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AIRCRAFT CIRCULARS
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 70

THE AVRO "AVIAN III" AIRPLANE (BRITISH)

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Washington, D. C.

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

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THE AVRO "AVIAN III" AIRPLANE (BRITISH)

The first Avro "Avian" was, it may be recollected, designed and built for the Daily Mail competition held at Lympne in 1926, and was then fitted with the new Armstrong-Siddeley "Genet" engine. Outstanding features of the prototype were: very low structure weight, wings of large area, and exceptional ratio of loaded weight to tare weight. Thus the tare weight of the competition airplane was 695 lb., and the loaded weight 1,600 lb., the load being made up of 77 lb. of gasoline and oil, and 828 lb. of useful load (including pilot). A detailed illustrated description of the original "Avian" was published in "Flight" of August 26, 1926.

Since 1926, the "Avian" has been put into production, and the type which we are about to describe is known as the "Avian" Mark III, which is fitted with the Mark II A.D.C. "Cirrus" engine. The latest model differs considerably from the prototype, and among other changes may be mentioned the decrease in wing area, the large area of the 1926 airplane being used in order to enable the airplane to carry a large useful load and thus score heavily for competition purposes. Incidentally, it is the original airplane which Hinkler used on his recent magnificent

* From "Flight," March 8, 1928.

flight to Australia in $15\frac{1}{2}$ days. The wings, however, are of much smaller area than those used in the competition.

The production type "Avian" has been strengthened a good deal so as to enable it to withstand the varied handling which it may receive from beginners in flying, and when used for school work. The lines have been improved considerably, and the airplane now has a remarkably "clean" appearance, the long slender fuselage terminating in front in a neat engine fairing, and merging cleanly into the spinner over the propeller boss (Figs. 1, 2, 3 and 4).

The fuselage is of the flat-sided three-ply covered type, and the details of its construction are shown in Figures 7 and 8. The form of construction adopted is simplicity itself, and has the advantage over the wire-braced girder type of construction that it does not require any trueing-up after prolonged service. In front a fireproof bulkhead separates the cockpits from the engine, which is supported on a very simple mounting of steel tubes, the arrangement of which is illustrated in Figure 7. The engine cowling is so arranged as to be entirely detachable, thus leaving the engine exceptionally accessible, the more so as there is little or no bracing to get in the way. What adds further to the facility with which inspection and adjustment of the engine can be carried out is the special type of landing gear, invented by "Bert" Hinkler, which lowers the airplane a good deal when the wings are folded, the top hamper of the en-

gine thus being within easy reach.

The two cockpits are arranged one behind the other in the customary manner; and dual controls are provided, so that the airplane may be used for instructional purposes. The "joy stick" in the front cockpit is detachable so as not to be in the way when a non-piloting passenger is being carried.

The controls are, generally speaking, of normal type, but as Figure 5 will show, they are mounted on a complete unit which is independent of the main fuselage structure except in so far as its very simple mounting is concerned. The foot bars are provided with T-shaped pedals, and these, which are made of tubing, are mounted in sockets and provided with bolt holes so that the pedals may be adjusted to suit pilots of different length of legs.

The landing gear is, as already mentioned, quite different from that fitted on the prototype airplane. The original "Avian" (G-EBOV) has a landing gear of similar type, rigged up by "Bert" Hinkler, its inventor, but the "Avian Mark III" has a slightly modified form, although incorporating the same general principle. The new landing gear is of the "divided" type, i.e., there is no axle running across from side to side. Instead, the two separate wheel axles are hinged on the center line of the bottom of the fuselage and bent to a horizontal direction near the wheels. The shock absorbing, or telescopic member is the front "leg" of the landing gear Vee, which incorporates rubber block compression

rubbers. The rear landing gear leg is taken to a point on the lower rear wing spar (Fig. 6).

As regards the lower wing, two short wing roots are attached permanently to the fuselage (Figs. 9 and 10). These roots are triangular in plan view, with the base of the triangle formed by the leading edge and the apex at the rear spar hinge. To brace the root against the landing gear loads a short diagonal strut runs to the top longeron. When the wings are folded they swing, of course, around the hinge. The point of attachment of the rear landing gear strut being situated some little distance out from the hinge, when the wings are folded the upper end of the rear strut moves back with the wing, and in so doing pulls the wheel back with it, and at the same time the wheel moves upward slightly. The combined effect is to lower the airplane and to relieve the load on the tail skid. Thus, with the wings folded, the airplane can be wheeled along quite easily by one man.

The divided landing gear has other advantages, such as a wide wheel track which renders possible taxiing the airplane in a strong cross wind without risk of it being blown over onto a wing tip. The absence of a horizontal axle also lessens the risk of nosing over in long grass or corn, in case of a forced landing.

Telescopic jury struts are used to separate the inner ends of the wings when the latter are folded. When the wings are

spread the jury struts are "telescoped" and rest in clips under the top wing.

The wing construction of the Avro "Avian" is of perfectly normal two-spar type. The wings are but slightly staggered in relation to each other, but the gap is large and the biplane arrangement is probably very efficient.

The top wing center section contains the gasoline tank, which has a capacity of 20 gallons. An interesting feature is that one of the center-section struts is used as the gasoline gravity pipe, the flexible gasoline tubing being joined to the lower end of this strut. This is indicated in the side elevation below. The high position of the gasoline tanks ensures an ample head of gasoline even during a steep climb and, of course, the gasoline system is greatly simplified by using direct gravity feed.

When fitted with the standard "Cirrus" Mark II engine, the tare weight of the "Avian III" is 875 lb. The normal loaded weight of the airplane is 1,360 lb., and the certificate of airworthiness covers up to a gross weight of 1,450 lb. for "aerobatics," and up to 1,600 lb. for ordinary straight flying. In other words, if it be desired to use the "Avian" for long-distance non-stop flights, a large tank can be fitted in the front cockpit, and the airplane may be loaded up to 1,600 lb. without exceeding its C. of A. for "nonaerobatic" flying.

The main dimensions and performance figures* are as follows:

| | |
|-------------------------------------|---|
| Length | 24 ft. 3 in. |
| Span | 28 " 0 " |
| Areas: | |
| Total wing areas | 244 sq.ft. |
| Ailerons | 15.4 " |
| Stabilizer | 19.7 " |
| Elevators | 11.2 " |
| Fin | 3.7 " |
| Rudder | 7.9 " |
| Top speed at ground level | 105 M.P.H. (170 km/h) |
| " " " 5000 feet | 100 " |
| Absolute ceiling | 17,000 ft. (5,180 m) |
| Stalling speed | 40 M.P.H. (65 km/h) |
| Power loading | $\frac{1360}{80} = 17$ lb./HP. |
| Wing loading | $\frac{1360}{244} = 5.57$ lb./sq.ft. |
| "Wing Power" | $\frac{80}{244} = 0.328$ HP./sq.ft. (3.53 HP/sq.m) |

Everling Quantities

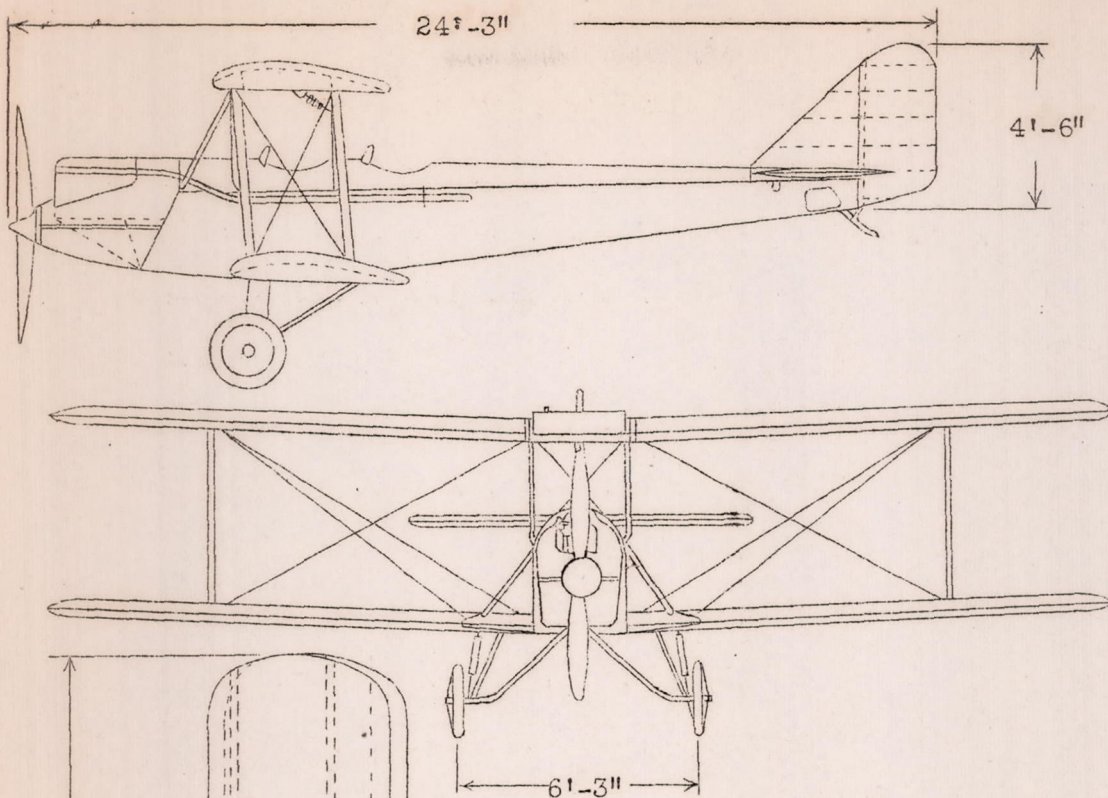
"High-speed Figure" : 26

"Distance Figure" : 4.9

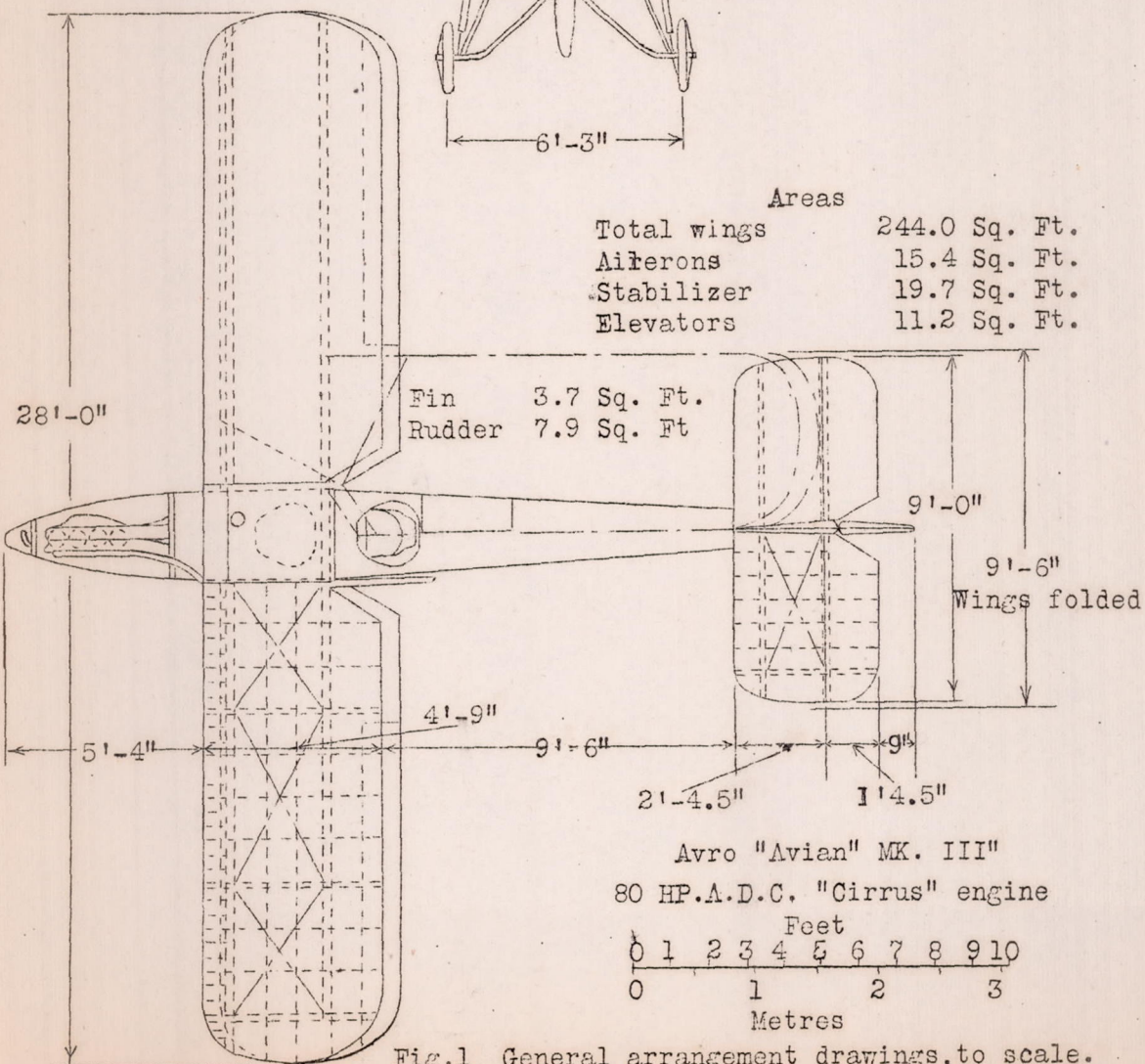
"Altitude Figure" (Ceiling) : 7.6.

All these figures are high, and well above the average.

*Apply to the loaded weight of 1360 lb.



| Areas | |
|-------------|---------------|
| Total wings | 244.0 Sq. Ft. |
| Ailerons | 15.4 Sq. Ft. |
| Stabilizer | 19.7 Sq. Ft. |
| Elevators | 11.2 Sq. Ft. |



| | |
|--------|-------------|
| Fin | 3.7 Sq. Ft. |
| Rudder | 7.9 Sq. Ft. |

Avro "Avian" MK. III
80 HP.A.D.C. "Cirrus" engine

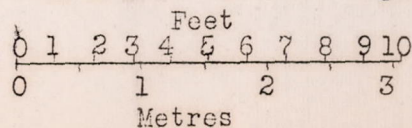
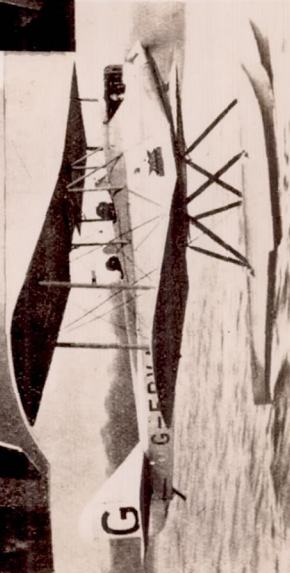
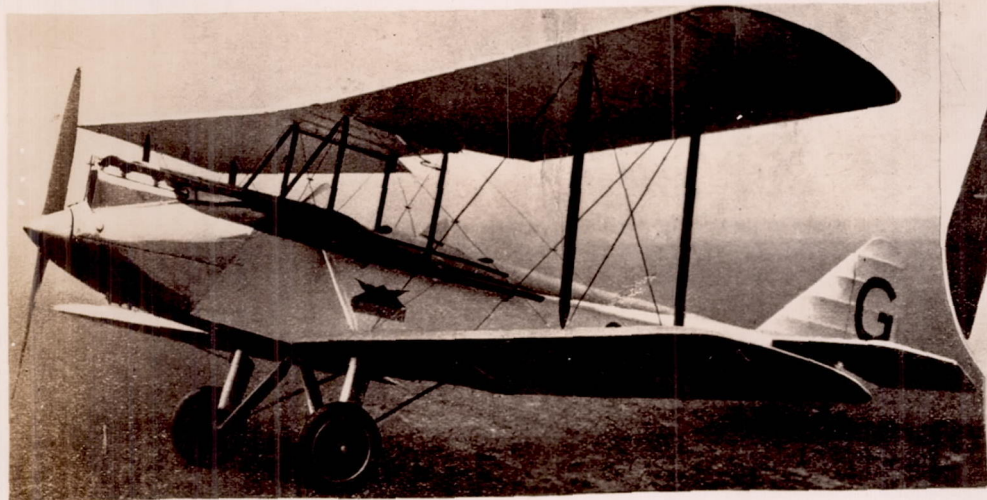


Fig.1 General arrangement drawings, to scale.



Figs. 2 & 3
Views of
the Avro
"Avian
III" air-
plane.
Note the
neat cowl-
ing at
the nose.



"Flight" photographs

Fig. 4
The
"Avian
III"
fitted
with
floats.

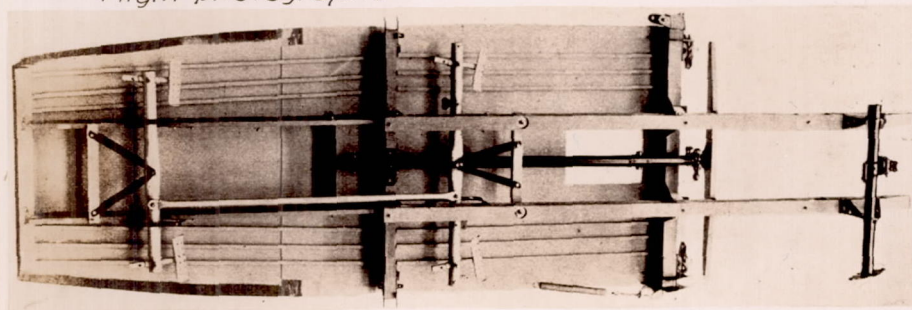
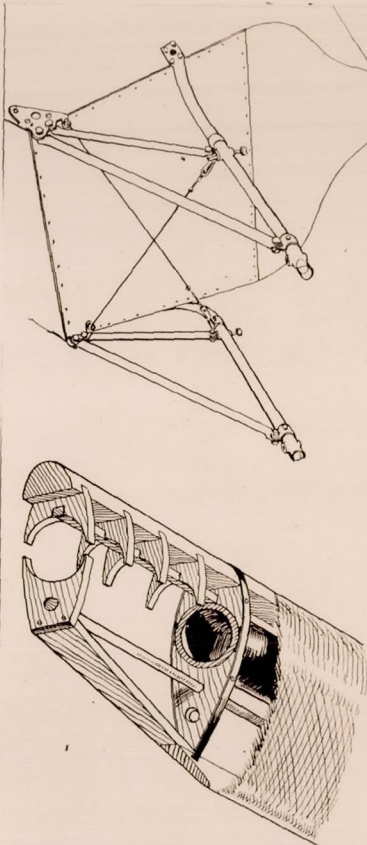


Fig. 5
Plan view of the
control unit of the
Avro "Avian III".
Note the pedal ad-
justment for pilots
of different
heights.



Fig. 6 View of the
Avro "Avian III"
showing port wings
spread and star-
board wings folded,
to illustrate how
landing gear wheels
move back when the
wings are folded.
The telescopic jury
struts fold flat
against the top
wing when in flight.



Figs. 7, 8, 9, 10
Fig. 7 On the left, a sketch of the very simple tubular engine mounting, sketch in detail of the axle fairing on the right.

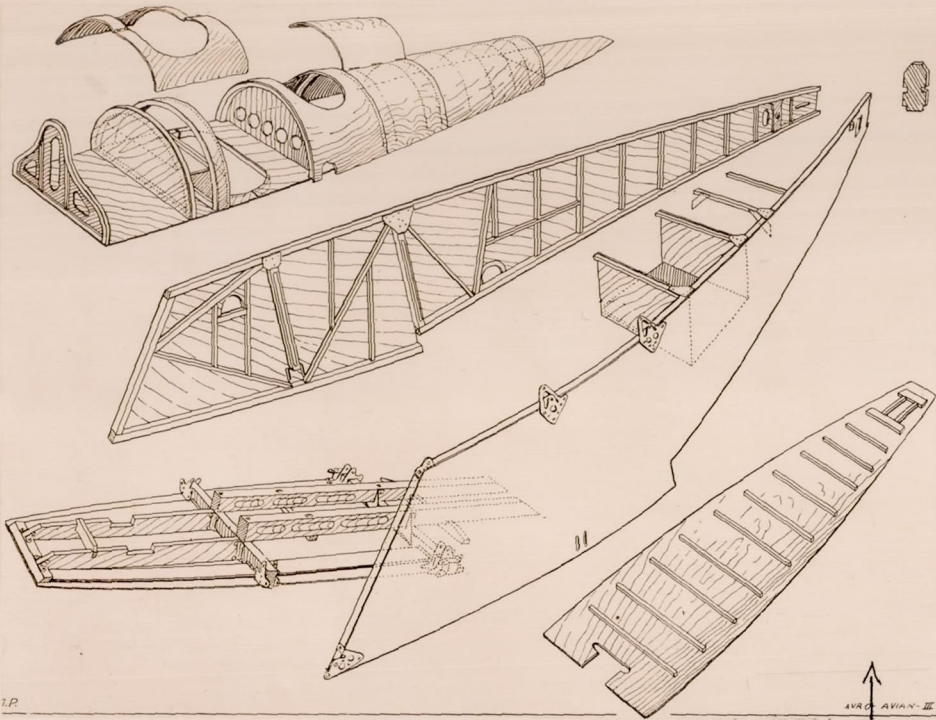


Fig. 8
Details of the Avro "Avian III" airplane fuselage construction. The simplicity of the "box" type of fuselage is well brought out. Note the supports for the control units. The fittings on the cross beams project through the sides of the fuselage. The luggage compartment has a hinged hatch. The sketches actually show how the main compartments of the fuselage are built for mass production.

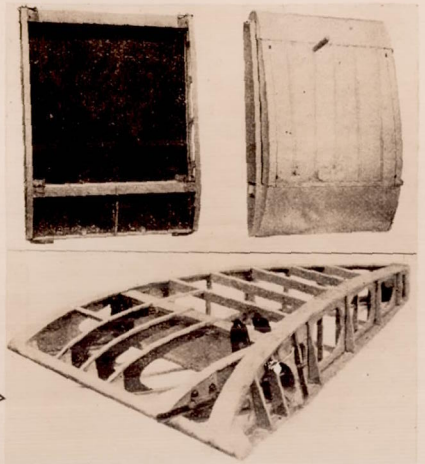


Fig. 9
Fig. 10
Sketch
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Mar. 8, 1928

Fig. 9 Above, a top center-section with and without the gasoline tank. Below, a wing root of the lower wing of the "Avian III". This is of triangular plan form to suit the folding arrangements of the wings.

Fig. 10 Sketch showing most of the details in the "Avian III" fuselage. The manner in which the landing gear wheels move back and up when the wings are folded is indicated by the dotted lines.

