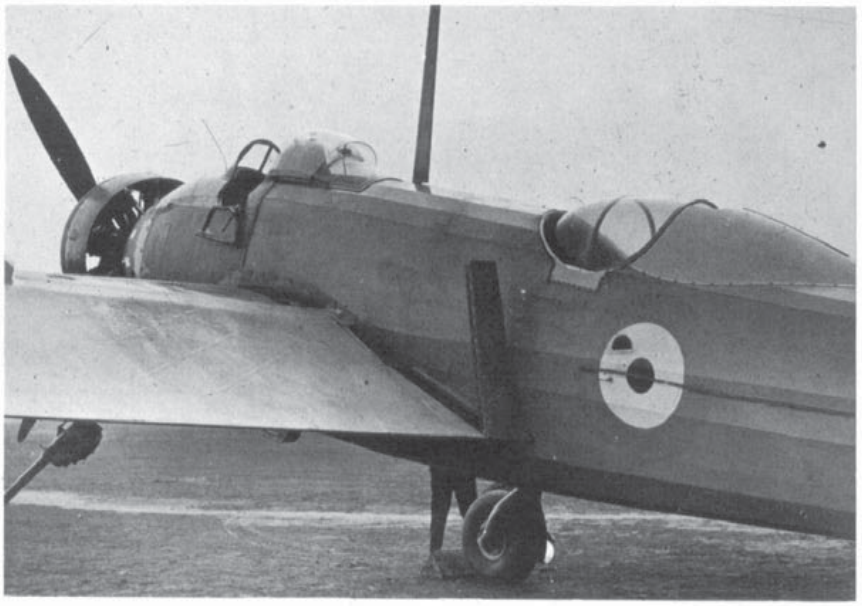

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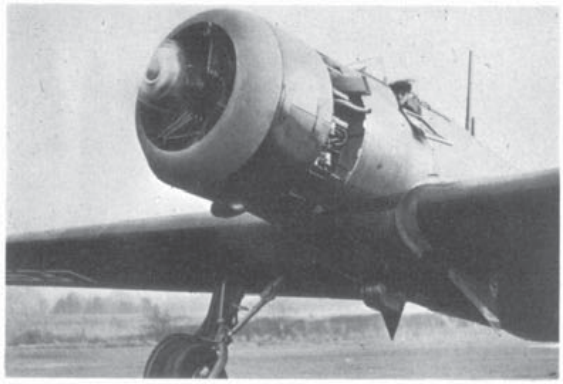

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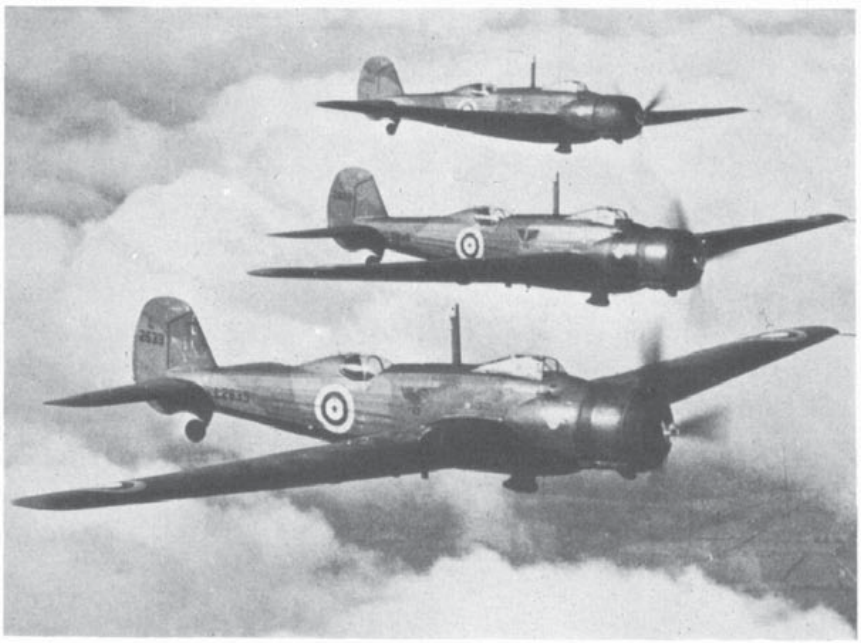

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1 *The 1,010 h.p. Bristol Pegasus XXII of Wellesley L2637, the first of five converted for the Long Range Development Unit (LRDU) during ground-running tests at Brooklands, February 18, 1938.*
(All photos: Vickers unless otherwise stated)

2 *K7717 was used as a test vehicle for the LRDU operation and still carried No. 148 Squadron's identity on the fuselage.*
(Photo: 'The Aeroplane' ref. 7808 via Bristol Siddeley)

3 *L2639 of LRDU (the No. 2 aircraft) with rations and Thermos flasks being checked on board at Ismailia by Squadron Leader Kellett, RAF.*

4 *L2638 of LRDU being refuelled at Ismailia.*

5 *LRDU's L2639, L2680 and L2638 before the record-breaking flight.*

6 *Preparations for the record flight at Ismailia.*

7 *Compass swinging L2638 (No. 1 aircraft) at Ismailia.*

After final surrender by the Italians, No. 47 Squadron sent a flight of Wellesleys up to British Mandated Palestine at the end of the year. On April 16, 1942, this flight became known as "47 Squadron Air Echelon" and went on to operate sea navigation, reconnaissance and anti-submarine patrols in the Eastern Mediterranean—first from Burgh-el-Arab, Egypt, and later from Shandur and St. Jean. The four Wellesleys in the squadron at this time each carried four 250 lb. depth-charges (two in each underwing bomb-container) and operated sorties of about seven hours duration. The Echelon was eventually disbanded in February 1943.

No. 223 Squadron, which operated Wellesleys from June 1938 to April 1941, also took part in the East African Campaign from its bases at Summit and Wadi Gazouza, Sudan—notably bombing Gura airfield on June 11, 1940; then Addis Ababa from Perim Island on October 18, 1940; and making numerous night-bombing raids in the area—until the fall of Asmara whence it moved to Egypt to re-equip with Martin Marylands.

From Wellesley to the Immortal Wellington

Efficient in concept and in action, and well-liked by its crews, the Vickers Wellesley proved to be for the Royal Air Force a key stepping stone into the monoplane era. However, when the Italians in East Africa finally capitulated in May 1941, and the bombing offensive became such a dominant factor in the war in Europe, the bigger and more effective two-motor Wellington was well-established in production at Weybridge.

The Wellington went on to take the unique Wallis-geodetic structural concept, so well demonstrated in the Wellesley, to become the mainstay of R.A.F. Bomber Command in the critical years of World War Two and on to immortality.

SQUADRON AND OTHER SPECIAL UNIT ALLOCATIONS

No. 7 Sqn: K7714, K7715, K7716, K7717, K7718, K7719, K7720.

No. 14 Sqn: K7743, K7749, K7755, K7757, K7759, K7763, K7764, K7765, K7768, K7769, K7774, K8533.
L2640, L2643, L2644, L2645, L2646, L2649, L2650, L2651, L2652, L2653, L2654, L2655, L2656, L2657, L2658, L2659, L2669, L2692, L2693, L2694, L2695, L2696, L2697, L2698, L2699, L2700, L2701, L2703.

No. 35 Sqn: K7736, K7738, K7739, K7745, K7747, K7748, K7749, K7750, K7751, K7752, K7754, K7755, K8526, K8529, K8530.
L2642, L2688.

No. 45 Sqn: K7742, K7750, K7756, K7760, K7775, K7776, K7777, K7778, K7779, K7780, K7781, K7782, K7783, K7784, K7785, K7786, K7788.
L2674, L2675, L2676, L2677, L2678, L2683, L2684, L2685, L2686, L2687, L2710, L2711, L2712, L2713, L2714, L2715.

No. 47 Sqn: K7713, K7715, K7720, K7722, K7724, K7725, K7726, K7727, K7728, K7730, K7733, K7739, K7742, K7750, K7751, K7756, K7757, K7759, K7762, K7765, K7767, K7768, K7769, K7771, K7773, K7774, K7775, K7776, K7777, K7779, K7780, K7781, K7782, K7785, K7786, K7791, K8520, K8521, K8525, K8526, K8527, K8528, K8529, K8530.
L2637, L2641, L2645, L2649, L2650, L2657, L2659, L2665, L2667, L2673, L2674, L2675, L2677, L2678, L2679, L2688, L2691, L2696, L2697, L2699, L2700, L2701, L2702, L2704, L2705, L2709, L2710, L2712, L2713, L2714, L2715.

No. 76 Sqn: K7715, K7716, K7717, K7718, K7719, K7720, K7722, K7725, K7726, K7730, K7731, K7735, K7740, K7741, K7742, K7743, K7744, K7746, K7748, K7752, K7790, K8522, K8527, K8528, K8530, K8531, K8532.
L2641, L2642, L2648, L2689, L2690.

No. 77 Sqn: K7739, K7747, K7787, K7789, K7790, K8520, K8521, K8522, K8523, K8524, K8525, K8534, K8535, K8536.
L2641, L2642, L2648, L2679, L2682, L2688.

No. 148 Sqn: K7713, K7714, K7715, K7716, K7717, K7718, K7720, K7721, K7723, K7724, K7727, K7728, K7730, K7732, K7733, K7734, K7735, K7751, K8526.
L2642, L2657, L2691.

No. 223 Sqn: K7720, K7724, K7727, K7731, K7740, K7747, K7750, K7751, K7768, K7769, K7774, K7780, K7783, K7788, K8520, K8524, K8526, K8528, K8529, K8530.
L2648, L2654, L2659, L2660, L2661, L2662, L2663, L2664, L2665, L2666, L2667, L2668, L2669, L2670, L2671, L2672, L2673, L2674, L2683, L2685, L2686, L2690, L2691, L2694, L2695, L2698, L2701, L2702, L2703, L2704, L2705, L2706, L2707, L2708, L2709, L2711, L2713, L2714, L2715.

No. 207 Sqn: K7756, K7757, K7758, K7759, K7760, K7761, K7762, K7763, K7764, K7765, K7766, K8531, K8532, K8533.

LRDU: K7734, K7735, K7748.
L2637, L2638, L2639, L2680, L2681.

No. 70 O.T.U.: K7770, K8523.

No. 71 O.T.U.: L2660, L2706.

No. 4 A.T.C.: K7751.

No. 7 A.T.S.: K8529.

A.T.D.U. (Torpedo Development Flt./Air Torpedo Development Unit): K7736, K7740.

A. & A.E.E.: K7713, K7724, K7729, K7740, K7754, K7791.

C.F.S.: K7714.

R.A.E.: K7721, K7729, K7740, K7753, K7772.
L2642, L2679, L2682, L2716.

Iraq Communications Flight: L2714.

Comm. Flt. Khartoum: L2649, L2657, L2673, L2704.

Comm. Flt. Khormaksar: K7726.

Royal Egyptian Air Force (sold in February 1940): K7728, K7735, K8531.

To training airframes: K7727 = 1029M; K7746 = 1041M; K8534 = 1092M; K8536 = 1066M.

Experimental aircraft: K7717 development for long-range operation; K7736 for intensive flying trials; K7740 for fuel jettisoning and Inter-cockpit glazed canopy modification: K7772 engine flying test-bed for Hercules engine with Bristol Aeroplane Co. at Filton; K7791 fitted with special gun mounting and reflector sight; L2641, L2642, L2679 and L2682 for experiments at R.A.E. on de-icing equipment; L2716 for experiments at R.A.E. on armoured wing leading-edges for barrage balloon cable-cutting trials.

TENDERS

As far as surviving Company records permit, the following notes have been prepared:

November 1931. Vickers submitted original biplane tender (Type 253) to Air Ministry Specification G.4/31.

April 1932. Biplane (Type 253) prototype one-off ordered under Contract 174761/32.

August 16, 1934. Biplane Type 253 (R.A.F. serial K2771) flown at Weybridge factory aerodrome of Brooklands (Surrey) for the first time.

July 29, 1935. Biplane K2771 delivered to A. & A.E.E., Martlesham Heath (East Suffolk) for Official Trials.

August 26, 1935. Biplane K2771 (on completion of A. & A.E.E. trials and return to Vickers at Weybridge) flown from Brooklands to Filton (Bristol) to serve the Bristol Aeroplane Company as an E.F.T.B. (engine flying test-bed) until 1941.

June 19, 1935. Monoplane (private-venture Type 246) first flown at Brooklands wearing Class B Provisional (S.B.A.C.-approved) registration marks "0-9".

September 1935. Monoplane Type 246 (registration "0-9") sold to Air Ministry under Contract 436980/35 and allocated R.A.F. serial K7556 for initial trials by Vickers.

March 1936. Monoplane Type 246 (K7556) flown to A. & A.E.E., Martlesham, for type and development trials to Spec. 22/35 which superseded A.M. Spec. G.4/31.

SERIES PRODUCTION

Two contracts followed the one-off prototype (K7556) resulting in a further 176 aircraft being ordered:

(1) Contract 435442/35 (Spec. 22/35) was allocated two batches of R.A.F. serials: K7713 to K7791 inclusive (79 aircraft) and K8520 to K8536 (17 a/c.).

First batch (K7713 to K7791)—K7713 delivered to A. & A.E.E. for evaluation on March 4, 1937; K7715 was first unit delivery, to No. 7 (Bomber) Squadron, R.A.F., on March 22, 1937; K7757 was last of first batch delivery, to No. 207 (B) Squadron, August 31, 1937. The last one of this batch (K7991) was retained for manufacturer's trials, from October 30, 1937.

Second batch (K8520 to K8536)—K8522 was first delivery, to R.A.F. Aircraft Storage Unit, Cardington (Bedfordshire), October 4, 1937; last delivery was K8536, to No. 77 (B) Squadron, November 17, 1937. Sixteen a/c. delivered to R.A.F. squadrons and one (K8531) sold to the Egyptian Army Air Force.

(2) Contract 537135/36, for 80 a/c. was allocated inclusive serials L2637 to L2716. The first a/c. to be delivered was L2641, to the Royal Aircraft Establishment at Farnborough (Hampshire) on January 26, 1938. The last was L2716 to Vickers D.T.D. (Air Ministry's Dir. of Tech. Dev.) on May 30, 1938.

From 1938 the Wellesley production output from Weybridge was direct to the R.A.F. Packing Depot at Sealand (Cheshire) or the Cardington Storage Unit prior to shipment to Middle East based squadrons to replace ageing Vickers Vincent and Fairey Gordon biplanes. The Wellesleys in R.A.F. Bomber Command were withdrawn in 1939 and also shipped to the Middle East. This accounts for the appearance of individual aircraft serials under more than one squadron in the following unit allocations breakdown.

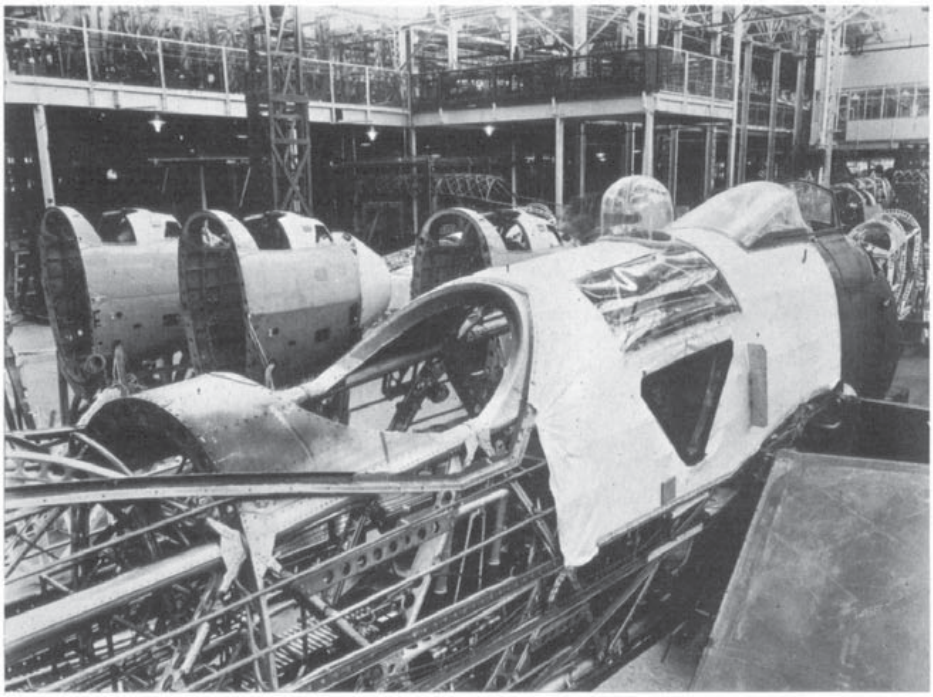
On September 6, 1939, in the Bay of Biscay, enemy action accounted for five Wellesleys in shipment to the Middle East: K7718, K7748, K7790, K8532 and K8522.

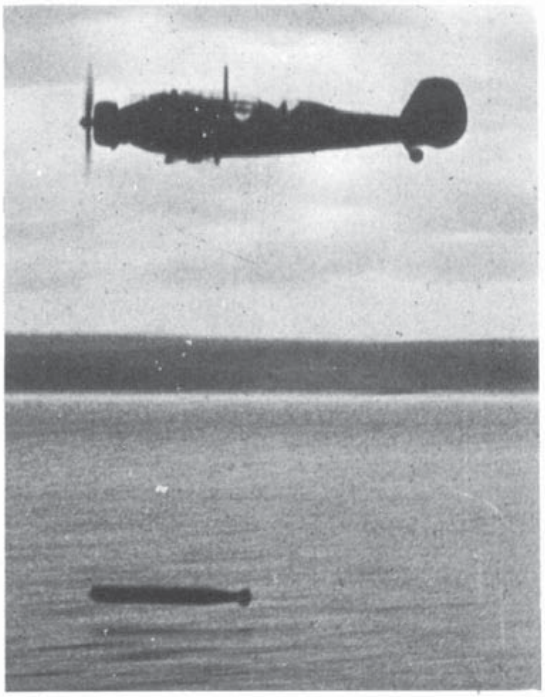
After wide-ranging service in the Middle East area and in the Italian East Africa Campaign of June 1940–November 1941 the Wellesley was finally grounded by the R.A.F. in 1943.

WELLESLEY DELIVERY SUMMARY

Year	R.A.F. Serials	Quantity
1936	K7556	1
1937*	K7713 to K7791; K8520 to K8536; L2643 to L2655; & L2657 to L2658	111
1938*	L2637 to L2642; L2656; & L2659 to L2716	65
	Total:	177

*By serial sequence: (79) K7713 to K7791; (17) K8520 to K8536; & (80) L2637 to L2716





Two rare views of special Wellesleys. (Left) An 'in situ mock-up' not proceeded with which would have provided an astrodome and upper side transparencies for the third seat position (the navigator's) amidships. (Right) Wellesley K7740 dropping an 18-inch torpedo with dummy warhead while undergoing trials in December 1940 at the Air Torpedo Development Unit. This was a prime requirement of the original G.4/31 Specification.
(Photos: Vickers and via 'Flight')

VICKERS WELLESLEY SPECIFICATION DETAILS

Type: Two/three-seat High-Performance Long-Range Bomber and General-Purpose monoplane.

Wings: Low-wing cantilever monoplane Vickers-Wallis "Geodetic" Duralumin structure. "Frise" type ailerons. Trailing-edge split flaps.

Fuselage: Oval-section metal structure built up of intersecting members on the Vickers-Wallis "Geodetic" principle.

Tail Unit: Monoplane type. Metal structure. Controllable trim tabs on rudder and elevators.

Undercarriage: Retractable type. Two cantilever Vickers oleo-pneumatic shock-absorbers retracting inward into the under-surfaces of the wings. Vickers wheel-brakes.

Powerplant: One Bristol Pegasus XX aircooled nine-cylinder geared and supercharged single-row radial engine, giving a maximum output of 950 h.p. at sea-level for take-off and a maximum output at 15,000 ft. of 900 h.p. De Havilland (Hamilton Standard licence) controllable-pitch propeller. Combined Townend cowling and exhaust ring.

Accommodation: Enclosed cockpits for pilot and gunner, with intercommunication between them. One (pilot's) fixed 0·303 in. machine-gun in starboard wing, movable 0·303 in. machine-gun in rear cockpit. Bombs carried in streamlined external containers below wings. Full wireless, electrical and night-flying equipment, oxygen, etc.

Dimensions: Span 74 ft. 7 in. Length 39 ft. 3 in. Height 12 ft. 4 in. Wing area 630 sq. ft.

Weights and Loadings: Weights (Empty, with instruments), 6,235 lb., (Normal), 11,100 lb. (Maximum overload), 12,500 lb. Wing loadings: (Normal), 17·6 lb./sq. ft.; (Overload), 19·85 lb./sq. ft., Power loadings: (Normal), 12·34 lb./h.p.; (Overload), 13·9 lb./h.p.

***Performance:** Maximum speed at sea-level 191 m.p.h. Speeds at altitude: (At 3,280 ft.), 191 m.p.h.; (6,560 ft.) 198·5 m.p.h.; (9,840 ft.), 208 m.p.h.; (13,120 ft.), 217 m.p.h.; (16,400 ft.), 226·5 m.p.h.; (17,000 ft.), 228 m.p.h.; (19,680 ft.), 226·5 m.p.h.
Landing speed (with flaps) 54·5 m.p.h.
Initial rate of climb 1,090 ft./min.
Climb to 3,280 ft. in 3·6 mins.; 6,560 ft. in 7·1 mins.; 9,840 ft. in 10·6 mins.; 13,120 ft. in 13·9 mins.; 16,400 ft. in 17·9 mins.; and 19,680 ft. in 21·5 mins.
Service ceiling 32,500 ft.
Cruising range at 15,000 ft. at normal loaded weight 1,325 miles at 187 m.p.h.; at 15,000 ft. at overload all-up weight 2,270 miles at 186 m.p.h.

*Figures based on test flights made by Vickers at Weybridge.

(Left) Cockpit details showing the ring-and-bead sight and the 'spectacles'-type control column.
(Photo: Vickers, ref. 4959)

(Right) Overseas posting! Groundcrew working on a Wellesley of No. 14 (Bomber) Squadron, RAF Amman in 1939.
(Photo: via Bruce Rigelsford)

VICKERS WELLESLEY VARIANTS

Vickers Type No.	Designation	Powerplant	Remarks
246	G.4/31 PV Monoplane	Bristol Pegasus IIM3	Class B registration 0-9—Private-venture
253	G.4/31 Biplane	Bristol Pegasus IIM3	Military serial K2771
281	Wellesley	Bristol Pegasus X	K7556—Converted from Type 246 as pre-production Wellesley
287	Wellesley	Bristol Pegasus XX	Production
289	Wellesley	Bristol Hercules HE15	K7772—Hercules engine test bed
291	Wellesley	Bristol Pegasus XX	Blind flying
292	Wellesley	Bristol Pegasus XXII	World distance record
294	Wellesley	Bristol Pegasus XX	Strengthened wing
402	Wellesley	Bristol Pegasus XX	Three-seat experimental

Acknowledgements

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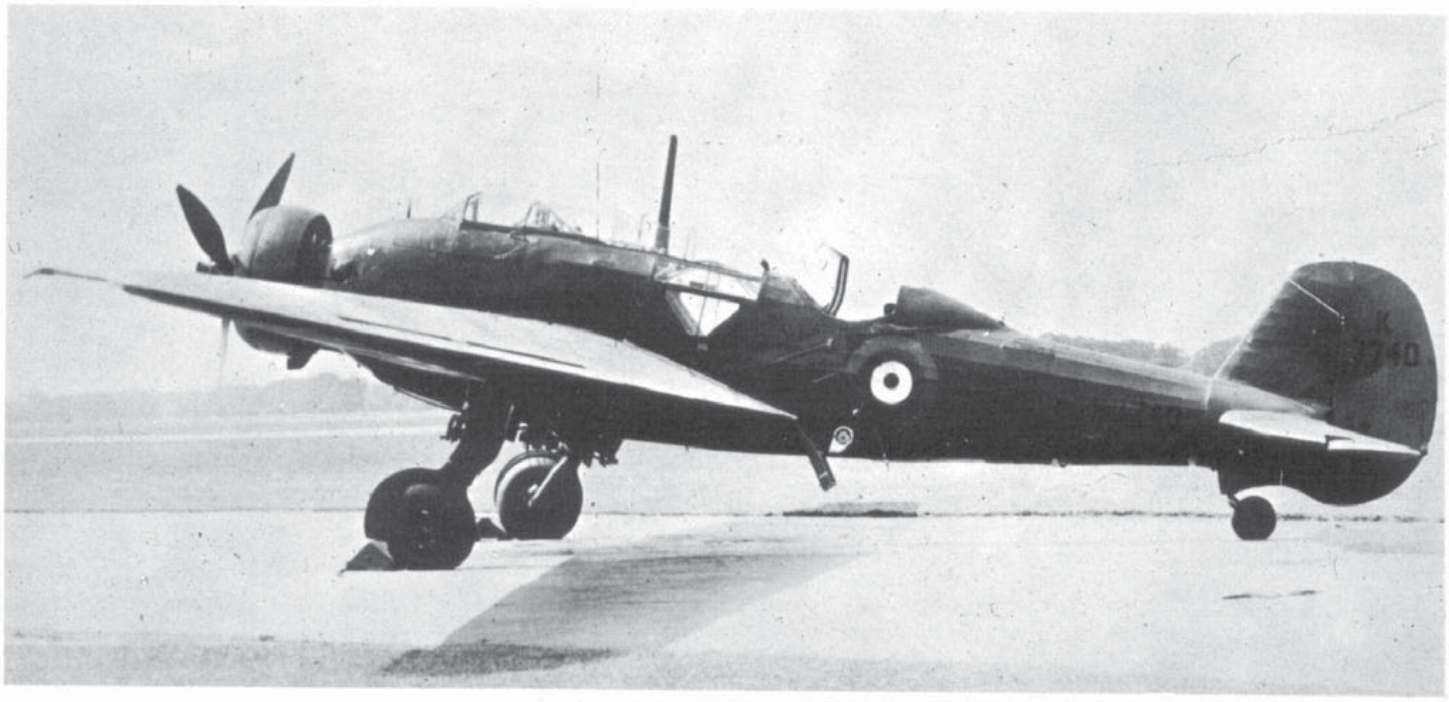
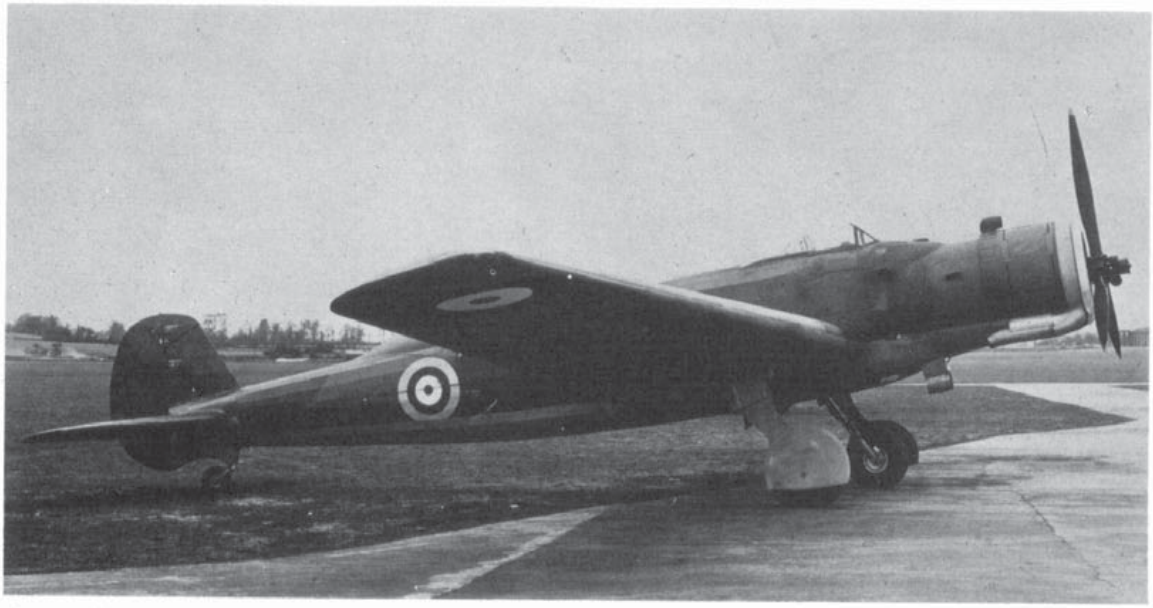
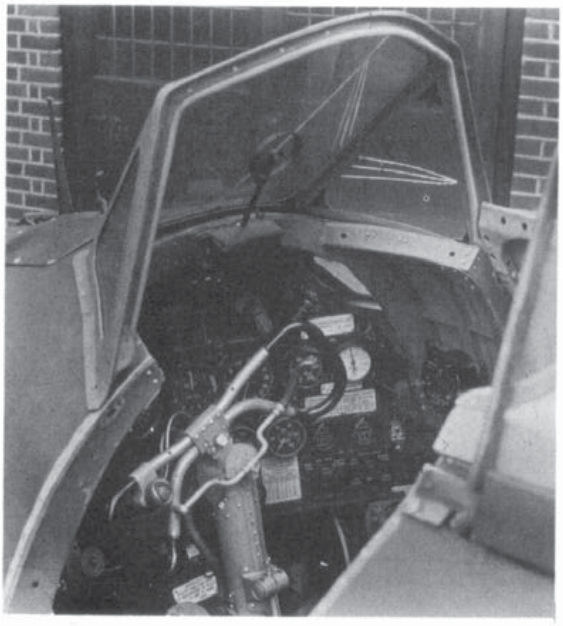
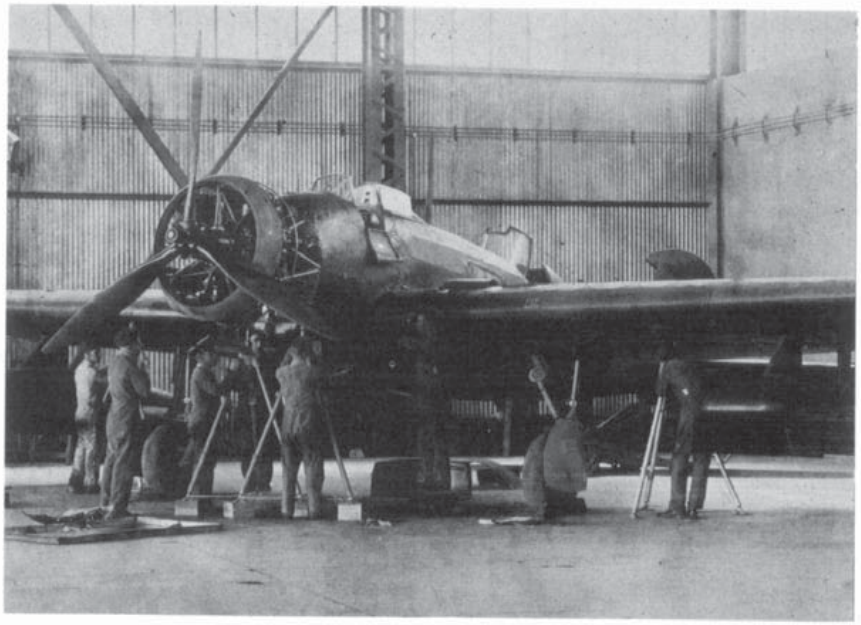




Another and clearer view of K7740 already illustrated on the opposite page in torpedo-dropping guise. The extended glazing between the pilot's and the gunner's positions gave rise to an unsubstantiated currency that this was a 'Mark II' variant. (Photo: Imperial War Museum MH135 via 'Air Pictorial')

Subject of colour side view No. 5, K7772, the 60th production Wellesley was delivered to the Bristol Aeroplane Co. at Filton, August 24, 1937, under the Vickers nomenclature of Type 289. As an engine flying test-bed, the Type 289 was used to evaluate the sleeve-valve Bristol HE15 two-row radial. (Photo: Rolls-Royce (1971) Ltd. Bristol Engine Divn., ref. 9188)





Success! From left to right, L2680, L2639 and L2638 of the LRDU at Darwin, at the completion of their record-breaking flight from Egypt to Australia in November 1938. Two Royal Australian Air Force Avro Anson trainers are also in evidence.
(Photo: Vickers, ref. 6053A)

No. 45 (Bomber) Squadron, RAF, over Helwan, Egypt, in the summer of 1938.
(Photo: Fox Photos via 'Flight')

An exceptionally fine air-to-air of Wellesleys of No. 14 (Bomber) Squadron flying over the Dead Sea in 1939. L2654 in the foreground carries squadron code letters 'BF' and the unit's badge on the tail fin. Such photos are rare indeed!
(Photo: via Chaz Bowyer)

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