AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 81

WESTLAND "WAPITI" (BRITISH)

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WESTLAND "WAPITI" (BRITISH).*

General Description

Designed and developed for general purpose work the Westland "Wapiti" provides an airplane suitable for bombing, reconnaissance, desert patrol work, photography, army cooperation, and advanced training.

The airplane is a normal two-bay wire-braced biplane, ample stowage being provided in the deep fuselage to accommodate all necessary equipment required to carry out the above-mentioned duties, and at the same time the airplane has a very excellent performance.

The airplane is equipped with defensive armament in the form of a fixed Vickers type gun, for use by the pilot, fitted externally on the port side of the fuselage, and a Lewis gun carried on a Scarrf ring mounting over the observer's cockpit.

Owing to his high position in the fuselage, the pilot has a commanding view in practically all directions, while the observer, situated just behind him, has a clear field of fire. An unrestricted downward range of view can be obtained by the observer for bombing from the easily reached prone position, the bottom of the fuselage being cut away for this purpose.

*Prepared by the Westland Aircraft Works, Yeovil, England, March, 1928.

The fuselage structure for carrying the power unit is arranged to suit either the Bristol Jupiter VI, Jupiter VIII, or Jupiter X engines.

The flying controls are well balanced and efficient in operation, making the airplane very pleasant to fly, and allowing all the usual aerobatic maneuvers to be carried out with ease. The Handley Page automatic slot gear can be fitted to the top wings if required. This gear in no way affects the action of the controls under normal circumstances, but enables lateral control to be maintained after the airplane has been stalled.

Ease of maintenance and inspection have been carefully borne in mind in the design of the airplane. Cowling can be readily removed and access easily gained to fuselage and engine components. Inspection doors are provided for the examination of the internal bracing wires of the wings. The fuselage can be readily inspected from the inside owing to the absence of bulkhead bracing wires, and by the provision of detachable fabric panels. Rudder and elevator cables are outside the fuselage and consequently readily accessible. These cables are carried close alongside the fuselage to obviate any danger of fouling the harness in the case of parachute descent.

The airplane can be supplied in composite metal and timber construction, or as an "all-metal" airplane, wood being used only for nonstructural parts. The wings, control surfaces and fuselage are in each case fabric-covered.

A great number of fittings are cadmium plated. All duralumin and aluminum parts (tanks, tubes, etc.) are anodically treated against corrosion.

Constructional

Fuselage.- The fuselage is built up in three sections:

(1) Engine plate and first bay.

(2) From first bay to behind pilot's cockpit.

(3) Behind pilot's cockpit to sternpost.

The first two sections are built up of square drawn duralumin and steel tubes, the steel being employed for the most highly stressed members. The construction is simple and straightforward, rendering the replacement of a tubular member a comparatively easy matter as no close hand fitting is required, the tubes being held together by means of flitch plates and tubular rivets.

The rear portion of the fuselage of the composite airplane is a wooden structure braced by wires and plywood. The top and bottom portions are covered with plywood, thus converting them into rigid members of unalterable shape. The sides consist of wooden struts with swaged rod cross bracings over a part and finishing with plywood covering at the tail end. Plywood bulkheads ensure transverse rigidity. These bulkheads provide a space for the observer, who, in the prone position lies on a floor which is laid along this part of the fuselage. Below the

observer's cockpit is an opening in the bottom of the fuselage to accommodate a bomb sight and give an outlook from the prone position. An adjustable wind-screen below the fuselage protects the observer. The bomb-sight opening can be covered by a sliding door operated by a hand wheel on the port side of the door. Above this door is a studded sliding floor, moving in horizontal metal guides, which is used by the observer when standing.

In the "all-metal" type of airplane the rear portion is made in a similar manner to the front, with square tubes and flitch plates, bracing in the side panels being by means of swaged rods as in the timber fuselages.

The top of the fuselage is faired off by fabric decking, formers, and stringers abaft observer's cockpit, fabric-covered three-ply round the cockpits, and sheet metal cowling thence to the nose. The sides and bottom of the fuselage remain flat except over the portion in front of the center-section struts where the shape is altered to merge into the round section immediately behind the engine. Where it is necessary to gain access to the interior of the fuselage or to the engine components, cowling panels may be detached by means of special flush fitting clips.

Cockpits.- The forward, or pilot's cockpit, lies just abaft the center-section trailing edge, the seat level being so arranged that it is quite easy to look either over or under the top wing. The bucket seat is adjustable in the air for height

and the rudder bar has three alternative leg positions.

The observer's seat when not required automatically folds up against the port side of the fuselage, thus ensuring freedom of movement in the cockpit.

The Wings.- The wings are of wooden construction and of a design which has been proved over years of service in England and foreign countries. The spars are of spindled I section spruce, and the ribs are built-up members. The interplane struts are of streamlined section spruce.

When desired, Handley Page automatic slots can be fitted to the top wing.

The ailerons are of the Frise balanced type, consisting of a wooden structure of airfoil section pivoted at about one-third of its chord. In plan the aileron completes the contour of the wing and in elevation lies at a continuation of the wing. It is so pivoted that the top surface does not rise above the general line of the top surface of the wing when the ailerons are actuated. In operation it is so arranged that the yawing moment of the up-moving aileron approximates to that of the down-moving one. The ailerons are balanced statically as well as aerodynamically. Alternatively the wings and ailerons can be of all-metal construction with fabric coverings.

Landing Gear.- The landing gear is of the V type with a front radius member of fixed length and an oleo leg as the rear member. The wheels fitted are Palmer 800 x 150 mm (31.50 x 5.91

in.). The front struts are tubular steel members fitted with streamline wood fairings.

The oleo legs are faired in by ribbed aluminum casings. The landing gear can easily be removed and floats substitued if required.

Tail Skid.- The tail skid is of metal and is steerable. The skid tube is a substantial steel member terminating in a removable cast iron shoe. The shock absorbing device is robust and reliable, consisting of ferodo-lined surfaces and a coiled-steel spring.

Tail Unit.- The stabilizer and elevators are manufactured in timber or of all-metal construction, the units being interchangeable. In both cases the front spar acts as the leading edge, and the elevators are hinged to the rear spar. In the all-metal stabilizer the front and rear spars are tubes, and the ribs are of sheet aluminum flanged over the edges and having flanged circular lightening holes.

The front spar is pivoted to the fuselage, while the rear spar is actuated by the stabilizer trimming gear, giving a range of angular movement of 7°. The front spar pivot position can be changed on the ground to either of two other positions and this with the normal hand-operated trimming gear, affords a large range of stabilizer setting for varying loads and speeds.

The rudder is of large area and has a horn balance and consequently is efficient and light in action. It is built of

flanged aluminum ribs on a duralumin tubular spar.

The stabilizer is braced on the under side to the fuselage and on the top to the fin by duplicate streamline wires at front and rear spars. Considerable care has been taken to prevent the tail elevating gear from getting clogged with sand and grit, but at the same time inspection can be readily carried out.

Controls.- The control surfaces are actuated by a normal control column and rudder bar system in dual. The observer's control column is detachable and when not in use is clipped in front of the cockpit. To assist in maintaining the correct course for bombing operations, a tight spring bias control is fitted to the rudder bar which can be adjusted by the pilot in flight. The stabilizer incidence can be varied from the pilot's seat by means of an easily worked wheel on the port side actuating a work gear which raises or depresses the stabilizer rear spar.

Engine Installation.- The engine mounting is a flanged steel plate to which is riveted a machined duralumin face to form the bed for the engine. This bed is rigidly braced by a structure of square section tubes, which needs no attention after rigging. The installation is very accessible and the mounting is simple, robust, and free from vibration.

All engine fittings, such as carburetors and magnetos, are very accessible as the cowling can be easily removed in less than two minutes, the attachment being by means of simple spring clips.

The fireproof bulkhead is situated well behind the engine and allows plenty of room for working on the engine components.

The engine exhaust is collected in an exhaust ring, and passed out through two long pipes, one on each side of the fuselage; a portion of the exhaust system supplies heating for the induction system.

Gasoline System

Under normal conditions of flying the fuel supply is contained in two tanks, a gravity tank of 40 gallons capacity, and a main tank holding 68 gallons. Both tanks are of welded aluminum and both are situated inside the fuselage in front of the pilot.

The main tank is cylindrical and is supported in position by straps anchoring it to curved duralumin brackets. If it is desired to remove the tank at any time, it is only necessary to uncouple the pipes, take out two bracing wires beneath the tank, and after slackening the straps the tank can be slipped through the bottom of the fuselage. The gravity tank can be taken out of the airplane through the top of the fuselage after the cowling is removed.

The main tank feeds by means of a wind-driven gasoline pump, and an indicator shows the pilot that the system is working correctly. Should the wind pump fail, the engine will continue to run on the gravity tank, and if necessary the gravity tank can

be filled from the main tank, while the airplane is in the air, by means of the pilot's hand pump.

For special long-distance conditions, a third or auxiliary tank of 23 gallons capacity is used.

Emergency cocks for shutting off the gasoline are provided.

Oil System

The oil supply is contained in a tank placed over the first fuselage bay, the tank conforming to the slope of the longerons and merging into the general shape of the fuselage top covering. No fairing is placed over the tank, the top surface being purposely exposed to provide a cooling area for the oil and so making it possible to use a smaller oil cooler. For this purpose a Potts five-element cooler is adopted.

The tank has a total capacity of 16 gallons, but the filler neck is placed so that no more than 15 gallons of oil can be introduced, leaving an air space equivalent to one gallon of oil. For ordinary flight duties, without long-distance equipment, 11 gallons of oil are carried.

An interconnecting lever shuts off the gasoline when the oil cock is closed.

Armament

Armament for both defensive and offensive operations is carried.

A total load of 580 lb. of bombs can be carried, the number and size of bomb within the limit being arranged as desired.

Wireless

The airplane is equipped for wireless transmission and reception, the receiving and transmitting instruments being fitted between the top longerons and the fuselage outer covering in the bay immediately behind the observer's cockpit.

Characteristics

Type	Two-seater, single-engined landplane or seaplane.
Span	46 ft. 5 in.
Length	31 " 8 "
Height	(Over main wing with tail skid on ground) 11 ft. 10 in.
Wing area	488 sq.ft.
Chord	5 ft. 9 in.
Gap	5 ft. 10-3/8 in.
Stagger	1 ft. 4 in.
Incidence	3°
Dihedral	3°
Wheel track	6 ft. 0 in.

Fuel Capacity

Main tank	68 gallons
Gravity tank	40 "
Auxiliary tank (Long distance equipment)	23 "

Oil Capacity

Normal	11 "
Long-distance equipment	15 "

Weight

Empty	2644 lb.
Fuel weight	696 "
Disposable load	900 "
Weight with normal load	4240 "
Weight with long-distance equipment	4838 "

Performance at Normal Weight 4240 lb.

Height (feet)	Rate of climb ft./min.	Speed M.P.H.
2000	1055	129
5000	1050	133
10000	750	129
15000	480	123

The engine cannot be opened out fully below 5000 feet.

Service ceiling (where rate of climb is 100 ft./min. - 22700 feet).

Take-off min. 285 ft. Wind 12 M.P.H.

Minimum distance from to clear 50 ft. screen

660 ft. Wind 12 M.P.H.

Landing run 378 " Wind 12 M.P.H.

Landing speed (A.S.I.) 50 M.P.H.

Performance with long-distance equipment
Load 4838 lb.

Height (feet)	Rate of climb ft./min.	Speed M.P.H.
2000	730	
5000	760	130
10000	510	126
15000	270	118

Service ceiling (where rate of climb is 100 ft./min.)
18800 ft.

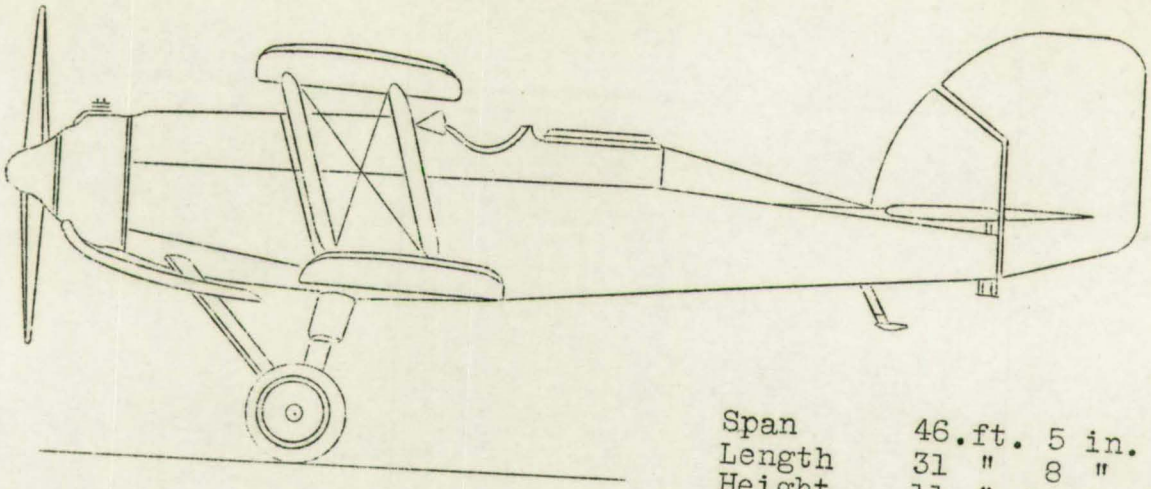
Take-off run 498 ft. Wind 10 M.P.H.

Minimum distance from to clear 50 ft. screen

750 ft. Wind 10 M.P.H.

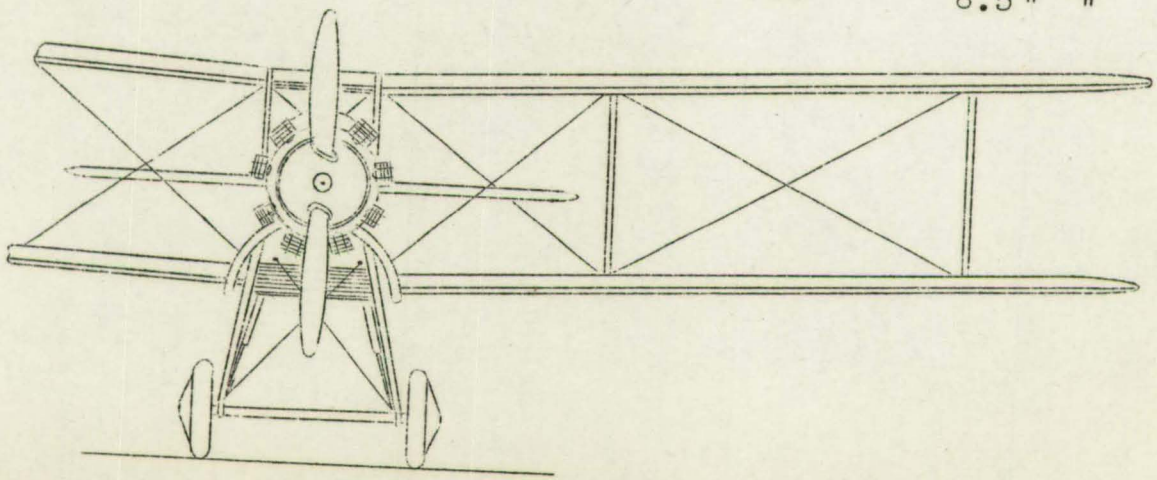
Landing run 507 " Wind 10 M.P.H.

Landing speed (A.S.I.) 53.5 M.P.H.



Jupiter VI air-cooled engine

Span	46.ft. 5 in.
Length	31 " 8 "
Height	11 " 10 "
Wing Area	488 sq.ft.
Aileron "	75 " "
Rudder "	22.5 " "
Elevator "	26 " "
Stabilizer	39 " "
Fin "	8.5 " "



Taken from pamphlet of Westland Aircraft Works.

Fig.1 The Wapiti general purpose airplane.

Figs.2,3,4 Views of the Westland "Wapiti" airplane, with a Jupiter VI engine.

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