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No. 208

THE AIRSPEED "OXFORD" TRAINING AIRPLANE (BRITISH)

A Two-Engine Cantilever Monoplane

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
LANGLEY AERONAUTICAL LABORATORY
LANGLEY FIELD, HAMPTON, VIRGINIA

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CURTISS-WRIGHT CORP.
ENGINEERING FILES
COLUMBUS, OHIO

Washington
September 1937

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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THE AIRSPEED "OXFORD" TRAINING AIRPLANE (BRITISH)*

A Two-Engine Cantilever Monoplane

The Airspeed A.S. 10 "Oxford" is a twin-engine trainer with all the essential modern conveniences: flaps, controllable-pitch propellers, retractable landing gear, and so forth. There also is provision for training in bombing, air gunnery, radio operation, navigation, and aerial photography. De-icers are the only things that the airplane seems to lack.

Suitable modification of the equipment turns the "Oxford" into a useful general-purpose type. The fact that the interior of the "Oxford" looks neat and simple is a tribute to the detail design. Actually a staggering amount of apparatus has been compactly stowed away.

The "Oxford" is a typical Airspeed low-wing cantilever monoplane built of wood, except for the ailerons which are metal framed (figs. 1 and 2). Powered with two 375-horsepower moderately supercharged Armstrong-Siddeley Cheetah X engines, the "Oxford" has a top speed of about 196 miles per hour at 7,500 feet. The landing speed is 64 miles per hour. The duration is 5-3/4 hours at 151 miles per hour cruising speed with the standard tanks for 156 gallons.

Wings

The "Oxford" wing is tapered in plan form and thickness and looks singularly strong. Its exceptionally high load factors bear out its appearance.

The wing has two spars and a stressed plywood covering. For ease of stowage and repair it is built in three pieces, the center section and two outboard portions (fig. 3). The box spars are of spruce and run toward each other from root to tip in wedge formation. The top and bottom flanges are glued spruce plank laminated and tapered in

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*From The Aeroplane, June 23, and July 28, 1937; and Flight April 29, and July 1, 1937.

thickness toward the tips. The flanges are joined by robust spruce members placed vertically between them. The whole girder is boxed in a plywood shell. The plywood is laid with its grain at 45° to the longitudinal axis.

The center-section spars run right through in one piece. At each end the box spars are reinforced by mahogany insertions spliced onto them to take compression loads. Engine mountings and landing-gear brackets are high-tensile steel channels bolted through the spar. The outer sections of the wings are attached to the center section by two vertical steel bolts on each side which pass through high-tensile steel fittings at the end of each spar.

The ribs, spaced at 15-inch intervals, are also made of spruce. They are of normal Warren girder type and are made in three sections, nose, centerpiece and trailing edge. Each section is attached to the spar by channel brackets. Between the spars two square stringers of about 1/4-inch square section are equally spaced and run spanwise. They are glued to the outer cover and run through cutout sections in the ribs.

The detail finish of the wings is remarkably fine. They are covered with Bakelite-cemented three-ply (fig. 4). This is one millimeter (0.03937 in.) thick over the leading edge up to the front spar, 1.25 millimeter (0.05 in.) thick between the spars, and 0.8 millimeter (0.0315 in.) thick from the rear spar to the trailing edge. Madapolam fine Irish damask linen is doped all over the plywood covering to Air Ministry requirements.

Two Vickers-Phillips landing lights are set in one alcove behind a transparent section of the leading edge of the port wing.

The metal-framed Handley Page slotted ailerons are fabric covered. They are built up on a tubular spar. The Airspeed designers apparently find metal is more suitable for this purpose where the necessary stiffness can be had in metal with less weight than in wood. The split flaps of duralumin extend from aileron to aileron. They are lowered to an angle of 80°.

Fuselage

The fuselage is jig built in two portions and has spruce longerons and hoops. The construction is semi-monocoque throughout. The after part of the fuselage is joined with aluminum plates to the forward half behind the cabin. The ply covering is scarfed together. Each portion is built in a rotatable jig which can be turned so that any part of the fuselage can be got at easily. An interesting point is that the door and its frame is built in as part of the fuselage and then cut out with a fret saw. So there is no trouble about that door fitting that particular fuselage.

The whole of the fuselage is covered with 2-millimeter (0.07874 in.) three-ply and has a Madapolam sheath doped on with Titanine. In the back part of the cabin a circular hole, with a deep interior flange, is cut in the roof for the gun turret. Over the pilot's cockpit is a welded steel structure, panelled in Perspex. Forward of the windshield and above the bomber's position the nose portion of the fuselage is contrived out of a single aluminum sheet to an excellent toe-cap shape. The whole fuselage is lowered onto the center section and secured with angle plates before the fabric fillet is added.

The engine mountings are then secured. They seem to combine the maximum of stiffness with the minimum of complication and allow ready access to the back of each engine after it has been "de-Oxford-bagged." The two Armstrong Siddeley Cheetah X nine-cylinder radial air-cooled engines are enclosed in long-chord N.A.C.A. cowlings. The previous helmeted type of cowling has been dropped. We have always believed that the eddies caused by the helmets must have far outweighed any gain claimed for the smaller frontal area. The Cheetah X engines are basically the same as the well-tried series. IX. The chief difference is provision for a variable-pitch propeller and for drives for all the auxiliaries from the back of the engine. The landing gear, flaps, instruments, and brakes of the "Oxford" are all worked from engine-driven pumps and compressors.

A Claudel-Hobson type 60 M carburetor is used on each engine. This particular model has automatic mixture and variable-datum boost controls. The fuel consumption is 13.4 gallons per hour per engine. The propeller drive is direct. At present there is a hold-up in delivery of variable pitch propellers and fixed-pitch propellers are being used. Constant-speed D.H. propellers are the ultimate aim.

The Armstrong-Siddeley Cheetah X engine on 87-octane fuel gives 375 hp. for take-off and 294 hp. for normal cruising at 2,100 r.p.m. at 7,400 feet. The maximum horsepower for level flying is 350 at 2,425 r.p.m. at 7,600 feet. Cockpit starting is made possible by Rotax electric starters.

The Airspeed patent retractable landing gear on the "Oxford" is built by the Lockheed Hydraulic Brake Co., Ltd. It works on the familiar broken-radius-rod principle which has proved so successful in numberless retractions. The landing gear folds up backward into the engine nacelles and is worked by an engine-driven hydraulic pump. The tire is left projecting to bear the brunt of accidental or purposeful wheel-up landings. The usual electric horn goes off if the throttles are closed with the wheels up (fig. 5). Avery wheels and brakes with Palmer tires are held between two compression legs with retracting jack outboard. The Palmer tail wheel is fully castering and self-centering.

The engine nacelles are metal framed and fabric covered. In the nacelles above the wings and behind the fireproof bulkheads are the 8.5-gallon oil tanks. These contain the patented oil coolers designed by Airspeed and manufactured with the tanks by Gallay Ltd. The air inlet to the cooler is through a 4-inch pipe which projects horizontally between the cylinders of the engine. It conveys air into a honeycomb through each tank and discharges out of an orifice at the back of the nacelle at the trailing edge. There is an automatic by-pass arrangement to cut out the coolers when the engines are being run up.

The fuel tanks are in the wings on each side of each engine nacelle. Each inboard tank has a capacity of 49 gallons, each outboard tank holds 29 gallons. They are secured by straps in the usual way and can be quickly removed for repair through the under surface of the wing. The fuel tanks were designed by Airspeed and are entirely constructed by them.

The tail unit is fully cantilever. The stabilizer and fin are built like the wing, but the rudder and elevators are fabric covered. The front spar of the stabilizer runs backward to meet the straight rear spar at the tip. Diagonal bracing connects the two spars. Nose ribs of graduated length are attached to the front spar. Unlike that of the "Envoy," the stabilizer of the "Oxford" is fixed. Plywood-covered trimming tabs are fitted to the trailing edges of the elevators. The other control surfaces have the well-known Airspeed bias gear for any adjustment.

Inside

Entrance to the cabin is through a door in the port side level with the trailing edge of the wings. This door can be instantly knocked out by pulling a lever inside the cabin.

Looking aft one sees the deep flange under the gun turret. The latter is of the standard Air-Force type made by A. V. Roe and Co. Ltd. by arrangement with Sir W. G. Armstrong Whitworth Aircraft Ltd. The gunner sits on a bicycle saddle connected to the turret-rotation mechanism and turns the turret in either direction. A sliding panel allows the gun to be elevated as far as the vertical and the saddle moves up and down with the gun. The turret is panelled in Perspex. Behind the turret are two inclined chutes for parachute flares which are projected through the floor.

Opposite the door on the starboard side is the radio apparatus. A loop aerial folds flat into a slot on the outside of the roof when not wanted. The pitot head was originally put on the end of the radio mast which projects five feet above the fuselage. Here "position error" was really bad, especially at the stall. The explanation seems to be that the flow off the brow over the pilot's cockpit upset things altogether - another illustration of the desirability of seeing the spray.

In front of the radio apparatus is a floor hatch for a vertical camera. Forward of this is a raised platform over the spars. Above this is an emergency exit in the roof. Still farther forward, the pilot's seat is on the port side, and the second pilot's seat beside it to starboard. This seat can be turned around to face aft. The spar platform then forms a large and handy chart table. The control column carries an Omega-type spectacle wheel.

The instrument board is well laid out. We hope that the Service will be able to settle a standard position for the numerous dials and switches of the new multiengine types (figs. 6, 7, 8). On the instrument board of the "Oxford" there are 19 different types of instruments and 8 switches. The more important of them are duplicated on the starboard side. Throttles, mixture control, landing-light control, rudder-bar gear, variable-pitch propeller control, landing-gear lever, flap lever, and tail-trim lever all bristle from a sort of toothbrush rack in the middle.

From the pilot's seat the view in every direction is excellent, except over the right side - which is unavoidable in a side-by-side airplane - and where the wings and engines cut off the downward rear view. The Perspex windshield is entirely adequate but seems a little far away from the pilot's face. On several new American types which we have seen lately the windshield has been brought up to within about 12 inches of the pilot's face. The result is that, although in no instance is the windshield more than 12 inches deep, the wide angle of view through it is most remarkable.

In the American airplanes the instrument board is not brought up uncomfortably close to the pilot but is lighted through a transparent horizontal panel in the decking immediately in front of the windshield.

Under the right-hand side of the instrument board of the "Oxford" a tunnel leads through to the bomb-aimer's position. There is a very fine view from this point. The bomber rests his chin on a comfortable rubber cushion, reads off his air-speed indicator, altimeter, and air-temperature dials, peers through his bomb sight, and has his bomb levers close at hand. The bombs are stowed in the center section between the spars beneath the chart table. So far, no bomb doors have been fixed. When the practice bombs are in position, half their diameter is exposed below the fuselage.

Large inspection panels in the fuselage allow all the control runs to be got at easily. There are also numerous inspection panels in the under side of the wings.

Altogether the "Oxford" seems to be an ideal training airplane, obviously capable of preparing the rawest pilot for the very latest type of multiengine high-speed airplanes and quite good enough to be itself a valuable weapon of war.

CHARACTERISTICS

The following are the more important figures for the Airspeed "Oxford" (two 375-hp. Armstrong-Siddeley Cheetah X engines) with fixed-pitch wood propellers:

Dimensions:

Length	34 ft. 3 in. (10.45 m)
Height	9 ft. 9 in. (2.97 m)
Span	53 ft. 0 in. (16.15 m)
Wing area	340 sq. ft. (31.6 m²)

Weights and loadings:

Weight empty (stripped)	4,800 lb. (2.180 kg)
Weight loaded	7,300 lb. (3.312 kg)
Wing loading	21.4 lb./sq.ft. (104.5 kg/m²)
Power loading	9.74 lb./hp. (4.4 kg/hp)
Span loading	2.62 lb./sq.ft (12.8 kg/m²)

Performance:

Maximum speed at 7500 ft. (2300 m)	197 m.p.h. (298 km/h)
Cruising speed at 5000 ft. (1500 m)	163 m.p.h. (262 km/h)
Stalling speed	64 m.p.h. (103 km/h)
Duration	5-3/4 hr.
Rate of climb at sea level	1,225 ft./min. (6.25 m/s)
Time to 15,000 ft. (4500 m)	16.75 min. (15 min.)
Service ceiling	23,000 ft. (7000 m)
Ceiling on one engine	6,000 ft. (1800 m)
Take-off run in 5 m.p.h. (8 km/h) wind,	275 yd. (250 m)

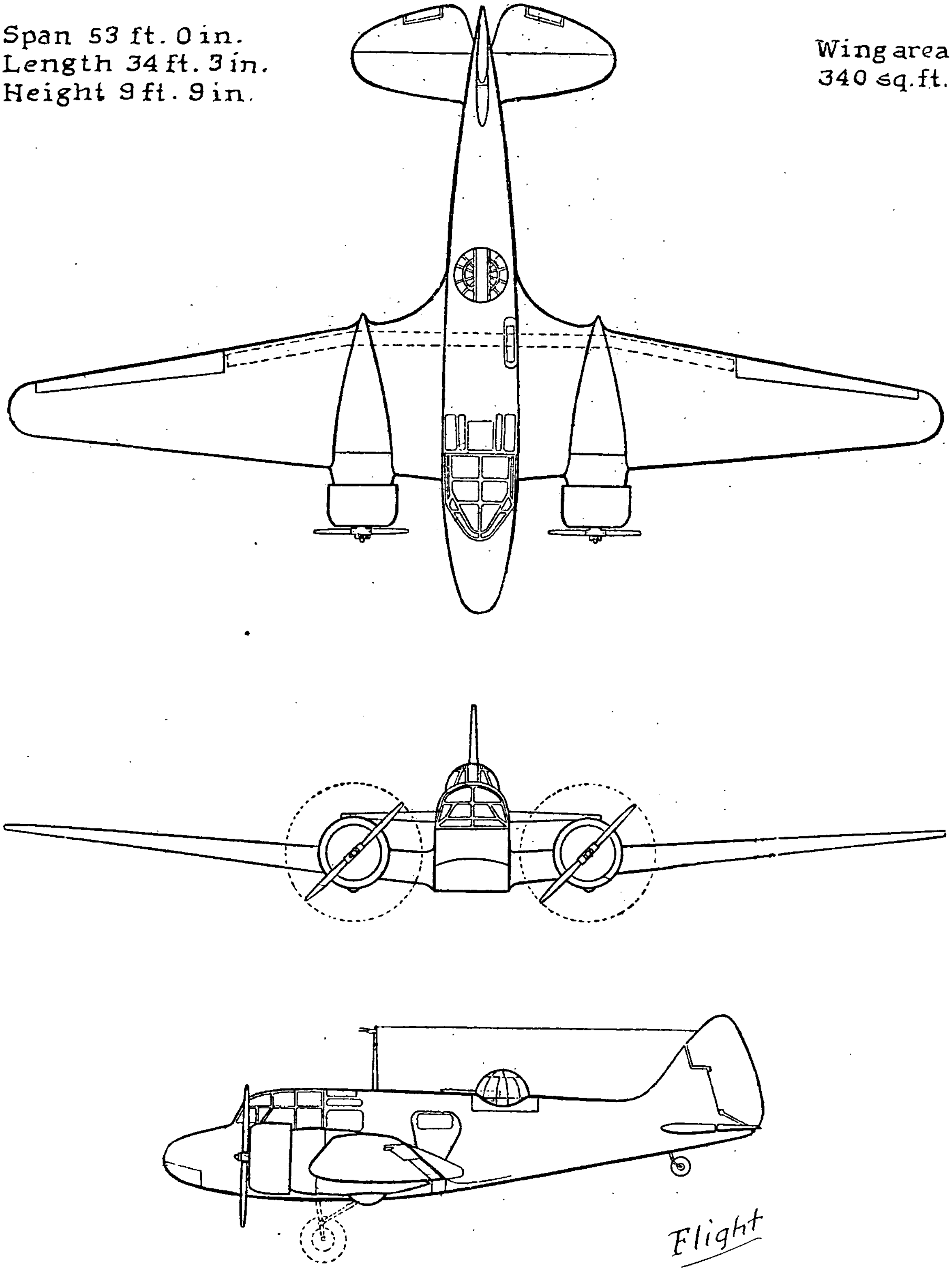


Figure 1.- General arrangement drawings of the Airspeed-Oxford: A twin-engined trainer.

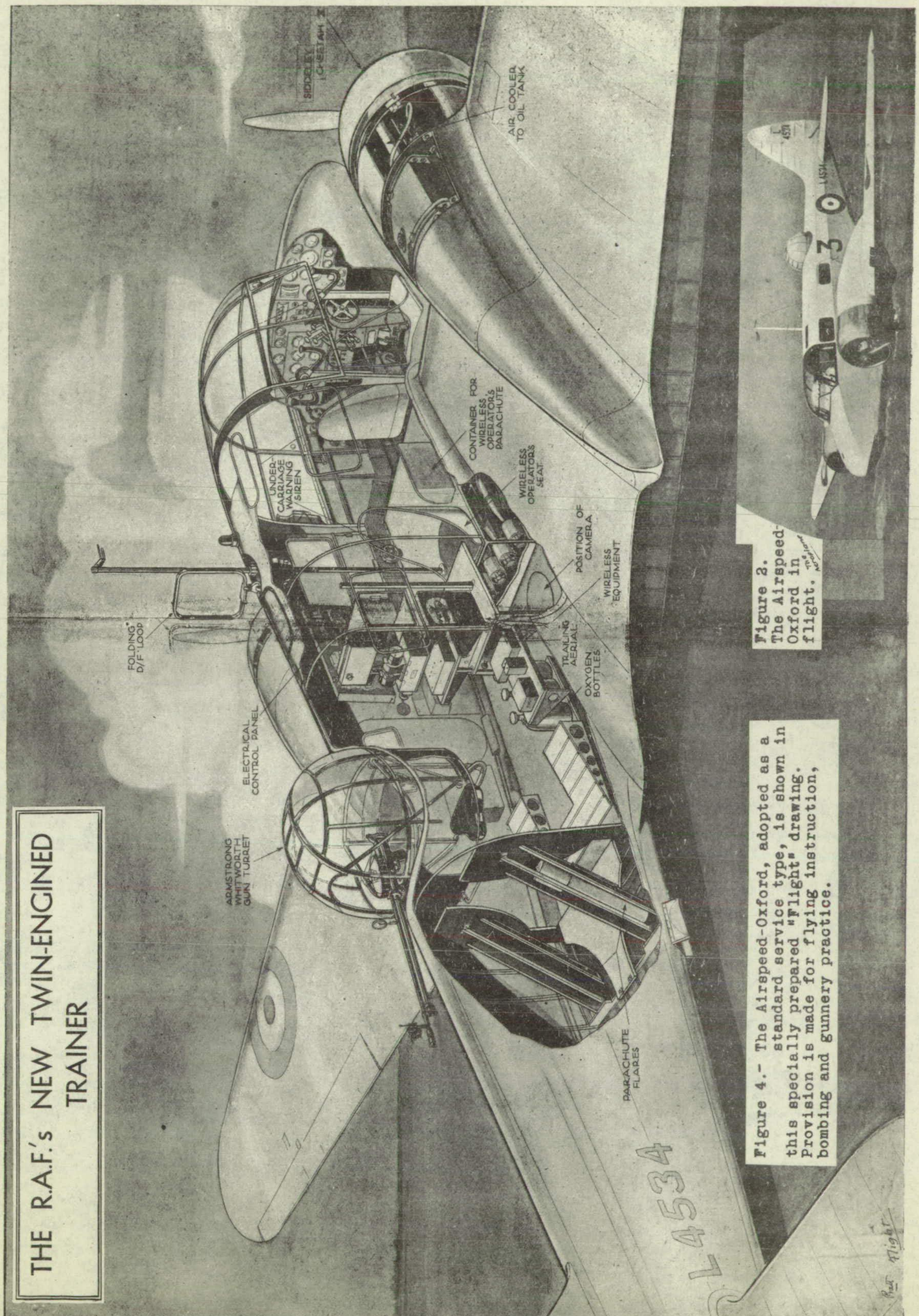
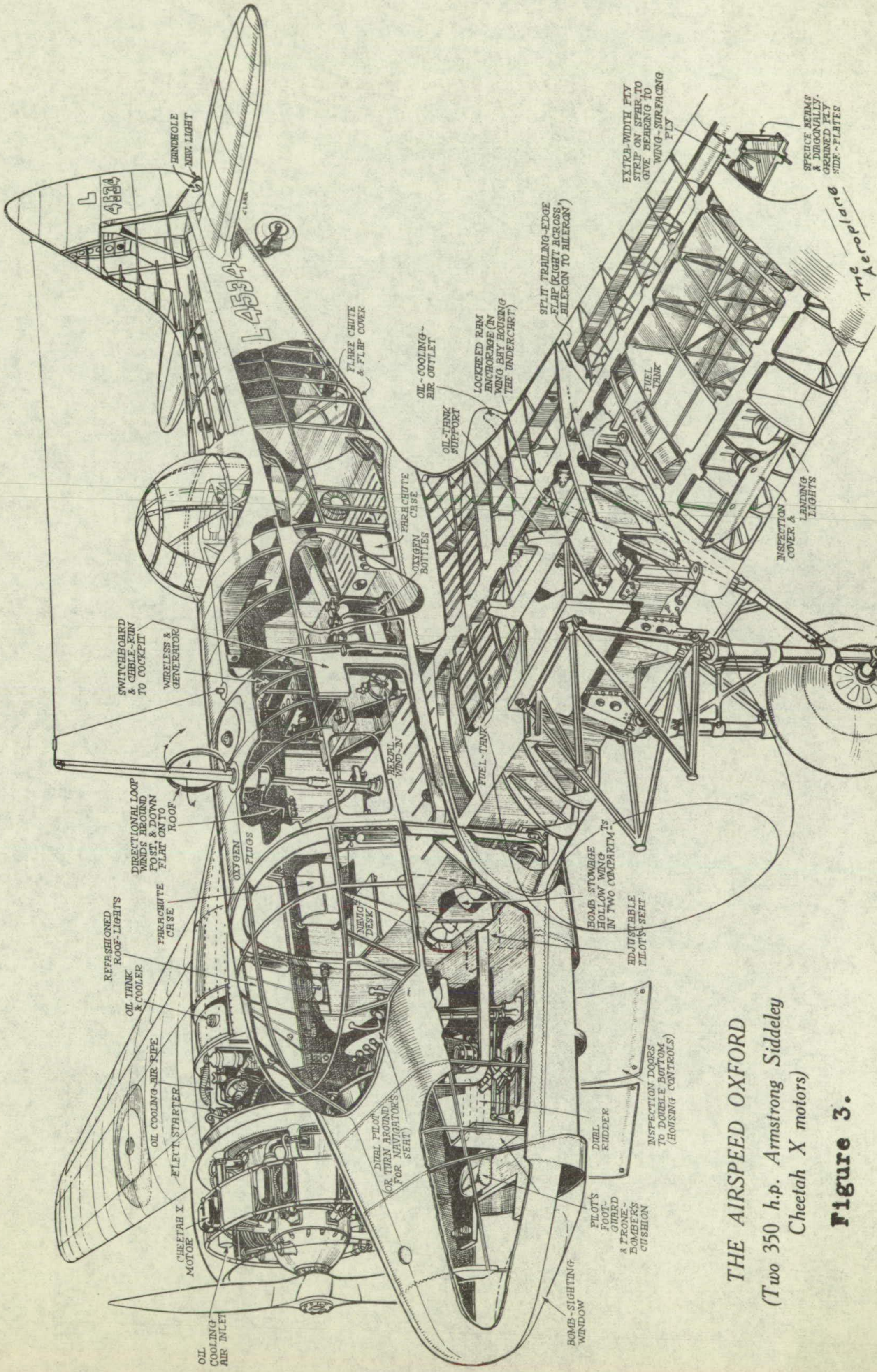


Figure 2. The Airspeed-Oxford in flight.

Figure 4.- The Airspeed-Oxford, adopted as a standard service type, is shown in this specially prepared "Flight" drawing. Provision is made for flying instruction, bombing and gunnery practice.



THE AIRSPEED OXFORD

(Two 350 h.p. Armstrong Siddeley Cheetah X motors)

Figure 3.

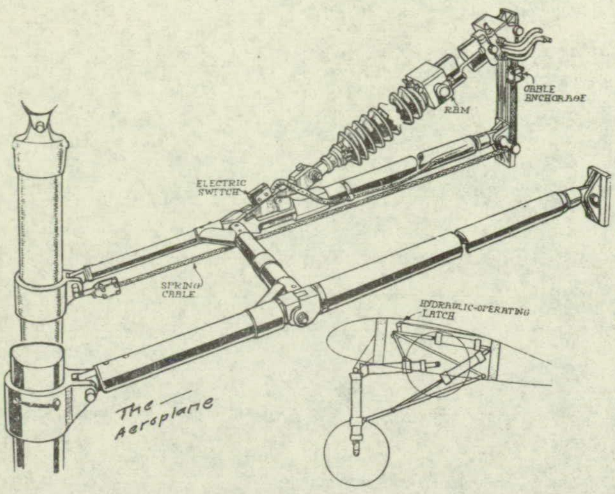


Figure 5.- The Airspeed-Lockheed landing gear.

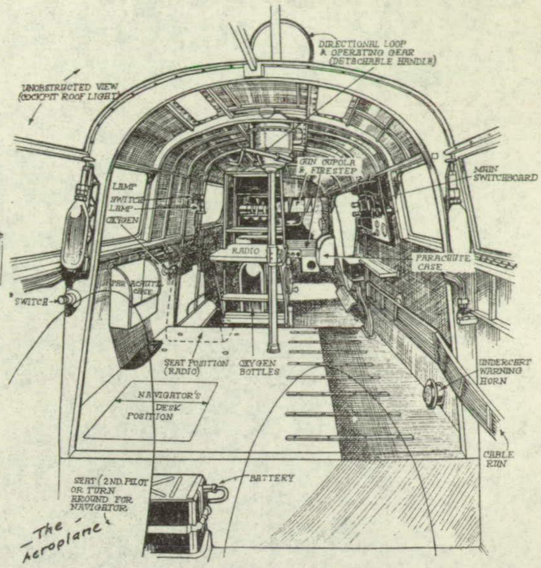


Figure 6.- Interior view back of Pilot's cockpit.

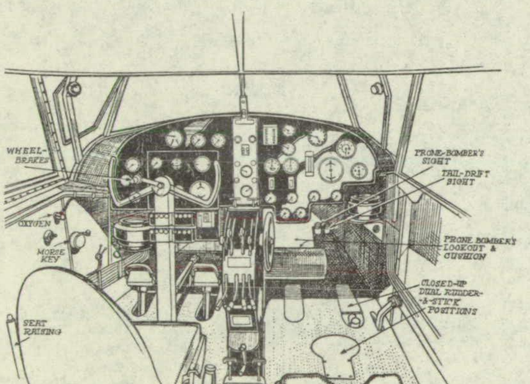


Figure 7.- Interior view of Pilot's cockpit.

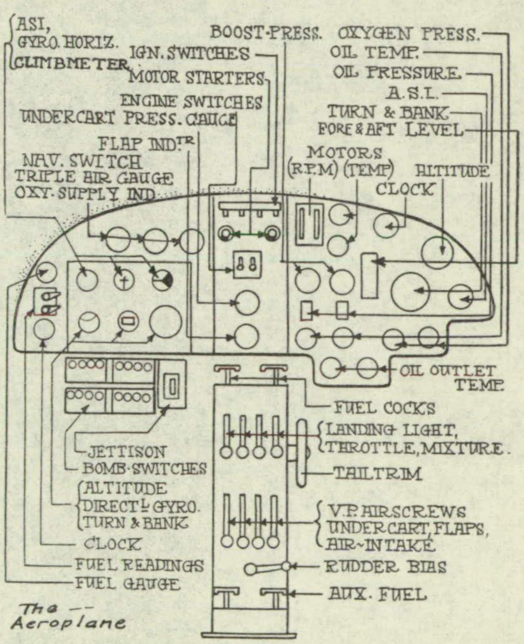


Figure 8.- The instruments on the dash of the Airspeed Oxford.