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RESEARCH MEMORANDUM

LOW-SPEED INVESTIGATION OF A SMALL TRIANGULAR WING OF ASPECT RATIO 2.0. I - THE EFFECT OF COMBINATION WITH A BODY REVOLUTION AND HEIGHT ABOVE A GROUND PLANE

By Leonard M. Rose

Ames Aeronautical Laboratory
Moffett Field, Calif.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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SUMMARY

Low-speed wind-tunnel tests were conducted of a triangular wing of aspect ratio 2.0 with a symmetrical double-wedge section having a maximum thickness of 5 percent of the chord at 20 percent of the chord. The wing was also tested in the presence of a ground plane. Additional data were obtained with constant-chord split flaps and in combination with a body having a fineness ratio of 12.5.

At low lift coefficients, relatively linear characteristics were obtained; whereas, at high lift coefficients the lateral-stability characteristics became increasingly nonlinear. This transition range of lift coefficients was marked by an abrupt change in longitudinal stability. The effect of the body was to reduce the severity of the longitudinal-stability change with relatively little effect on the lateral characteristics. Decreasing the height above the ground resulted in a considerable increase in the lift-curve slope and the maximum lift, a reduction in induced drag, as well as a slight increase in longitudinal stability.

The split flaps were relatively ineffective for increasing the maximum lift or for reducing the angle of attack for maximum lift.

INTRODUCTION

The possible advantages of thin, low-aspect-ratio, triangular wings at supersonic speeds have been shown theoretically by several investigators (references 1, 2, and 3). The characteristics of these wings at subsonic and transonic speeds are not so amenable to theoretical treatment, nor have they been extensively investigated experimentally at any speed.

An experimental investigation has been undertaken at the Ames Aeronautical Laboratory of the characteristics of thin, low-aspect-ratio, triangular wings over a wide range of Mach and Reynolds numbers. For this investigation a triangular wing with an aspect ratio of 2.0, the leading edge swept back 63.4°, and a symmetrical double-wedge section having a maximum thickness of 5 percent of the chord at 20 percent of the chord was selected. The experimental results obtained with this wing from tests at low speed and large scale, have been presented in reference 4.

This report presents the results of tests in the Ames 7- by 10-foot wind tunnel to determine the characteristics of the wing alone and in combination with a body of fineness ratio 12.5. Results are also presented for the wing at several heights above a ground plane.

SYMBOLS AND COEFFICIENTS

The results are presented in the form of standard NACA coefficients. All moments are referred to a point on the wing center line at the quarter mean aerodynamic chord of the wing. (See fig. 1.) The symbols and coefficients are defined as follows:

C_D drag coefficient (drag/qS)

C_L lift coefficient (lift/qS)

C_m pitching-moment coefficient (pitching moment/$qS\bar{c}$)

C_n yawing-moment coefficient (yawing moment/qSb)

C_Y lateral-force coefficient (lateral force/qS)

S wing area, square feet

b wing span, feet

c wing chord, feet

$\bar{c}$ wing mean aerodynamic chord, feet

q dynamic pressure $(\frac{1}{2}\rho V^2)$, pounds per square foot

ρ mass density of air, slugs per cubic foot

V airspeed, feet per second

h wing height above ground plane (measured to trunnion), feet

α angle of attack of wing, degrees

ψ angle of yaw, degrees

δ_f flap deflection, degrees

C_{L_α} rate of change of lift coefficient with angle of attack $(\partial C_L/\partial\alpha)$, per degree

C_{n_ψ} rate of change of yawing-moment coefficient with angle of yaw $(\partial C_n/\partial\psi)$, per degree

C_{Y_ψ} rate of change of lateral-force coefficient with angle of yaw $(\partial C_Y/\partial\psi)$, per degree

MODELS AND TEST METHODS

The wing tested was of aspect ratio 2.0 (leading edge swept back 63.4°) having a symmetrical double-wedge airfoil section with a maximum thickness of 5 percent of the chord at 20 percent of the chord. A fineness ratio of 12.5 was selected for the body, since it appeared to be a reasonable choice for a supersonic airplane. The body was proportioned relative to the wing to represent a volume approximately that required for either a rocket or turbo-jet installation in a fighter airplane. The two wing locations relative to the body were chosen to cover a range of possible applications. The wing was constructed of wood over a laminated steel spar; whereas the body was of all-wood construction. Sketches of the wing and body are shown in figures 1 and 2.

The constant-chord split flaps investigated in these tests were bent to the proper deflection from 1/16-inch-thick aluminum sheet. The flap chord was equal to 20 percent of the average wing chord, and the flaps extended along the span to the intersection of the flap leading edge and a line along the wing maximum thickness. This resulted in a flap area equal to 17.4 percent of the wing area.

The model was supported in the wind tunnel by a single strut attached to the wing spar. Figure 3 shows the model-mounting arrangement. For the tests in the presence of the ground plane, the height of the wing was varied by suitable spacers under the support strut. A sketch of the ground-plane arrangement showing the relative location of the wing and ground plane for the various strut heights is shown in figure 4. Photographs of the model and ground plane are presented in figure 5.

The data were corrected for wind-tunnel-wall effects by the methods outlined in reference 5. These corrections are strictly applicable only to wings of larger aspect ratio. Since the model wing area relative to the cross-sectional area of the wind tunnel was small, it is believed the error in using these corrections is negligible. The corrections added were:

$$\Delta\alpha = 0.53 \; C_L$$

$$\Delta C_D = 0.0093 \; C_L^2$$

No tunnel-wall corrections were applied to the ground-plane test results, since the corrections were small. The test results were also corrected for air-stream inclination and strut tares. The strut tares were evaluated by using an image strut as shown in figure 6.

The major portion of the data was obtained at a Reynolds number of approximately 1.8×10^6 based on the mean aerodynamic chord.

RESULTS AND DISCUSSION

A summary of the more pertinent test results is presented in figures 7 through 15. The remainder of the test results are given in tables I through VII.

Isolated Wing and Wing-Body Combinations

The basic wing characteristics, as well as the results obtained with the wing in two fore-and-aft locations on the body, are presented in figure 7 and tables I, II, and III. These results indicate that the wing, alone or in combination with the body, attained a maximum lift coefficient comparable to that of wings of greater aspect ratios. This maximum lift, however, was attained at an angle of attack in excess of 30° and the attendant high drag yielded lift-drag ratios of less than 2.0. (See fig. 8.) Consequently, it would be necessary to resort to either very low wing loadings or considerable power for this triangular wing to achieve rates of descent in the landing approach of as low an order of magnitude as those occurring with present-day airplanes.

The variation of pitching-moment coefficient with lift coefficient for the wing alone indicates satisfactory static longitudinal stability except for an abrupt change at approximately 0.7 lift coefficient. (See fig. 7.) It is probable that this discontinuity resulted from a rapid change in the conditions of air flow about the wing. This change in air flow has previously been observed and discussed by Winter (reference 6). A similar break in the variation of C_m with C_L was found in the large-scale tests reported in reference 4.

The effect of the body was to suppress to a great extent the abrupt change in stability evident for the wing alone. (See fig. 7.) This beneficial effect quite possibly resulted from favorable interference of the body on the transition from the even flow at the lower angles of attack to the partially separated flow at large angles.

The effect of angle of attack on the variation of yawing moment and side force with angle of yaw is shown in figures 9(a), 9(b), and 9(c) for the isolated wing and the two wing-body combinations. Although the experimental data indicate considerable scatter, the fairing of the curves is believed to represent the trend of the experimental data. The variation of the parameters C_{n_ψ} and C_{Y_ψ} with angle of attack is summarized in figure 10. These parameters represent the slopes of the curves through zero yaw and are useful primarily at angles of attack below 20° because of the erratic variation of yawing moment and side force with yaw at larger angles of attack. The results for the wing alone indicate increasing directional stability C_{n_ψ} with increasing angle of attack to a maximum at approximately 20°, followed by a reduction in C_{n_ψ} to zero at the stall. The side-force variation C_{Y_ψ} was such, however, that a vertical tail would be necessary to achieve the proper variation of angle of bank with angle of yaw. The addition of the body in either position resulted in unstable values of C_{n_ψ} for all conditions, as well as undesirable side-force variations at angles of attack above 10°.

Split-Flap Effectiveness

Figures 11, 12, and 13 show, respectively, the variation of maximum-lift coefficient, change in lift coefficient, and change in pitching-moment coefficient with flap deflection. Obviously, the flap tested was of little value in increasing the maximum lift attainable. In fact, for large flap deflections the maximum lift was less than that attainable with the flap undeflected. The increment in lift resulting from downward flap deflection decreased markedly with increasing angle of attack; whereas the effect of angle of attack was negligible for upward flap deflections. Similarly, the increment of angle of attack at a constant lift coefficient, produced by the flaps, was small at high angles of attack.

Some insight into the usefulness of these flaps as balancing devices may be obtained from figure 13 which indicates little effect of lift coefficient on the increment in pitching moment attainable with upward flap deflection. However, the results also indicate that this flap produced relatively small pitching moments, which would necessitate static margins of less than 10 percent for operation at lift coefficients in excess of 0.8.

Ground Effect

The effects of proximity to the ground on static longitudinal stability, lift-curve slope, and maximum lift coefficient of the wing are summarized in figure 14 from the data presented in tables IV through VII for the wing alone and the wing without flap in the aft location on the body.[1] The effect of the ground plane on the static longitudinal stability of the wing was relatively small and decreased rapidly as the height of the wing was increased. The presence of the ground increased the lift-curve slope more than 25 percent for the closest position $(h/b = 0.19)$; and even with a height-to-span ratio of 1.0, C_{L_α} was almost 15 percent greater than the free-air value. Similarly, the proximity of the ground resulted in an increase in the maximum lift coefficient attainable which ranged from 16 percent for $h/b = 0.31$ to 8.5 percent for $h/b = 1.0$. The drag was, as expected, considerably reduced by the presence of the ground. This reduction resulted in an increase of the lift-drag ratio from 2.1 (at $h/b = \infty$) to 3.0 (at $h/b = 0.19$) at a lift coefficient of 1.2. Similar, though smaller, increases in lift-drag ratio were evident for other heights above the ground plane and higher lift coefficients. (See fig. 15.) The data presented in tables IV through VII indicate only a slight increase in flap effectiveness in the presence of the ground plane.

CONCLUDING REMARKS

Tests of a triangular wing of aspect ratio 2.0 with a symmetrical double-wedge airfoil section having a maximum thickness of 5 percent of the chord at 20 percent of the chord, indicated that two regimes of air flow existed over the wing. It was surmised that at low angles of attack smooth flow existed, which resulted in relatively linear variations of forces and moments with changes in angle of attack. At higher angles of attack partially separated flow prevailed, resulting in increasingly nonlinear variation of the lateral-force and moment characteristics as the angle of attack was increased. The transition between the two flow conditions was marked by an abrupt change in longitudinal stability.

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[1]With the wing in the forward location on the body, data could be obtained only at low angles of attack before the tail of the body came in contact with the ground plane. The wing in the aft location on the body gave results identical with those from the wing alone for all ground-effect tests. Therefore the results in tables IV through VII for $\delta_f = 0$ are applicable to the body and wing aft configuration.

A maximum lift coefficient of 1.40 was obtained at an angle of attack of 35°. Split flaps were relatively ineffective for increasing the maximum lift or reducing the angle of attack for maximum lift.

Lift-drag ratios of less than 2.0 were obtained at high-lift coefficients, indicating that very low wing loadings or considerable power would be necessary to achieve safe rates of descent in the landing approach.

The characteristics of the wing in combination with a body having a fineness ratio of 12.5 were similar to those of the wing alone except that the abrupt change in longitudinal stability evident with the wing alone was to a large extent suppressed.

Decreasing height above a ground plane resulted in a considerable increase in lift-curve slope and maximum lift, a slight increase in longitudinal stability, and a reduction in induced drag.

Ames Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Moffett Field, Calif.

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TABLE I.- EFFECT OF FLAP DEFLECTION ON THE CHARACTERISTICS OF THE WING

$\delta_f = -10°$				$\delta_f = -20°$				$\delta_f = -25°$			
α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m
-9.87	-0.637	0.1403	0.1253	-9.91	-0.711	0.1805	0.1676	-9.93	-0.764	0.2117	0.1838
-7.81	-.530	.1052	.1144	-7.85	-.607	.1413	.1573	-7.88	-.658	.1684	.1789
-5.76	-.423	.0737	.1014	-5.81	-.518	.1103	.1463	-5.83	-.564	.1339	.1651
-3.71	-.331	.0520	.0901	-3.76	-.422	.0855	.1246	-3.78	-.471	.1049	.1468
-1.67	-.252	.0401	.0658	-1.71	-.335	.0650	.1123	-1.74	-.381	.0880	.1391
.38	-.152	.0317	.0638	.34	-.244	.0548	.1036	.31	-.301	.0748	.1208
2.43	-.069	.0289	.0454	2.38	-.160	.0459	.0914	2.35	-.216	.0648	.1102
4.48	.028	.0289	.0357	4.42	-.070	.0447	.0715	4.39	-.134	.0589	.0973
6.52	.110	.0354	.0277	6.47	.021	.0461	.0641	6.45	-.026	.0607	.0784
8.57	.215	.0499	.0174	8.52	.119	.0591	.0479	8.50	.069	.0669	.0745
10.62	.312	.0710	.0073	10.57	.211	.0762	.0409	10.55	.177	.0818	.0692
12.68	.420	.1027	-.0022	12.62	.311	.1029	.0323	12.60	.274	.1092	.0507
14.72	.499	.1367	-.0065	14.67	.407	.1329	.0349	14.64	.356	.1363	.0488
16.77	.601	.1789	-.0179	16.72	.504	.1731	.0209	16.70	.467	.1741	.0478
18.83	.706	.2254	-.0089	18.77	.605	.2160	.0223	18.75	.554	.2169	.0360
20.88	.804	.2839	-.0213	20.83	.707	.2746	.0026	20.79	.645	.2676	.0278
22.96	.890	.3484	-.0293	22.87	.793	.3326	-.0009	22.84	.740	.3320	.0096
24.97	.978	.4289	-.0526	24.92	.884	.4046	-.0126	24.89	.830	.3952	.0156
27.02	1.075	.5031	-.0453	26.96	.969	.4732	-.0158	26.93	.904	.4631	.0063
29.05	1.137	.5870	-.0618	28.98	1.011	.5538	-.0572	28.97	.993	.5342	.0095
31.07	1.190	.6681	-.0802	31.02	1.083	.6256	-.0532	31.00	1.048	.6136	-.0306
33.10	1.244	.7513	-.0732	33.06	1.165	.6947	-.0419	33.02	1.093	.6838	-.0378
35.12	1.277	.8331	-.1090	35.05	1.158	.7754	-.0729	35.03	1.118	.7558	-.0658
37.12	1.288	.8923	-.0934	37.06	1.173	.8308	-.0722	37.03	1.115	.8062	-.0716

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TABLE I. - CONCLUDED.

$\delta_f = 10°$				$\delta_f = 25°$				$\delta_f = 45°$			
α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m
−9.69	−0.292	0.0695	−0.0073	−9.62	−0.157	0.0867	−0.0608	−9.55	−0.006	0.1134	−0.1117
−7.65	−.210	.0498	−.0236	−7.57	−.061	.0722	−.0744	−7.51	.083	.1061	−.1347
−5.58	−.089	.0322	−.0353	−5.52	.046	.0623	−.0869	−5.45	.185	.1092	−.1483
−3.54	−.010	.0276	−.0413	−3.47	.125	.0623	−.1016	−3.41	.255	.1163	−.1553
−1.49	.082	.0290	−.0535	−1.44	.192	.0661	−.1169	−1.37	.343	.1250	−.1645
.54	.152	.0313	−.0654	.60	.273	.0752	−.1311	.67	.410	.1453	−.1888
2.59	.237	.0388	−.0555	2.65	.365	.0882	−.1442	2.72	.501	.1634	−.1988
4.63	.325	.0519	−.0927	4.70	.463	.1075	−.1485	4.76	.582	.1898	−.2083
6.69	.426	.0736	−.1048	6.76	.561	.1355	−.1675	6.82	.690	.2218	−.2158
8.74	.527	.1049	−.1245	8.81	.662	.1679	−.1707	8.86	.762	.2582	−.2102
10.79	.629	.1402	−.1259	10.86	.753	.2093	−.1815	10.89	.827	.2988	−.2194
12.85	.746	.1876	−.1356	12.85	.798	.2466	−.1711	12.90	.838	.3377	−.1977
14.89	.813	.2267	−.1210	14.92	.877	.2946	−.1629	14.95	.934	.3922	−.2073
16.92	.888	.2804	−.1310	16.96	.963	.3527	−.1741	16.98	.991	.4477	−.1999
18.98	.997	.3469	−.1381	19.01	1.046	.4237	−.1894	19.03	1.084	.5163	−.2050
21.02	1.080	.4121	−.1415	21.06	1.140	.4914	−.1778	21.03	1.103	.5761	−.2153
23.08	1.186	.4981	−.1550	23.08	1.183	.5670	−.1961	23.07	1.168	.6499	−.2113
25.10	1.228	.5817	−.1706	25.13	1.282	.6447	−.1805	25.10	1.237	.7168	−.1921
27.14	1.317	.6659	−.1595	27.13	1.294	.7187	−.2013	27.11	1.245	.7921	−.2250
29.18	1.381	.7601	−.1623	29.15	1.325	.8026	−.2157	29.11	1.258	.8524	−.1901
31.19	1.413	.8281	−.1820	31.16	1.351	.8664	−.1885	31.11	1.262	.9132	−.2092
33.19	1.410	.8997	−.1701	33.17	1.375	.9351	−.1930	33.11	1.258	.9682	−.2129
35.19	1.406	.9644	−.1761	35.14	1.312	.9680	−.1724	35.08	1.210	1.0092	−.2144
37.16	1.352	1.0036	−.1648	37.10	1.250	1.0049	−.1976	37.06	1.170	1.0199	−.1794

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TABLE II.– EFFECT OF FLAP DEFLECTION ON THE CHARACTERISTICS OF THE WING IN THE AFT LOCATION ON THE BODY

$\delta_f = -10^\circ$			$\delta_f = -20^\circ$			$\delta_f = -25^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
−9.85	−0.605	0.1180	−9.89	−0.676	0.1530	9.91	−0.712	0.1742
−7.80	−.506	.1135	−7.83	−.570	.1533	7.86	−.616	.1590
−5.74	−.400	.0909	−5.78	−.463	.1364	5.80	−.515	.1496
−3.69	−.310	.0800	−3.73	−.379	.1224	3.75	−.412	.1339
−1.65	−.221	.0734	−1.68	−.291	.1142	1.70	−.318	.1267
.40	−.126	.0598	.36	−.205	.0934	.33	−.257	.1036
2.42	−.089	.0489	2.41	−.115	.0825	2.38	−.165	.0980
4.49	.044	.0346	4.45	−.029	.0752	4.43	−.077	.0866
6.54	.137	.0290	6.50	.062	.0569	6.47	.006	.0684
8.60	.237	.0104	8.56	.162	.0459	8.53	.117	.0590
10.65	.337	.0069	10.61	.265	.0300	10.58	.212	.0455
12.70	.430	−.0023	12.67	.368	.0260	12.64	.317	.0382
14.76	.538	−.0176	14.72	.466	.0205	14.69	.412	.0274
16.81	.637	−.0190	16.77	.574	.0072	16.74	.518	.0190
18.86	.732	−.0380	18.82	.666	.0055	18.80	.623	.0032
20.91	.832	−.0410	20.87	.754	−.0205	20.85	.712	.0023
22.97	.942	−.0549	22.93	.864	−.0169	22.90	.814	−.0150
25.01	1.027	−.0641	24.98	.961	−.0423	24.95	.910	−.0243
27.05	1.100	−.0803	27.03	1.051	−.0384	26.99	.978	−.0353
28.08	1.148	−.0800	28.04	1.066	−.0497	28.00	1.005	−.0392
29.10	1.183	−.0822	29.06	1.108	−.0639	29.03	1.060	−.0570
30.10	1.196	−.0822	30.07	1.129	−.0522	30.05	1.085	−.0660
31.11	1.211	−.0914	31.09	1.161	−.0866	31.06	1.115	−.0695
32.13	1.253	−.0714	32.11	1.198	−.1021	32.09	1.176	−.0863
33.13	1.238	−.0701	33.09	1.177	−.0685	33.08	1.157	−.0819
34.12	1.221	−.0655	34.09	1.174	−.1239	34.09	1.175	−.0964
35.08	1.157	−.0806	35.10	1.197	−.0944	35.08	1.146	−.1018
36.09	1.164	−.0992	36.09	1.177	−.1122	36.11	1.202	−.0491

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TABLE II.– CONCLUDED.

$\delta_f = 10^\circ$			$\delta_f = 20^\circ$			$\delta_f = 45^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
-9.70	-0.324	0.0014	-9.66	-0.252	0.0343	-9.56	-0.054	-0.0888
-7.65	-.224	-.0077	-7.60	-.138	.0408	-7.51	.042	-.1142
-5.59	-.119	-.0240	-5.54	-.025	.0536	-5.46	.138	-.1252
-3.54	- 027	-.0364	-3.50	.058	.0598	-3.42	.209	-.1375
-1.50	.056	-.0491	-1.60	.130	.0886	-1.38	.288	-.1423
.56	.162	-.0514	.58	.212	.0946	.66	.367	-.1610
2.59	.220	-.0688	2.62	.285	.1116	2.71	.458	-.1768
4.64	.322	-.0852	4.67	.385	.1190	4.77	.558	-.1850
6.69	.412	-.0966	6.73	.492	.1320	6.81	.648	-.1901
8.74	.506	-.1166	8.79	.601	.1470	8.86	.728	-.2028
10.79	.612	-.1244	10.83	.674	.1576	10.87	.760	-.1763
12.83	.683	-.1205	12.86	.742	.1423	12.91	.823	-.1790
14.88	.778	-.1241	14.91	.832	.1530	14.95	.907	-.1950
16.94	.893	-.1296	16.96	.918	.1590	16.99	.988	-.1890
18.99	.983	-.1472	19.00	1.008	.1719	19.04	1.068	-.1866
21.05	1.085	-.1502	21.06	1.112	.1684	21.07	1.134	-.1853
23.08	1.154	-.1622	23.10	1.195	.1674	23.11	1.202	-.1665
25.13	1.244	-.1576	25.13	1.244	.1804	25.13	1.244	-.1933
27.16	1.304	-.1506	27.18	1.338	.1806	27.15	1.278	-.1810
29.19	1.356	-.1775	29.19	1.365	.1809	29.17	1.313	-.1936
30.20	1.370	-.1673	30.19	1.361	.1956	30.15	1.287	-.2053
31.20	1.385	-.1626	31.19	1.360	.1994	31.15	1.280	-.1532
32.20	1.369	-.1292	32.19	1.350	.1819	32.12	1.234	-.2097
33.15	1.283	-.1596	33.16	1.298	.1563	23.11	1.204	-.1919
34.14	1.259	-.1636	34.14	1.263	.1693	34.11	1.199	-.2065
35.14	1.255	-.1279	35.13	1.245	.1540	35.12	1.230	-.1960
36.12	1.231	-.1450	35.12	1.230	.1720	36.11	1.201	-.2047

TABLE III. - EFFECT OF FLAP DEFLECTION ON THE CHARACTERISTICS OF THE WING IN THE FORWARD LOCATION ON THE BODY

$\delta_f = -10^\circ$			$\delta_f = -20^\circ$		
α	C_L	C_m	α	C_L	C_m
-9.84	-0.592	0.1270	-9.88	-0.668	0.1606
-7.79	-.488	.1098	-7.84	-.578	.1450
-5.73	-.385	.1053	-5.78	-.473	.1396
-3.69	-.302	.0907	-3.73	-.381	.1200
-1.64	-.208	.0740	-1.68	-.276	.1091
.41	-.120	.0693	.36	-.204	.0876
2.46	-.021	.0576	2.41	-.117	.0778
4.50	.061	.0410	4.45	-.031	.0686
6.55	.156	.0268	6.50	.061	.0551
8.61	.259	.0164	8.56	.169	.0416
10.66	.353	.0014	10.61	.256	.0218
12.70	.435	-.0101	12.66	.350	.0178
14.75	.534	-.0202	14.71	.451	.0169
16.82	.652	-.0244	16.76	.548	-.0046
18.86	.728	-.0483	18.82	.662	-.0142
20.92	.848	-.0590	20.88	.768	-.0287
22.98	.967	-.0638	22.92	.856	-.0474
25.02	1.045	-.0819	24.98	.956	-.0564
27.07	1.124	-.0935	27.03	1.060	-.0643
28.08	1.158	-.0949	28.04	1.075	-.0820
29.10	1.190	-.1012	29.06	1.119	-.0710
30.13	1.237	-.1008	30.09	1.166	-.1015
31.14	1.256	-.1012	31.10	1.184	-.0942
32.12	1.235	-.1224	32.09	1.165	-.0990
33.13	1.243	-.1313	33.10	1.190	-.1071
34.14	1.267	-.1363	34.10	1.195	-.1167
35.14	1.263	-.1540	35.11	1.210	-.1127
36.15	1.291	-.1440	36.12	1.225	-.1330

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TABLE III. - CONCLUDED.

$\delta_f = 10^\circ$			$\delta_f = 20^\circ$			$\delta_f = 45^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
-9.71	-0.331	0.0059	-9.66	-0.248	-0.0238	-9.57	-0.070	-0.0916
-7.65	-.230	-.0100	-7.61	-.142	-.0410	-7.52	.026	-.1086
-5.60	-.123	-.0176	-5.56	-.053	-.0508	-5.47	.115	-.1192
-3.54	-.027	-.0324	-3.56	.052	-.0693	-3.42	.206	-.1346
-1.50	.055	-.0414	-1.60	.124	-.0775	-1.38	.279	-.1522
.54	.130	-.0587	.58	.212	-.0890	.66	.357	-.1609
2.58	.215	-.0691	2.63	.297	-.1004	2.71	.448	-.1647
4.62	.316	-.0871	4.67	.382	-.1221	4.76	.546	-.1824
6.67	.405	-.1051	6.73	.484	-.1352	6.80	.623	-.1982
8.74	.507	-.1162	8.78	.588	-.1450	8.85	.720	-.2016
10.80	.616	-.1287	10.83	.679	-.1596	10.86	.743	-.1865
12.84	.694	-.1261	12.86	.740	-.1454	12.91	.823	-.1930
14.88	.783	-.1301	14.91	.831	-.1500	14.95	.907	-.2049
16.94	.890	-.1388	16.96	.926	-.1674	16.98	.970	-.2121
18.99	.988	-.1523	19.01	1.021	-.1677	19.03	1.058	-.2190
21.04	1.079	-.1668	21.06	1.109	-.1822	21.07	1.137	-.2149
23.09	1.162	-.1603	23.09	1.172	-.1929	23.10	1.193	-.2180
25.13	1.250	-.1865	25.15	1.280	-.1989	25.14	1.260	-.2230
27.17	1.318	-.1920	27.17	1.320	-.2001	27.16	1.299	-.2231
29.19	1.366	-.1984	29.19	1.363	-.2057	29.15	1.283	-.2478
30.19	1.352	-.2102	30.19	1.358	-.2242	30.18	1.332	-.2334
31.17	1.330	-.1900	31.18	1.337	-.2291	31.16	1.302	-.2492
32.18	1.332	-.2138	32.19	1.354	-.2107	32.17	1.321	-.2395
33.18	1.333	-.1910	33.18	1.349	-.2240	33.16	1.297	-.2432
34.18	1.347	-.2145	34.19	1.356	-.2418	34.16	1.306	-.2593
35.19	1.356	-.2120	35.19	1.368	-.1991	35.19	1.353	-.2203
36.18	1.345	-.2220	36.20	1.379	-.1832	36.17	1.323	-.2315

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TABLE IV.– EFFECT OF FLAP DEFLECTION ON THE CHARACTERISTICS OF THE WING IN THE PRESENCE OF THE GROUND (h/b = 0.19)

$\delta_f = 0^{\circ}$ [1]			$\delta_f = -5^{\circ}$			$\delta_f = -15^{\circ}$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0	0.037	−0.0090	0	−0.053	0.0446	0	−0.199	0.0987
1	.069	− .0105	1	− .014	.0319	1	− .144	.0895
2	.132	− .0174	2	.031	.0238	2	− .098	.0774
3	.181	− .0270	3	.094	.0236	3	− .051	.0641
4	.216	− .0352	4	.133	.0156	4	.026	.0626
5	.274	− .0477	5	.206	.0067	5	.076	.0560
6	.349	− .0514	6	.261	− .0024	6	.122	.0419
7	.414	− .0540	7	.315	− .0111	7	.184	.0306
8	.465	− .0659	8	.373	− .0176	8	.241	.0287
9	.536	− .0697	9	.450	− .0289	9	.314	.0216
10	.594	− .0782	10	.506	− .0289	10	.355	.0107
11	.654	− .0834	11	.560	− .0428	11	.420	.0057
12	.708	− .0908	12	.617	− .0481	12	.491	.0087
13	.757	− .1004	13	.669	− .0498	13	.533	− .0046
14	.822	− .1024	14	.718	− .0610	14	.605	− .0105
15	.869	− .1026	15	.804	− .0610	15	.673	− .0135
16	.938	− .1097	16	.848	− .0733	16	.729	− .0311
17	.990	− .1094	17	.908	− .0792	17	.767	− .0421
18	1.032	− .1224	18	.966	− .0830	18	.847	− .0428
19	1.106	− .1116	19	1.018	− .0892	19	.895	− .0566
20	1.147	− .1257	20	1.090	− .0911	20	.977	− .0624
21	1.207	− .1227	21	1.122	− .1094	21	1.035	− .0735
22	1.251	− .1304	22	1.193	− .1068	22	1.085	− .0912
23	1.303	− .1277	23	1.240	− .1238	23	1.169	− .0824
24	1.337	− .1378	24	1.298	− .1269	24	1.239	− .0931
25	1.391	− .1434	25	1.356	− .1253	25	1.286	− .1095
26	1.416	− .1531	26	1.399	− .1455	26	1.335	− .1299
27	1.440	− .1688	27	1.437	− .1568	27	1.381	− .1443

[1] These values also apply for the body plus wing aft to an angle of attack of 17°.

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TABLE IV.– CONCLUDED.

$\delta_f = -25^\circ$			$\delta_f = 25^\circ$			$\delta_f = 45^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0	–0.294	0.1477	0	0.383	–0.1441	0	0.547	–0.2025
1	– .252	.1406	1	.430	– .1497	1	.588	– .2089
2	– .205	.1287	2	.484	– .1614	2	.634	– .2349
3	– .140	.1199	3	.543	– .1690	3	.689	– .2276
4	– .082	.1118	4	.590	– .1794	4	.742	– .2281
5	– .051	.0975	5	.653	– .1780	5	.787	– .2284
6	.033	.0937	6	.718	– .1868	6	.845	– .2288
7	.095	.0796	7	.789	– .2244	7	.875	– .2452
8	.148	.0735	8	.837	– .2036	8	.942	– .2277
9	.206	.0605	9	.880	– .2016	9	.953	– .2215
10	.270	.0582	10	.948	– .2003	10	.999	– .2201
11	.320	.0510	11	.979	– .2001	11	1.022	– .2278
12	.381	.0478	12	1.016	– .2054	12	1.107	– .2280
13	.439	.0377	13	1.092	– .1997	13	1.175	– .2215
14	.510	.0339	14	1.151	– .2047	14	1.198	– .2366
15	.565	.0255	15	1.195	– .2131	15	1.263	– .2369
16	.636	.0153	16	1.233	– .2266	16	1.310	– .2380
17	.695	.0076	17	1.304	– .2209	17	1.347	– .2437
18	.755	–.0025	18	1.355	– .2204	18	1.411	– .2454
19	.817	–.0146	19	1.393	– .2348	19	1.433	– .2607
20	.882	–.0279	20	1.449	– .2368	–	---	----
21	.981	–.0277	21	1.517	– .2336	–	---	----
22	1.003	–.0614	22	1.555	– .2339	–	---	----
23	1.079	–.0640	–	---	----	–	---	----
24	1.167	–.0732	–	---	----	–	---	----
25	1.223	–.0882	–	---	----	–	---	----
26	1.271	–.1098	–	---	----	–	---	----
27	1.333	–.1257	–	---	----	–	---	----

TABLE V.— EFFECT OF FLAP DEFLECTION ON THE CHARACTERISTICS OF THE WING IN THE PRESENCE OF THE GROUND (h/b = 0.31)

${}^{1}\delta_f = 0^\circ$			$\delta_f = -5^\circ$			$\delta_f = -15^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0	0.028	0.0058	0	-0.068	0.0485	0	-0.212	0.1008
1	.074	-.0041	1	-.027	.0390	1	-.167	.0876
2	.113	-.0120	2	.023	.0199	2	-.124	.0828
3	.171	-.0167	3	.068	.0199	3	-.068	.0761
4	.205	-.0335	4	.120	.0132	4	-.015	.0757
5	.276	-.0363	5	.175	.0036	5	.034	.0591
6	.336	-.0383	6	.240	-.0064	6	.107	.0462
7	.408	-.0463	7	.299	-.0102	7	.169	.0419
8	.465	-.0597	8	.352	-.0312	8	.212	.0325
9	.523	-.0617	9	.431	-.0172	9	.290	.0321
10	.565	-.0728	10	.472	-.0344	10	.345	.0234
11	.639	-.0780	11	.534	-.0359	11	.396	.0172
12	.708	-.0803	12	.590	-.0412	12	.477	.0226
13	.759	-.0878	13	.641	-.0434	13	.527	.0129
14	.811	-.0839	14	.707	-.0496	14	.579	-.0015
15	.871	-.0886	15	.772	-.0519	15	.636	-.0038
16	.932	-.0903	16	.825	-.0573	16	.705	-.0070
17	.975	-.0986	17	.887	-.0680	17	.760	-.0170
18	1.034	-.1124	18	.948	-.0645	18	.819	-.0283
19	1.103	-.1026	19	1.009	-.0798	19	.875	-.0236
20	1.144	-.1168	20	1.070	-.0890	20	.928	-.0393
21	1.203	-.1262	21	1.110	-.0954	21	.986	-.0420
22	1.266	-.1212	22	1.179	-.0929	22	1.030	-.0621
23	1.329	-.1313	23	1.232	-.1073	23	1.122	-.0535
24	1.374	-.1260	24	1.296	-.1097	24	1.137	-.0674
25	1.403	-.1393	25	1.342	-.1218	25	1.202	-.0765
26	1.482	-.1403	26	1.380	-.1310	26	1.259	-.0841
27	1.513	-.1423	27	1.420	-.1201	27	1.290	-.0955
28	1.554	-.1495	28	1.496	-.1368	28	1.337	-.1049
29	1.600	-.1549	29	1.530	-.1373	29	1.387	-.1157
30	1.598	-.1669	30	1.530	-.1419	30	1.435	-.1173
31	1.624	-.1665	31	1.584	-.1545	31	1.461	-.1288
32	1.635	-.1658	32	1.577	-.1576	32	1.443	-.1365

[1]These values also apply for the body plus wing aft to an angle of attack of 28°.

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TABLE V.– CONCLUDED.

$\delta_f = -25^\circ$			$\delta_f = 25^\circ$			$\delta_f = 45^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0	-0.315	0.1490	0	0.345	-0.1309	0	0.505	-0.1934
1	-.276	.1363	1	.390	-.1403	1	.567	-.1947
2	-.224	.1335	2	.450	-.1518	2	.594	-.2117
3	-.149	.1234	3	.450	-.1568	3	.650	-.2150
4	-.095	.1261	4	.549	-.1677	4	.694	-.2189
5	-.067	.1112	5	.607	-.1743	5	.751	-.2246
6	-.007	.0999	6	.674	-.1747	6	.797	-.2330
7	.056	.0891	7	.753	-.1779	7	.828	-.2316
8	.119	.0831	8	.791	-.1858	8	.903	-.2292
9	.185	.0862	9	.823	-.1953	9	.918	-.2278
10	.244	.0676	10	.883	-.1995	10	.940	-.2030
11	.283	.0614	11	.933	-.1864	11	.964	-.2097
12	.345	.0521	12	.952	-.1839	12	1.011	-.2163
13	.404	.0582	13	.998	-.1823	13	1.070	-.2211
14	.453	.0393	14	1.059	-.1949	14	1.098	-.2233
15	.530	.0468	15	1.107	-.1956	15	1.151	-.2240
16	.586	.0397	16	1.162	-.2031	16	1.212	-.2213
17	.626	.0260	17	1.223	-.2081	17	1.252	-.2234
18	.712	.0334	18	1.285	-.2150	18	1.294	-.2373
19	.770	.0170	19	1.322	-.2151	19	1.352	-.2292
20	.829	.0084	20	1.368	-.2312	20	1.383	-.2414
21	.887	.0033	21	1.436	-.2263	21	1.437	-.2294
22	.944	-.0053	22	1.447	-.2370	22	1.473	-.2264
23	.971	-.0225	23	1.520	-.2160	23	1.486	-.2435
24	1.037	-.0219	24	1.555	-.2267	24	1.526	-.2415
25	1.087	-.0376	25	1.580	-.2304	25	1.553	-.2392
26	1.138	-.0436	26	1.604	-.2322	26	1.600	-.2333
27	1.202	-.0477	27	1.641	-.2360	27	1.587	-.2419
28	1.225	-.0646	28	1.661	-.2219	28	1.612	-.2335
29	1.278	-.0687	29	1.679	-.2349	29	1.605	-.2373
30	1.321	-.0786	30	1.680	-.2327	30	1.600	-.2449
31	1.384	-.0780	31	1.686	-.2388	31	1.590	-.2345
32	1.377	-.1031	32	1.673	-.2236	32	1.556	-.2425

TABLE VI.– EFFECT OF FLAP DEFLECTION ON THE CHARACTERISTICS OF THE WING IN THE PRESENCE OF THE GROUND (h/b = 0.43)

[1] $\delta_f = 0^\circ$			$\delta_f = -5^\circ$			$\delta_f = -15^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0	0.025	-0.0004	0	-0.065	0.0374	0	-0.160	0.1087
1	.070	-.0042	1	-.030	.0301	1	-.151	.0848
2	.117	-.0125	2	.014	.0275	2	-.106	.0741
3	.172	-.0135	3	.065	.0200	3	-.063	.0753
4	.226	-.0190	4	.113	.0140	4	.022	.0763
5	.273	-.0332	6	.239	- .0006	6	.103	.0508
6	.341	-.0355	8	.351	- .0163	8	.234	.0423
7	.392	-.0455	10	.472	- .0262	10	.338	.0312
8	.448	-.0556	11	.531	- .0312	11	.391	.0134
10	.572	-.0634	12	.577	- .0381	12	.442	.0140
12	.685	-.0798	13	.627	- .0381	13	.508	.0155
14	.795	-.0810	14	.685	- .0394	14	.553	.0107
15	.850	-.0810	15	.740	- .0455	15	.608	.0016
16	.885	-.0881	16	.805	- .0557	16	.691	.0129
17	.941	-.0927	17	.853	- .0532	17	.735	-.0071
18	1.002	-.0994	18	.902	- .0711	18	.784	-.0152
19	1.071	-.1044	19	.958	- .0777	19	.872	-.0149
20	1.103	-.1175	20	1.020	- .0807	20	.892	-.0109
21	1.159	-.1215	21	1.075	- .0937	21	.967	-.0362
22	1.223	-.1248	22	1.146	- .0844	22	1.016	-.0339
23	1.283	-.1256	23	1.184	- .0862	23	1.051	-.0454
24	1.337	-.1283	24	1.236	- .1062	24	1.082	-.0528
25	1.371	-.1436	25	1.293	- .1163	25	1.150	-.0657
26	1.413	-.1502	26	1.310	- .1150	26	1.196	-.0713
27	1.467	-.1465	27	1.386	- .1192	27	1.225	-.0773
28	1.479	-.1578	28	1.386	- .1255	28	1.245	-.0872
29	1.534	-.1599	29	1.459	- .1118	29	1.304	-.0830
30	1.568	-.1654	30	1.460	- .1387	30	1.313	-.0903
31	1.578	-.1752	31	1.520	- .1414	31	1.375	-.1037
32	1.567	-.1920	32	1.506	- .1545	32	1.402	-.1160
33	1.607	-.1812	33	1.532	- .1669	33	1.400	-.1386
34	1.607	-.2022	34	1.557	- .1716	34	1.438	-.1325
35	1.642	-.1808	35	1.588	- .1720	35	1.473	-.1213

[1] These values also apply for the body plus wing aft to an angle of attack of 31°.

TABLE VI.- CONCLUDED

$\delta_f = -25^\circ$			$\delta_f = 25^\circ$			$\delta_f = 45^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0	-0.263	0.1500	0	0.349	-0.1361	0	0.498	-0.2018
1	-.245	.1365	1	.390	-.1442	1	.538	-.2047
2	-.196	.1234	2	.442	-.1438	2	.596	-.2083
3	-.147	.1218	3	.488	-.1590	3	.630	-.2114
4	-.104	.1095	4	.553	-.1680	4	.688	-.2271
6	-.004	.1012	6	.676	-.1676	6	.797	-.2242
8	.115	.0760	8	.777	-.1907	8	.895	-.2353
10	.229	.0658	10	.881	-.1986	10	.922	-.1992
11	.292	.0648	11	.886	-.1855	11	.926	-.2215
12	.372	.0702	12	.931	-.1827	12	.965	-.2205
13	.407	.0601	13	.980	-.1727	13	1.018	-.2224
14	.469	.0634	14	1.031	-.1916	14	1.066	-.2254
15	.512	.0507	15	1.073	-.1962	15	1.106	-.2254
16	.572	.0373	16	1.139	-.2016	16	1.141	-.2180
17	.621	.0326	17	1.167	-.2036	17	1.205	-.2268
18	.688	.0299	18	1.208	-.2175	18	1.236	-.2270
19	.742	.0235	19	1.219	-.2133	19	1.269	-.2311
20	.786	.0160	20	1.330	-.2278	20	1.298	-.2234
21	.873	.0002	21	1.350	-.2310	21	1.323	-.2384
22	.903	-.0013	22	1.369	-.2426	22	1.361	-.2384
23	.945	-.0061	23	1.416	-.2356	23	1.407	-.2355
24	1.002	-.0068	24	1.458	-.2375	24	1.428	-.2371
25	1.058	-.0198	25	1.483	-.2498	25	1.448	-.2503
26	1.090	-.0304	26	1.542	-.2331	26	1.474	-.2426
27	1.092	-.0554	27	1.563	-.2450	27	1.495	-.2479
28	1.169	-.0516	28	1.610	-.2340	28	1.507	-.2515
29	1.209	-.0577	29	1.612	-.2495	29	1.539	-.2558
30	1.210	-.0653	30	1.634	-.2612	30	1.524	-.2690
31	1.251	-.0808	31	1.657	-.2485	31	1.516	-.2741
32	1.303	-.0754	32	1.642	-.2611	32	1.516	-.2600
33	1.314	-.0947	33	1.627	-.2581	33	1.494	-.2650
34	1.349	-.1039	34	1.650	-.2520	34	1.450	-.2870
35	1.335	-.1223	35	1.611	-.2690	35	1.467	-.2900

TABLE VII.- EFFECT OF FLAP DEFLECTION ON THE CHARACTERISTICS OF THE WING IN THE PRESENCE OF THE GROUND (h/b = 1.0)

$\delta_f = 0^\circ$			$\delta_f = -5^\circ$			$\delta_f = -15^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0.47	0.010	-0.0050	0.47	-0.088	0.0344	0.47	-0.204	0.0832
1.47	.061	-.0052	1.47	-.027	.0340	1.47	-.159	.0812
2.47	.097	-.0137	2.47	.005	.0291	2.47	-.104	.0792
3.47	.148	-.0179	3.47	.051	.0230	3.47	-.068	.0780
4.47	.202	-.0193	4.47	.099	.0120	4.47	-.022	.0689
6.47	.286	-.0374	6.47	.206	-.0051	6.47	.070	.0532
8.47	.417	-.0424	8.47	.309	-.0152	8.47	.140	.0258
10.47	.504	-.0612	10.47	.418	-.0213	10.47	.294	.0268
11.47	.575	-.0614	11.47	.471	-.0222	11.47	.349	.0262
12.47	.634	-.0603	12.47	.528	-.0314	12.47	.394	.0191
13.47	.689	-.0687	13.47	.582	-.0353	13.47	.449	.0188
14.47	.733	-.0806	14.47	.641	-.0310	14.47	.499	.0265
15.47	.787	-.0710	15.47	.681	-.0338	15.47	.543	.0192
16.47	.833	-.0674	16.47	.722	-.0466	16.47	.603	.0131
17.47	.880	-.0695	17.47	.781	-.0479	17.47	.654	.0114
18.47	.914	-.0691	18.47	.833	-.0408	18.47	.708	.0131
19.47	.988	-.0779	19.47	.885	-.0540	19.47	.756	-.0059
20.47	1.047	-.0877	20.47	.951	-.0523	20.47	.821	-.0042
21.47	1.085	-.0873	21.47	1.011	-.0594	21.47	.877	-.0039
22.47	1.157	-.1052	22.47	1.067	-.0715	22.47	.913	-.0171
23.47	1.201	-.0921	23.47	1.103	-.0742	23.47	.969	-.0304
24.47	1.249	-.1070	24.47	1.167	-.0694	24.47	1.054	-.0140
25.47	1.293	-.1105	25.47	1.212	-.0779	25.47	1.065	-.0424
26.47	1.314	-.1218	26.47	1.227	-.0907	26.47	1.096	-.0439
27.47	1.372	-.1164	27.47	1.265	-.0894	27.47	1.148	-.0501
28.47	1.391	-.1288	28.47	1.325	-.0939	28.47	1.160	-.0498
29.47	1.440	-.1182	29.47	1.341	-.1166	29.47	1.214	-.0535
30.47	1.461	-.1261	30.47	1.402	-.0968	30.47	1.233	-.0690
31.47	1.501	-.1413	31.47	1.418	-.1280	31.47	1.265	-.0738
32.47	1.513	-.1380	32.47	1.432	-.1158	32.47	1.307	-.0968
33.47	1.514	-.1398	33.47	1.447	-.1324	33.47	1.302	-.0916
34.47	1.496	-.1531	34.47	1.440	-.1174	34.47	1.300	-.0944
35.47	1.557	-.1820	35.47	1.464	-.1289	35.47	1.330	-.0758

TABLE VII.- CONCLUDED.

$\delta_f = -25^\circ$			$\delta_f = 25^\circ$			$\delta_f = 45^\circ$		
α	C_L	C_m	α	C_L	C_m	α	C_L	C_m
0.47	-0.323	0.1317	0.47	0.331	-0.1287	0.47	0.442	-0.1986
1.47	-.283	.1227	1.47	.351	-.1420	1.47	.495	-.2057
2.47	-.226	.1194	2.47	.409	-.1495	2.47	.533	-.2119
3.47	-.172	.1165	3.47	.438	-.1542	3.47	.586	-.2165
4.47	-.141	.1136	4.47	.493	-.1678	4.47	.634	-.2175
6.47	-.027	.1039	6.47	.635	-.1678	6.47	.730	-.2267
8.47	.076	.0817	8.47	.711	-.1832	8.47	.818	-.2262
10.47	.186	.0698	10.47	.823	-.1933	10.47	.896	-.2154
11.47	.235	.0680	11.47	.878	-.1819	11.47	.884	-.2090
12.47	.291	.0571	12.47	.883	-.1724	12.47	.913	-.2079
13.47	.332	.0590	13.47	.923	-.1701	13.47	.982	-.2014
14.47	.382	.0556	14.47	.946	-.1732	14.47	1.021	-.2007
15.47	.440	.0428	15.47	.999	-.1872	15.47	1.055	-.1942
16.47	.476	.0408	16.47	1.068	-.1843	16.47	1.109	-.2133
17.47	.534	.0400	17.47	1.116	-.1965	17.47	1.128	-.1978
18.47	.589	.0390	18.47	1.148	-.1917	18.47	1.156	-.2038
19.47	.645	.0315	19.47	1.187	-.1976	19.47	1.186	-.2146
20.47	.723	.0368	20.47	1.234	-.1958	20.47	1.221	-.2028
21.47	.764	.0141	21.47	1.291	-.1972	21.47	1.263	-.1927
22.47	.818	.0248	22.47	1.295	-.1895	22.47	1.276	-.2109
23.47	.852	.0084	23.47	1.344	-.1997	23.47	1.304	-.1923
24.47	.897	.0019	24.47	1.389	-.2065	24.47	1.330	-.1846
25.47	.942	.0087	25.47	1.402	-.2021	25.47	1.379	-.1929
26.47	.981	-.0152	26.47	1.430	-.2043	26.47	1.374	-.2146
27.47	1.023	-.0192	27.47	1.438	-.2240	27.47	1.386	-.1977
28.47	1.070	-.0229	28.47	1.434	-.2251	28.47	1.400	-.2073
29.47	1.097	-.0343	29.47	1.489	-.2229	29.47	1.398	-.2110
30.47	1.130	-.0296	30.47	1.496	-.2268	30.47	1.402	-.2001
31.47	1.148	-.0345	31.47	1.486	-.2164	31.47	1.398	-.2051
32.47	1.173	-.0498	32.47	1.481	-.2157	32.47	1.412	-.2004
33.47	1.200	-.0468	33.47	1.452	-.2351	33.47	1.382	-.1995
34.47	1.208	-.0772	34.47	1.415	-.2638	34.47	1.435	-.2208
35.47	1.210	-.1001	35.47	1.422	-.2530	35.47	1.320	-.2159

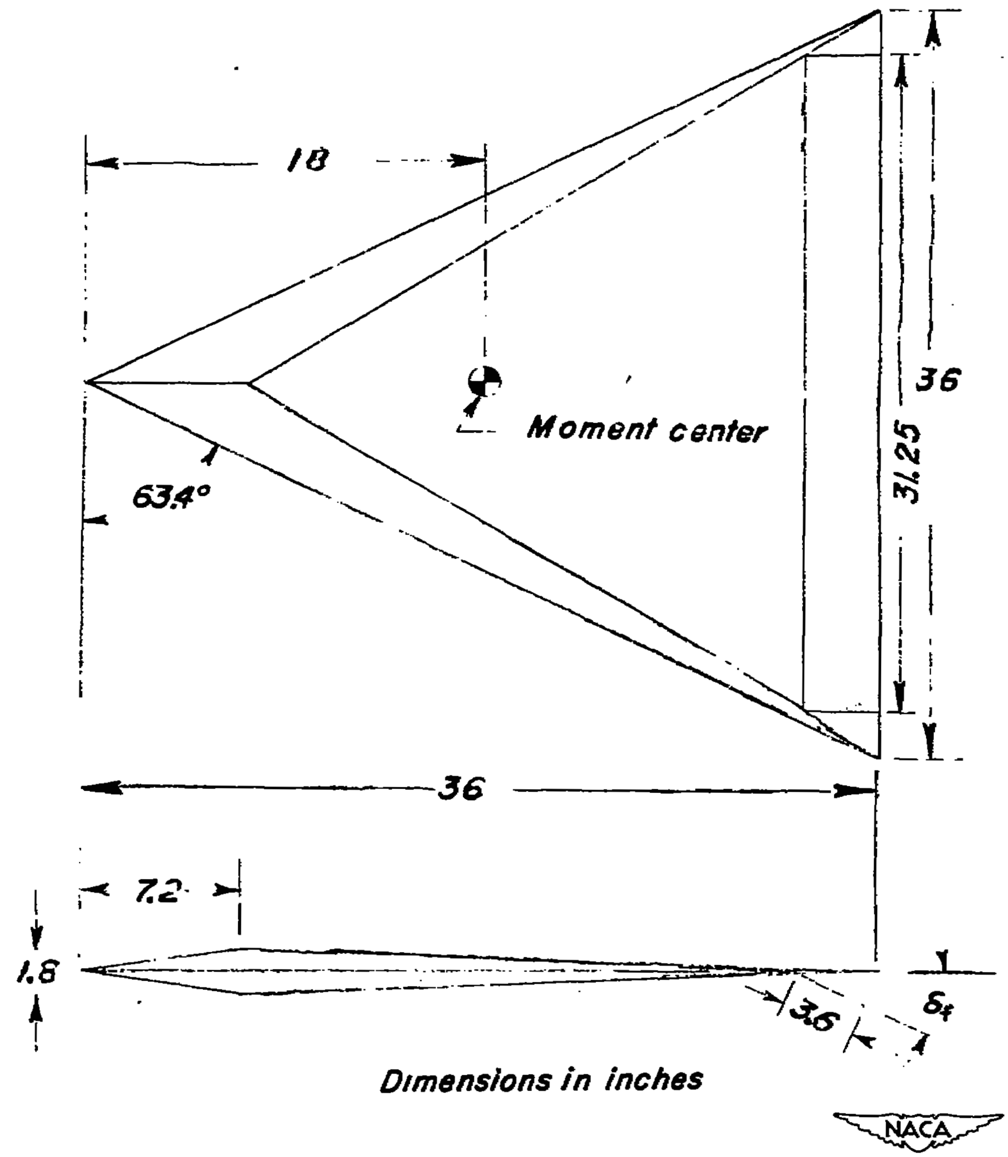


Figure 1.– The triangular wing with constant-chord, trailing-edge, split flap.

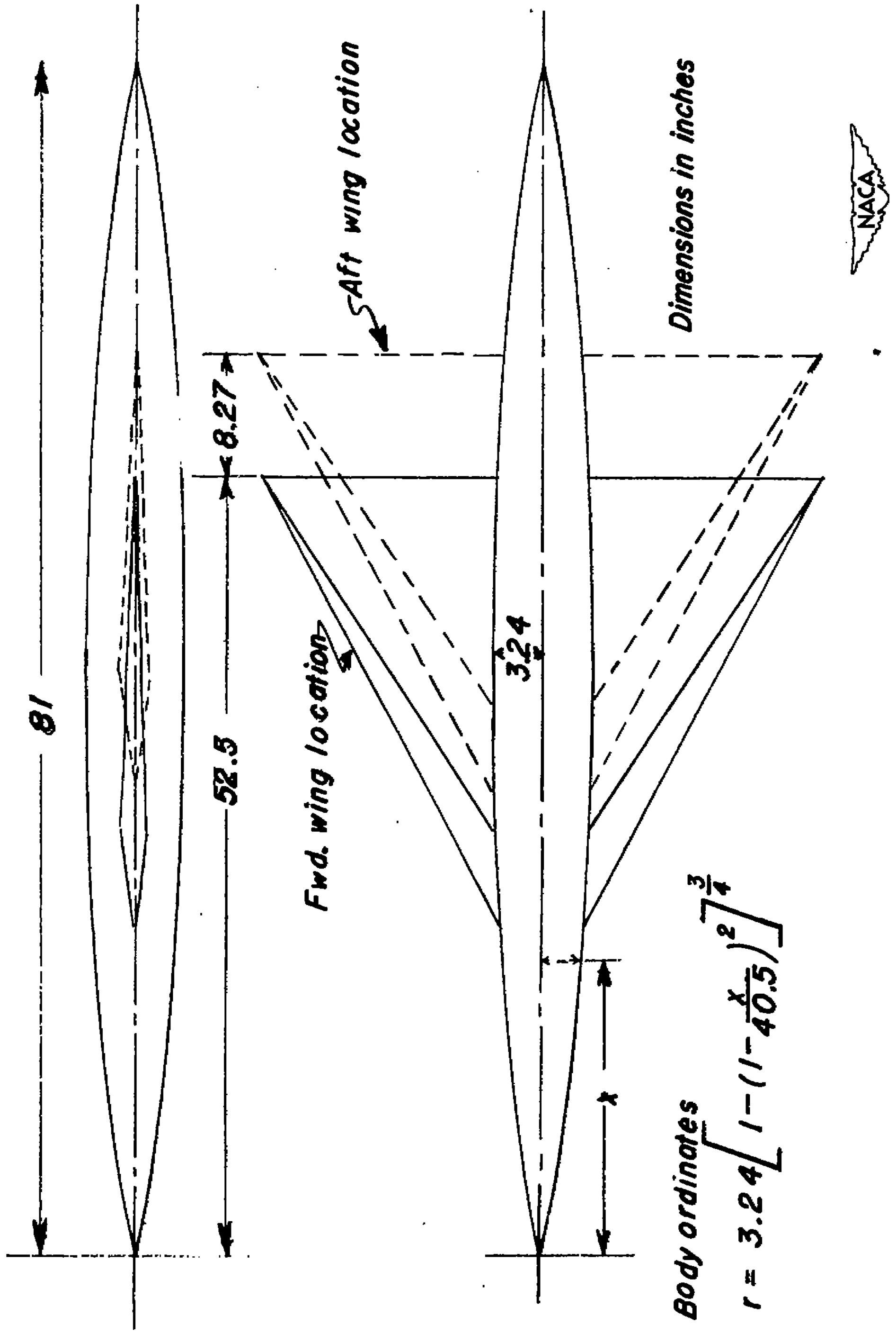
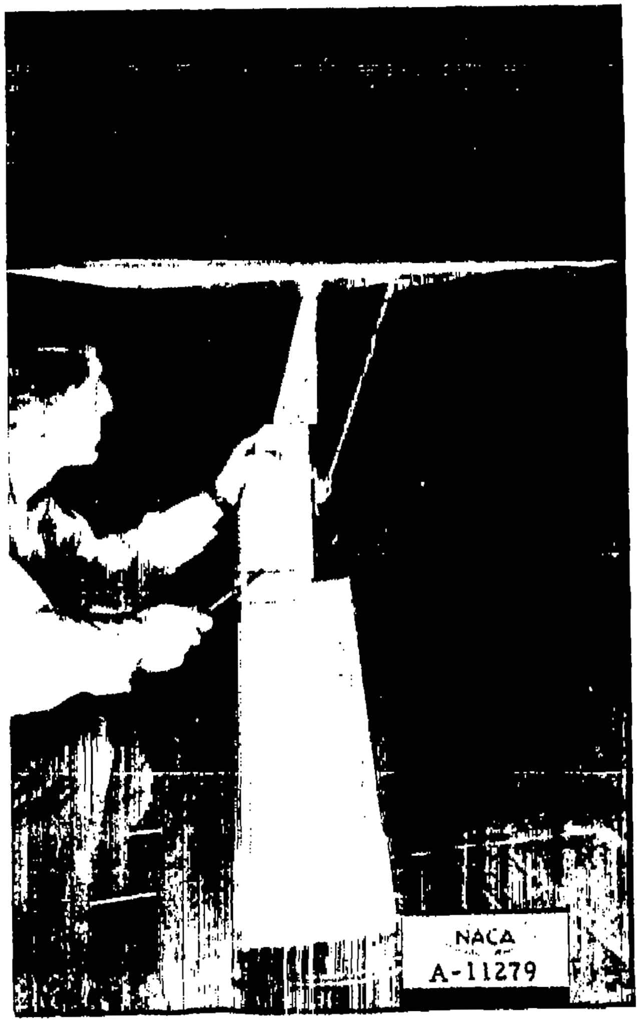
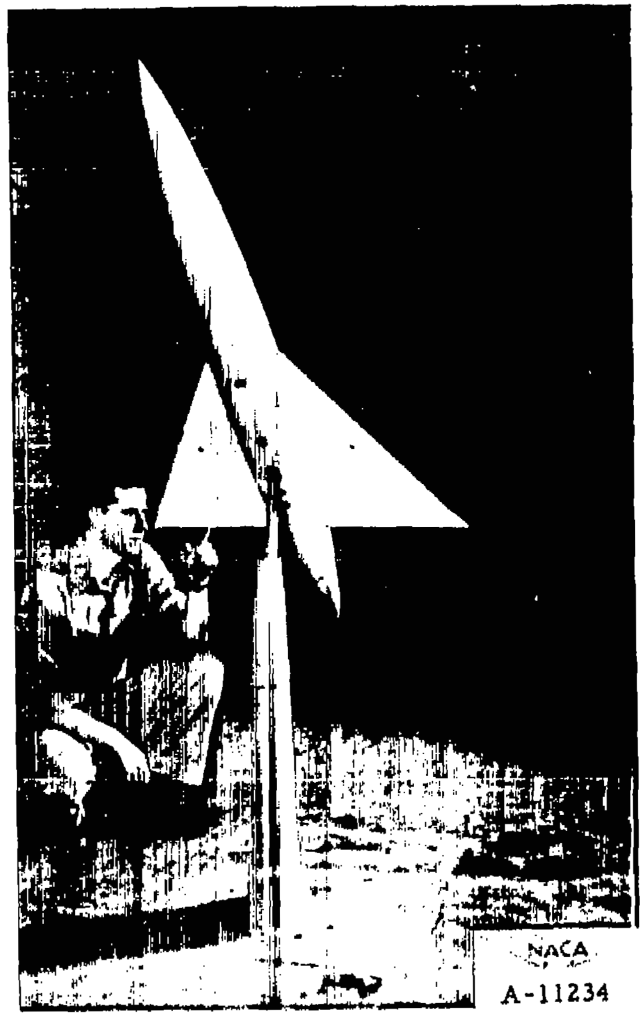


Figure 2.– The body of fineness ratio 12.5 with the two wing locations.



(a) Wing with split flaps.



(b) Wing in aft position on body.

Figure 3.- The strut support used in the model tests.

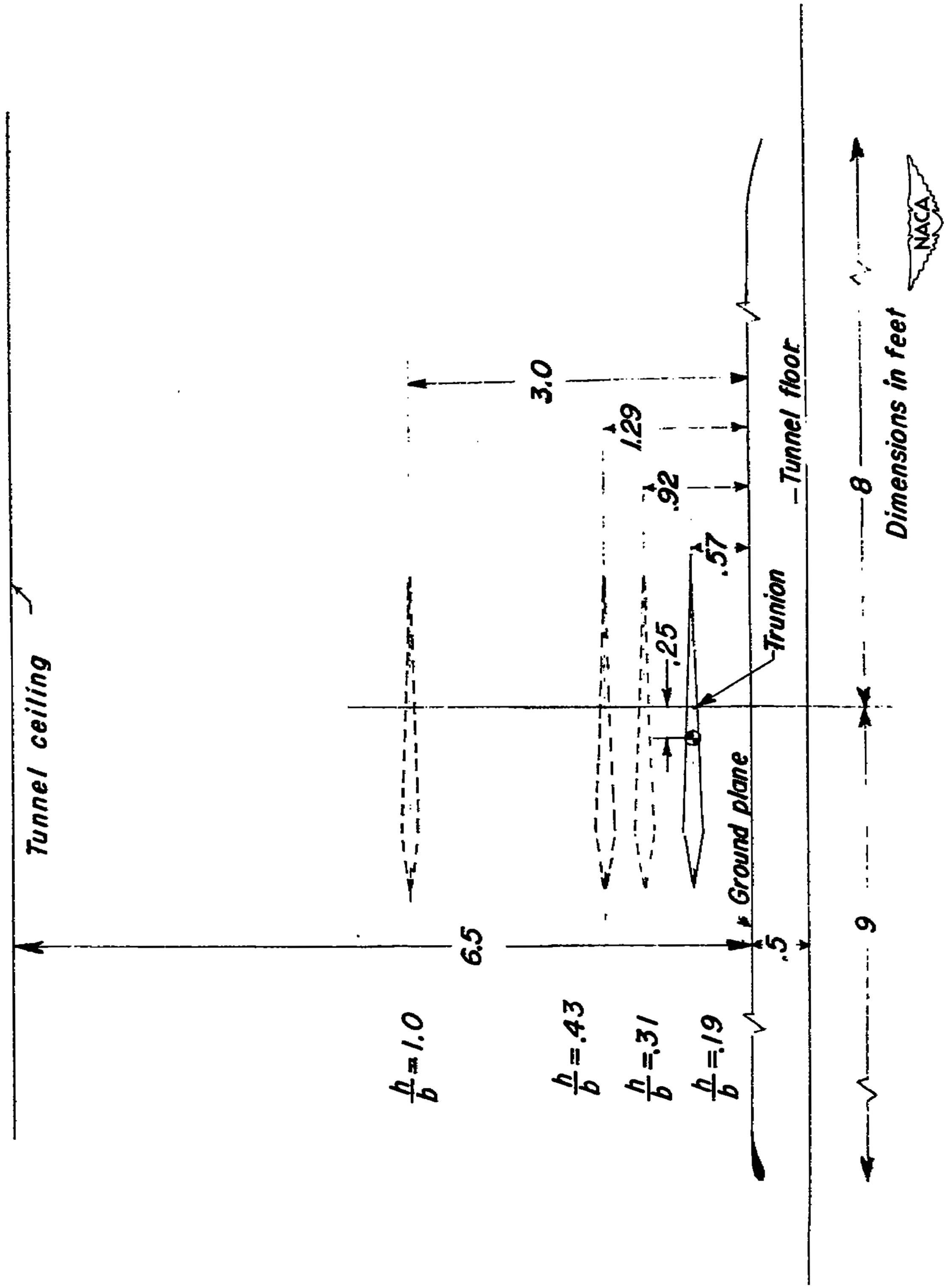
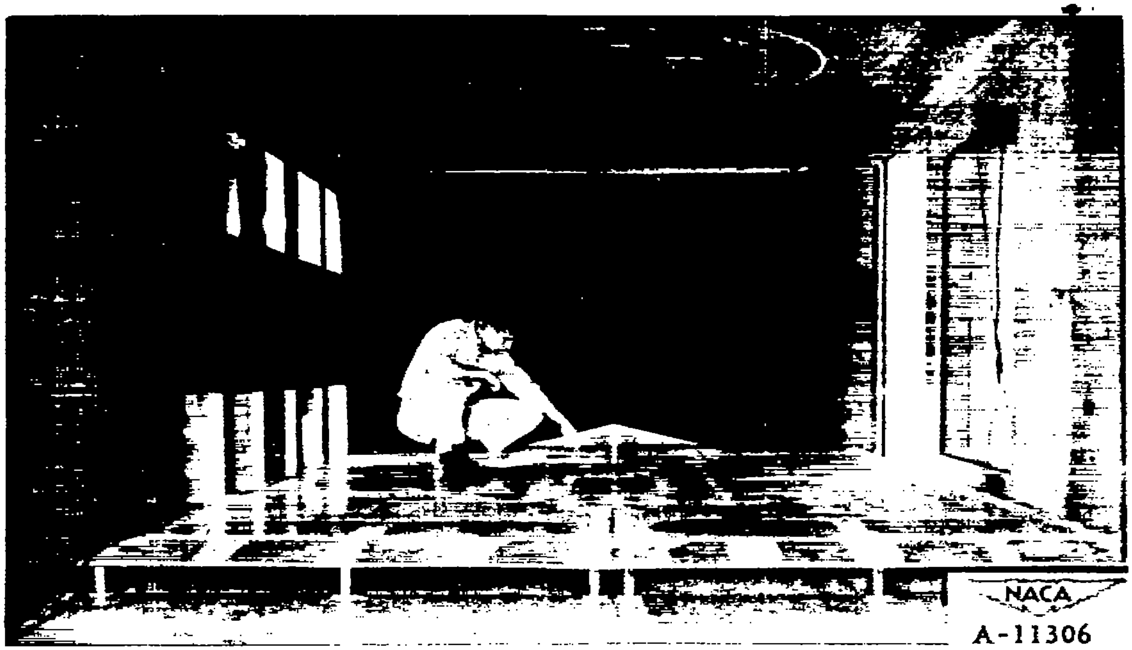
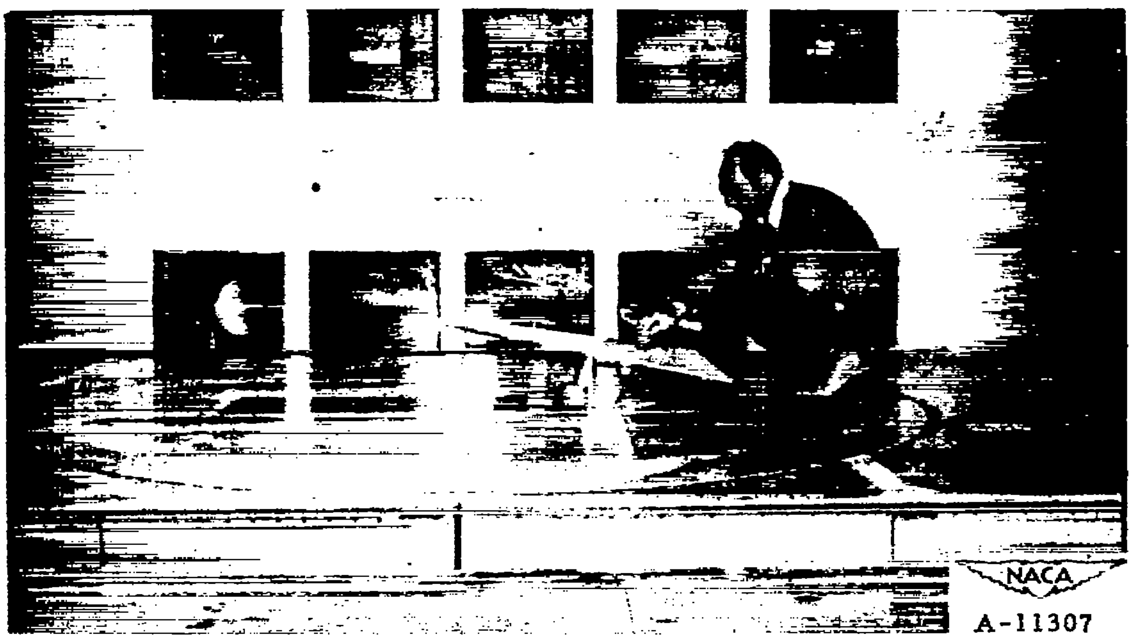


Figure 4.- Relative location of wing and ground plane



(a) Front view.



(b) Side view.

Figure 5.– Model installation for ground–plane tests.

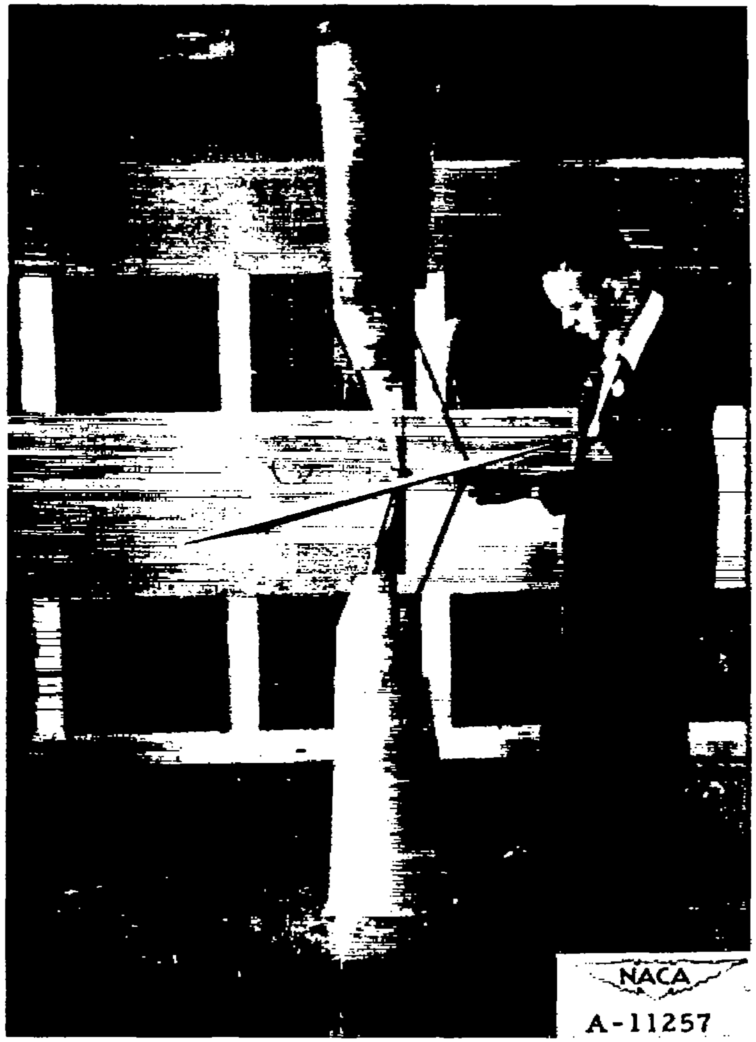


Figure 6.– The image-strut system used to evaluate strut tares.

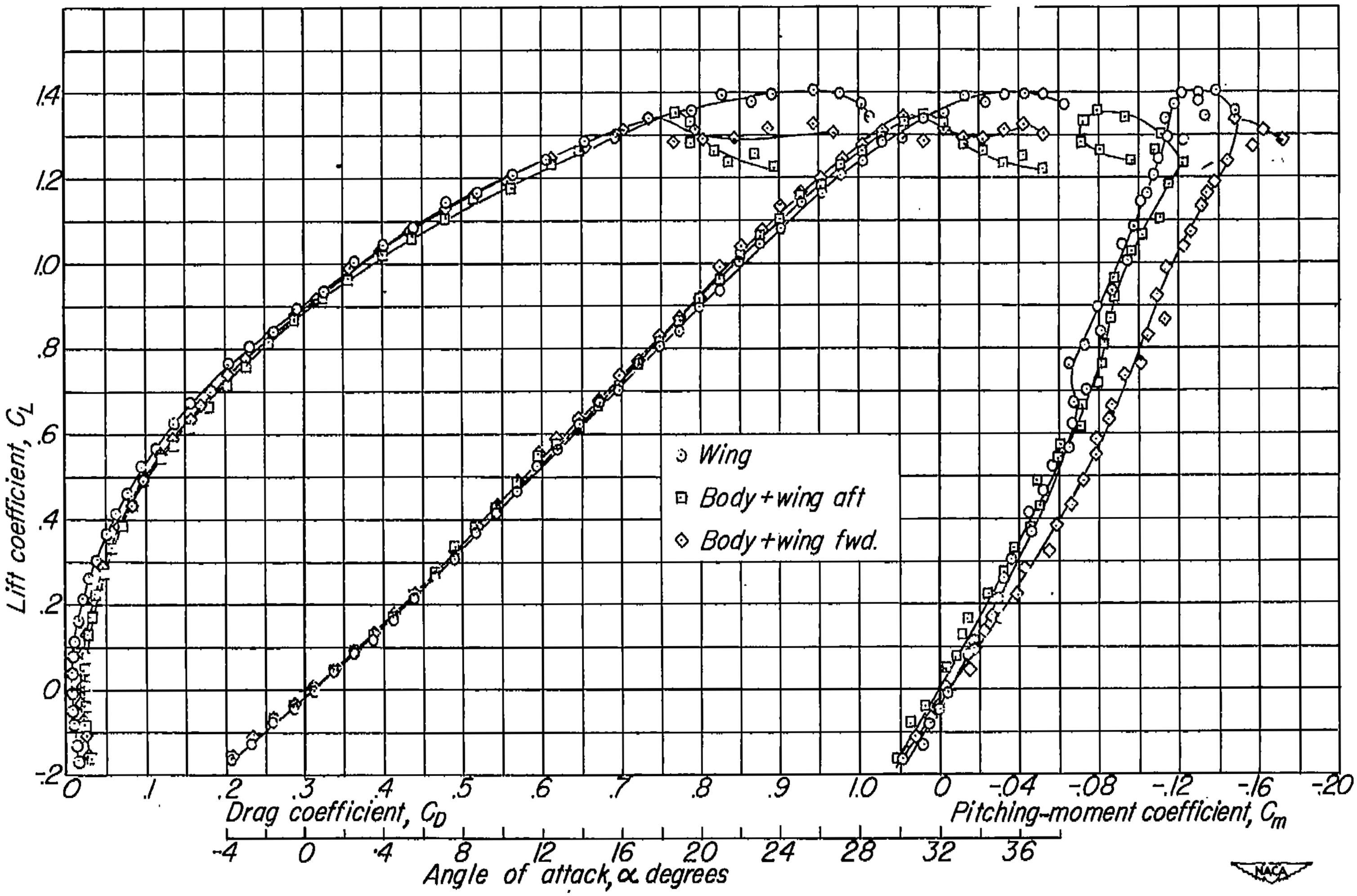


Figure 7.– Lift, drag and pitching-moment coefficients for wing and wing-body combinations.

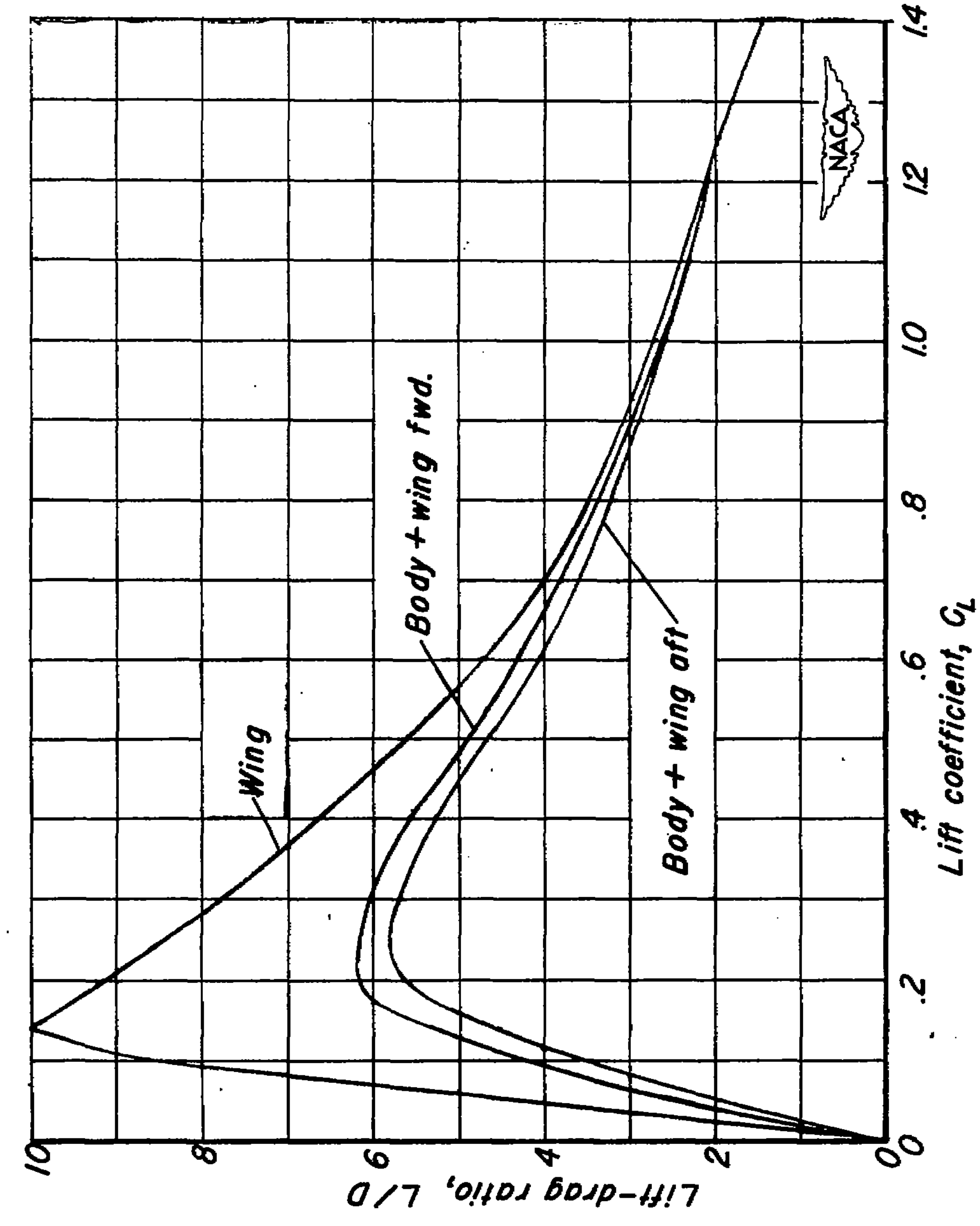


Figure 8.- The variation of lift-drag ratio with lift coefficient for the wing alone and in combination with the body.

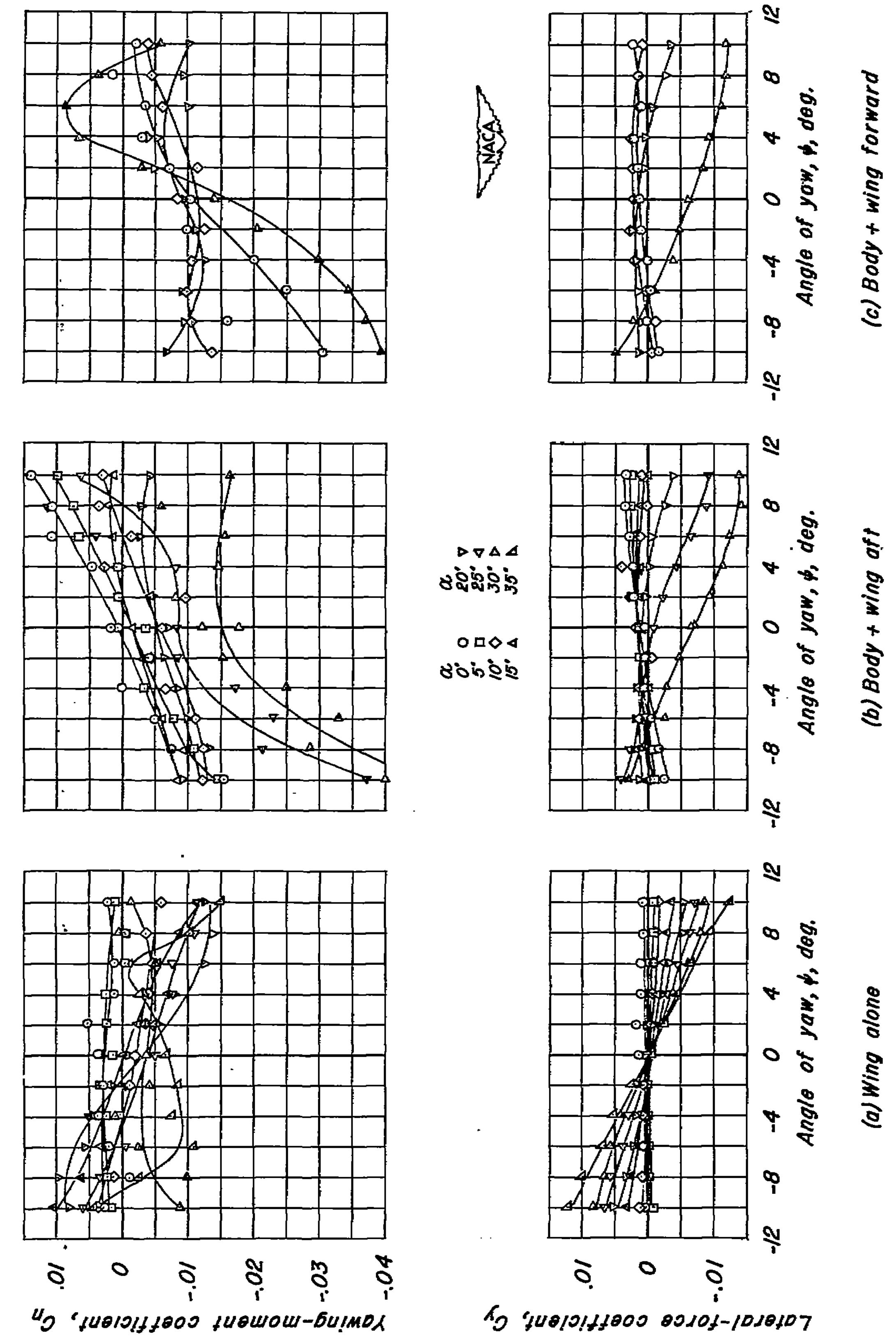
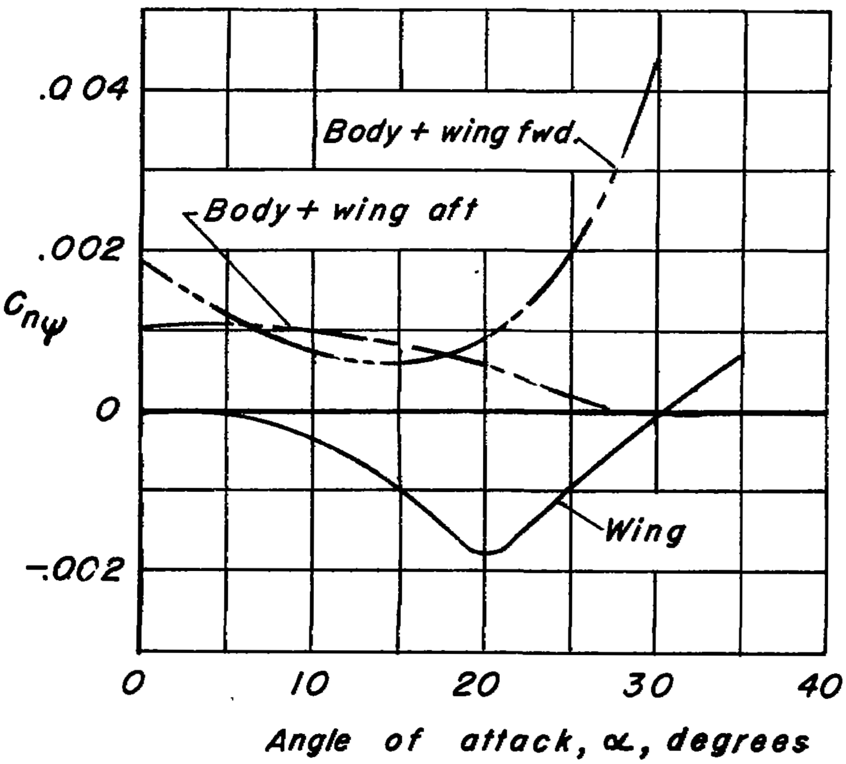


Figure 9.- The effect of angle of attack on the lateral characteristics of the model



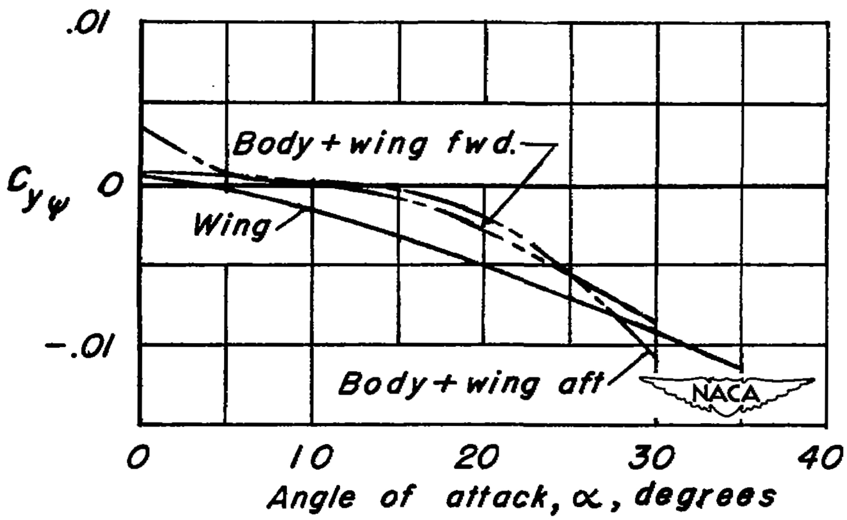


Figure 10.– The variation of the parameters C_{n_ψ} and C_{y_ψ} with angle of attack.

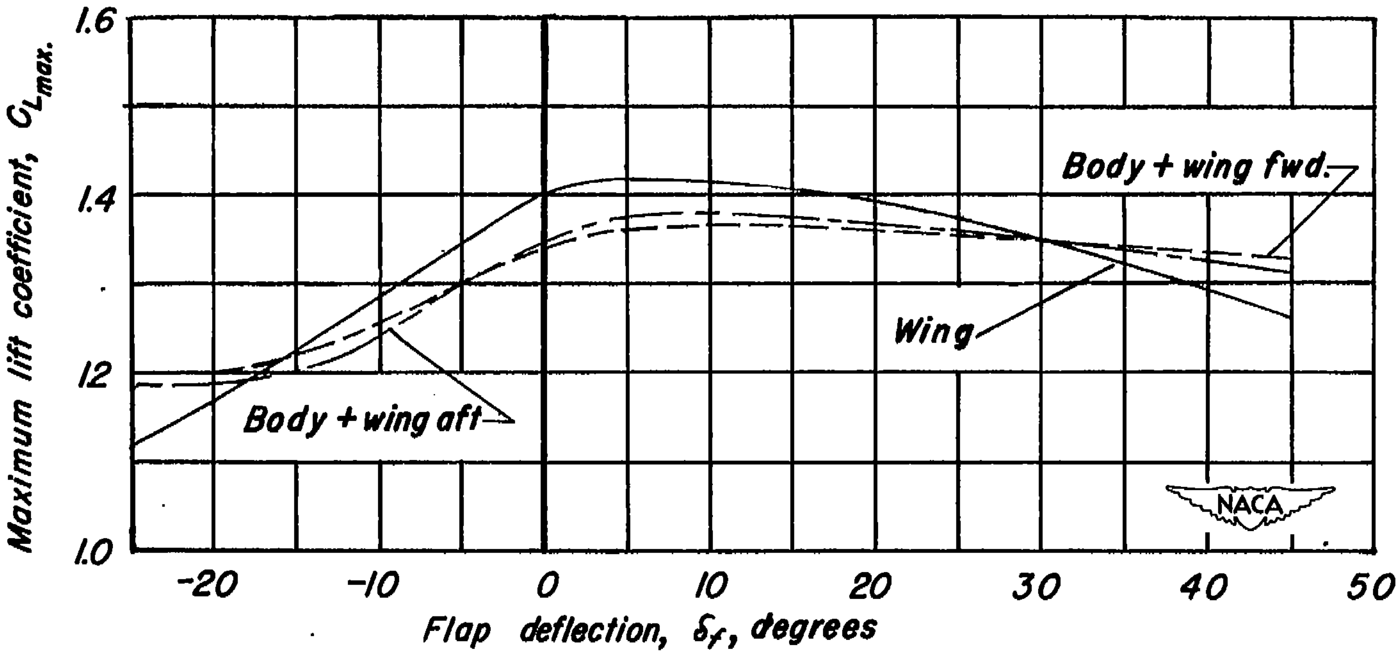


Figure 11 – The effect of flap deflection on the maximum lift coefficient of the model.

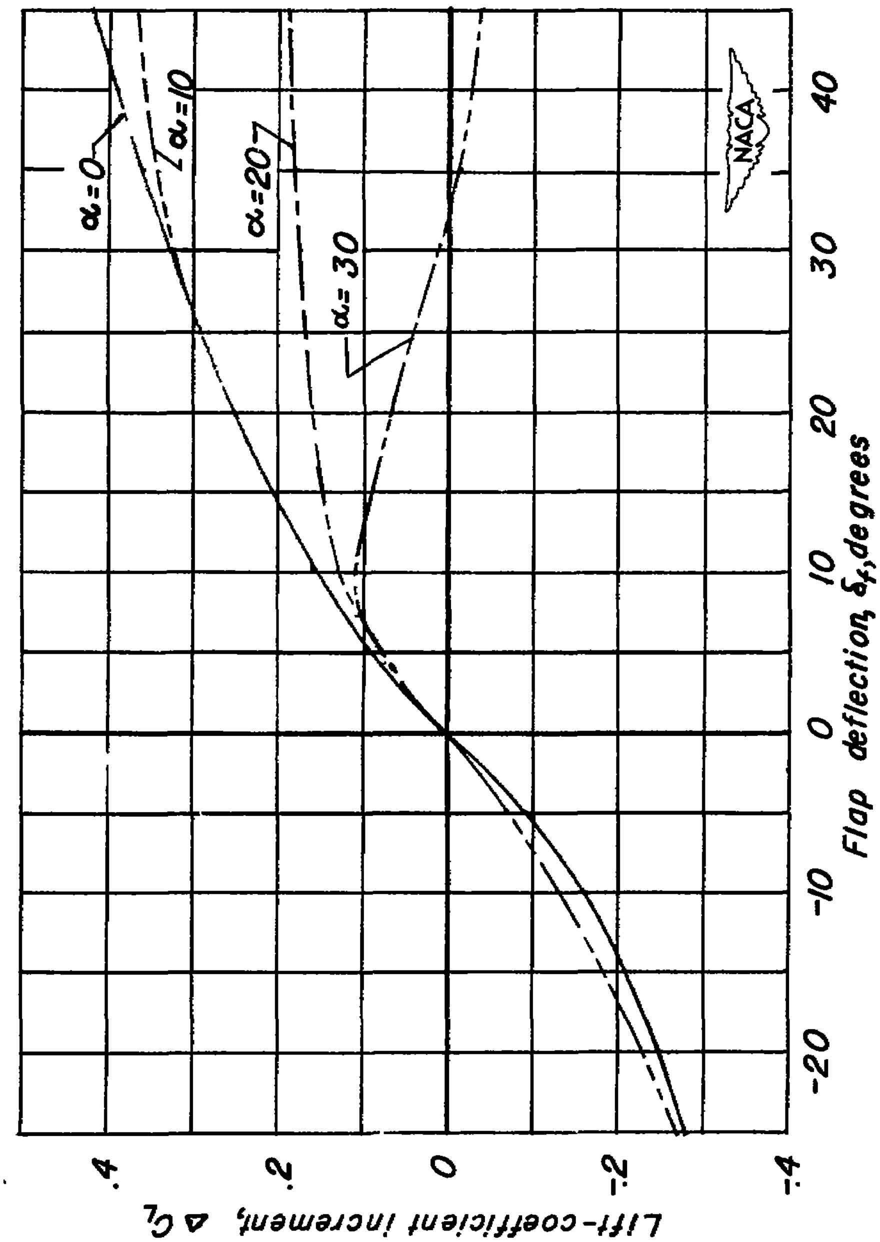


Figure 12.- The effect of flap deflection on the lift coefficient of the wing.

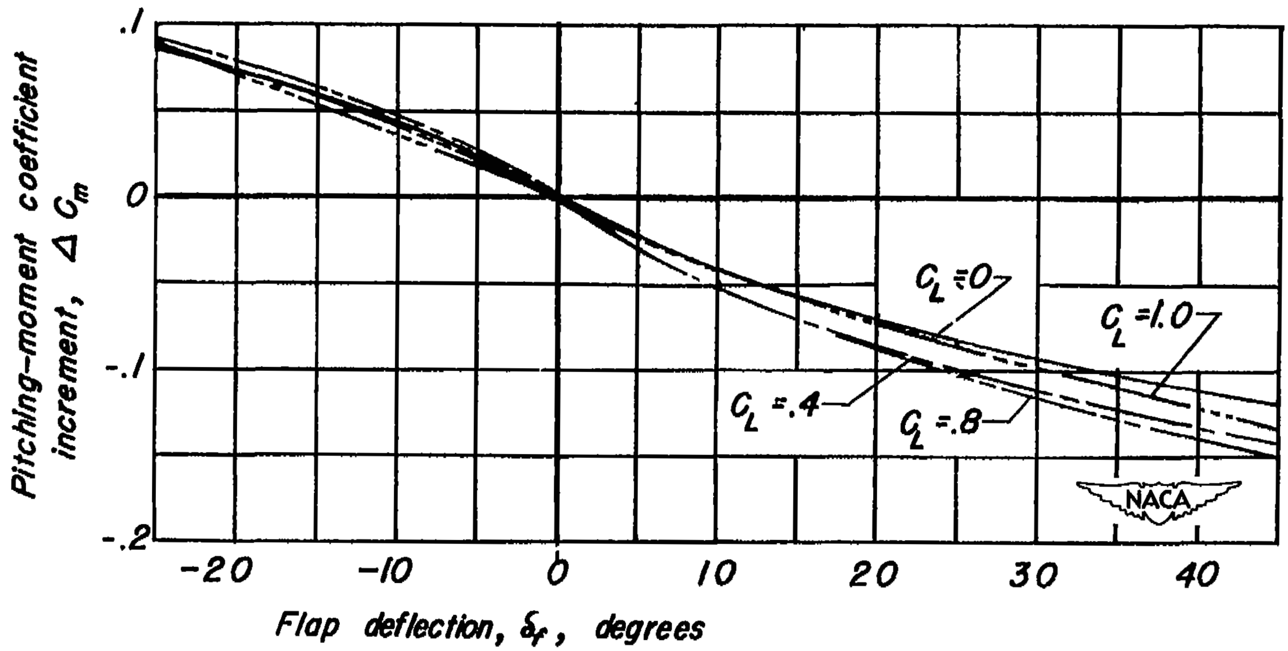


Figure 13.– The effect of flap deflection on the pitching-moment coefficient of the wing.

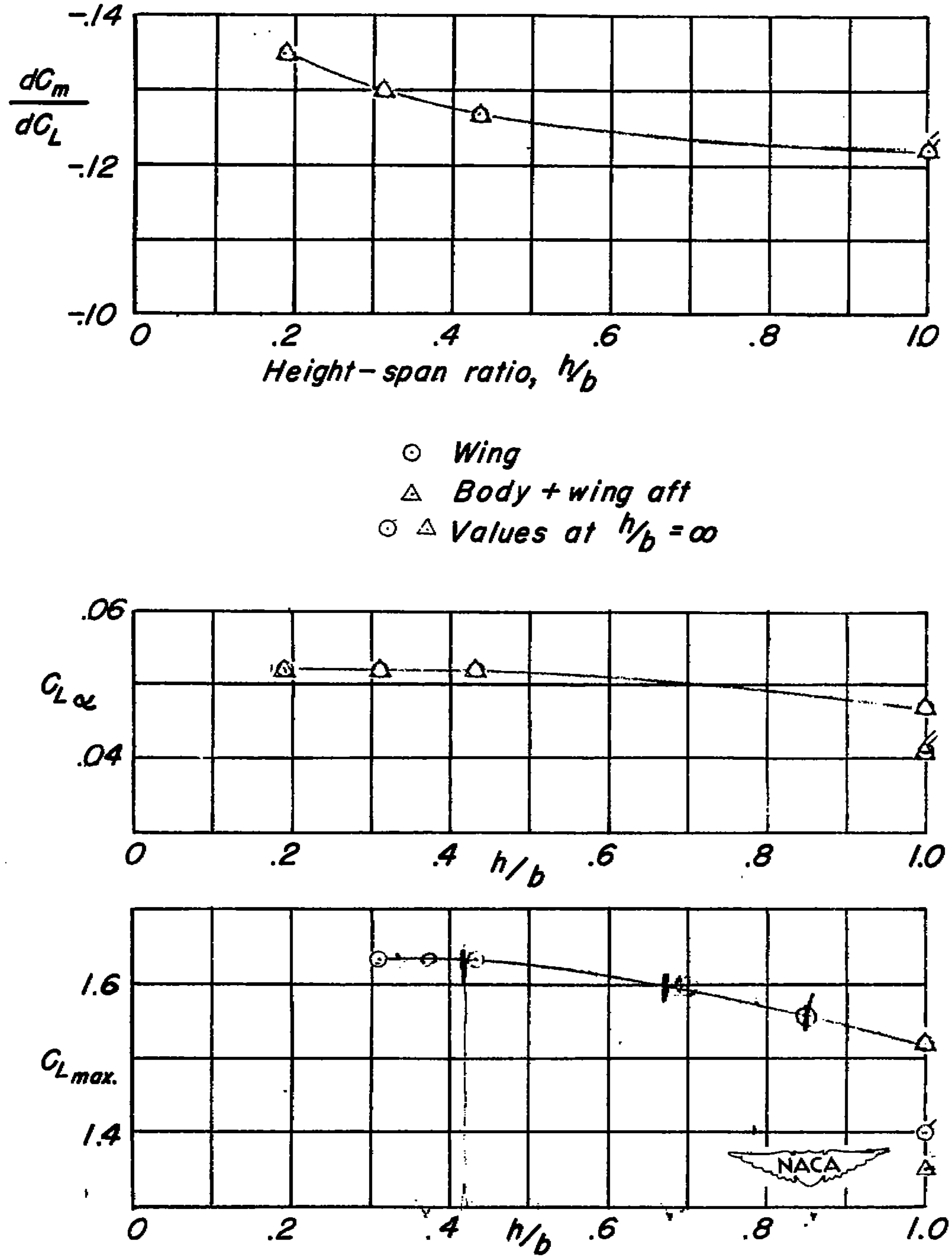


Figure 14.- The effect of height above the ground plane on the longitudinal characteristics of the model.

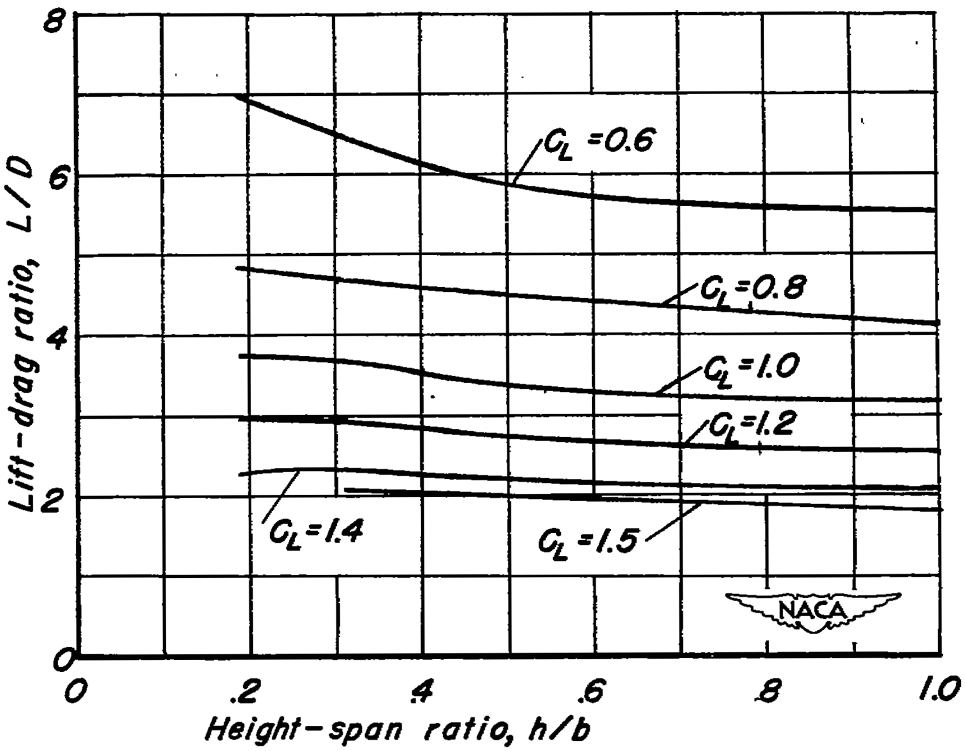


Figure 15.– The effect of height above the ground plane on the lift-drag ratio of the wing.