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WIND TUNNEL TEST OF THE ORIGINAL DB-1 MODEL

(AIRPLANE SECTION REPORT)

Prepared by A. L. Morse
Engineering Division, Air Service
McCook Field, Dayton, Ohio
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WIND TUNNEL TEST OF THE ORIGINAL DB-1 MODEL

OBJECT

The object of the DB-1 model test was to determine the aerodynamic characteristics of the original Gallaudet DB-1 airplane.

DATE AND PLACE

The original DB-1 was tested in the Massachusetts Institute of Technology 4-foot wind tunnel at 40 miles per hour on the following dates:

<table>
<thead>
<tr>
<th>Date</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr. 25, 1922</td>
<td>L, D, and M, on complete model with various elevator settings.</td>
</tr>
<tr>
<td>Aug. 22, 1922</td>
<td>L and D, on complete model and component parts.</td>
</tr>
<tr>
<td>Do.</td>
<td>L, D, and M, on wing alone.</td>
</tr>
</tbody>
</table>

DESCRIPTION

The original DB-1 was a cantilever tractor monoplane. The wings, with the overhung balanced ailerons, tapered in both plan and thickness. The elevators were unbalanced. The rudder was of the overhanging balance type. Both horizontal and vertical tail surfaces had symmetrical sections. The cylinders of the 18-cylinder "W" engine were exposed. The landing gear was of the usual "V" type with two additional struts connecting the center of the hinged axle to the point of wing attachment. Side radiators were located on top of the wings adjacent to the fuselage. Below is tabulated the design characteristics of the above airplane.

Type: Day bomber.


Where tested: Massachusetts Institute of Technology.

Wind speed of test: 40 miles per hour.

Material of model: Wood with brass ailerons, rudder, elevator, and landing-gear struts.

Dimensional accuracy: Wings and tail, 0.001 inch; fuselage, etc., 0.01 inch.

Position of center of gravity on model: 0.95 inch aft of left end of wing at root. On the thrust line 29.5 per cent chord at root.

Over all length (L) 48 feet.

Over all span (S) 67 feet.

Over all height 11.6 feet.

Weight fully loaded (W) 9,206 pounds.

Horsepower 750 horsepower.

Wing area (including ailerons) 660 square feet.

Power loading 12.29 pounds per horsepower.

Wing loading 13.95 pounds per square foot.

WINGS

Area (including ailerons) 660 square feet.

Span less aileron balances 81 64.48 feet.

Chord mean 10.16 feet.

Aspect ratio 6.44.

Angle of incidence at root 4°.

Angle of incidence at tip 4°.

Dihedral 5.8°.

Wing section Gallaudet T-9.

CONTROLS

AILERONS

Total aileron area 57 square feet.

Percentage of aileron area to wing area (a) 8.64 per cent.

Distance from center line of airplane to center pressure of aileron (Sm) 26 feet.

C 22.1.

HORIZONTAL TAIL SURFACES

Area of stabilizer 58.9 square feet.

Area of elevators 40.6 square feet.

Total horizontal tail area 99.5 square feet.

Aspect ratio 3.1.

Percentage of horizontal tail area to wing area (h) 15.1.

Number chord lengths from center of gravity to tail hinge (t1) 2.87c.

Center of gravity position in per cent of chord 29.5.

VERTICAL TAIL SURFACES

Area of fin 20.64 square feet.

Area of rudder aft of hinge 15.20 square feet.

Area of balanced portion 1.76 square feet.

Total rudder area 16.96 square feet.

Total vertical tail area 37.60 square feet.

Percentage of vertical tail area to wing area (v) 5.7.

Number chord lengths from center of gravity to tail hinge (t2) 2.87c.

t,v 16.35.

Figure 1 is a drawing of the model complete. Figures 2 and 3 are wing template drawings.

PROCEDURE

The original DB-1 was tested in the Massachusetts Institute of Technology, 4-foot wind tunnel on the neutral position lateral balance in the usual manner.

RESULTS

Figures 4 to 7.—L, D, L/D, Mc, g. and equilibrium curve for complete model with various elevator settings.

Figure 8.—L and D on complete model and component parts. Parasite drag.

Figure 9.—Lc, Dc, L/D, Mc, and component parts for wing alone.

(1)
FIG. 4

DB-1 MODEL
Lift & Thrust at different elevator angles
Wind speed: 40 M.P.H.
Model size: 1/10 scale
Stabilizer: 0° & Thrust line

FIG. 5

DB-1 MODEL
Lift & Thrust at different elevator angles
Wind speed: 40 M.P.H.
Model size: 1/10 scale
Stabilizer: 0° & Thrust line

FIG. 6

DB-1 MODEL
Drag at different elevator angles
Wind speed: 40 M.P.H.
Model size: 1/10 scale
Stabilizer: 0° & Thrust line
DB-1 MODEL
Curve of Equilibrium
Wind speed: 40 M.P.H.
Model size: 1/44 scale
Stabilizer: 0° to thrust line

Fig. 7

Fig. 8

Fig. 9
Fig. 10

ORIGINAL DB-1 WING
C.P. & M.C. curves
Wind speed: 40 M.P.H.
Model size: 1/48 scale