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RESEARCH MEMORANDUM

STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - LONGITUDINAL CHARACTERISTICS OF A TRIANGULAR WING AND CANARD

By John W. Boyd and Victor L. Peterson

Ames Aeronautical Laboratory
Moffett Field, Calif.

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NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS
WASHINGTON
January 22, 1958

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RESEARCH MEMORANDUM

STATIC STABILITY AND CONTROL OF CANARD CONFIGURATIONS AT MACH NUMBERS FROM 0.70 TO 2.22 - LONGITUDINAL CHARACTERISTICS OF A TRIANGULAR WING AND CANARD

By John W. Boyd and Victor L. Peterson

SUMMARY

Results of an investigation of the static longitudinal stability and control characteristics of a canard airplane configuration are presented without analysis for the Mach number range of 0.70 to 2.22. The configuration consisted of a triangular wing and triangular canard, both of aspect ratio 2.0, a low-aspect-ratio vertical tail, and a fineness ratio 12.5 Sears-Haack body. The hinge line of the canard was in the extended wing chord plane, 1.21 wing mean aerodynamic chords ahead of the reference center of moments. The ratio of the area of the exposed canard panels to the total area of the wing was 6.9 percent. Data are presented at angles of attack ranging from -6° to $+18^{\circ}$ for the canard set at angles from -5° to $+30^{\circ}$ with the wing both on and off. Data are also presented for the same angle-of-attack range with the canard off and the wing on and off.

INTRODUCTION

The trend of modern aircraft to fly larger portions of their missions at supersonic speeds is making it increasingly important to devise configurations which are efficient at these speeds. While the conventional tail aft and trailing-edge flap controls are usually satisfactory at subsonic speeds, their inherently short lever arms coupled with their large reductions in total lift and their high drag at trim conditions severely restrict maneuverability at supersonic speeds. The canard arrangement appears to offer a means of alleviating some of the problems associated with tail aft and trailing-edge flap controls at supersonic speeds. High fineness ratio bodies required for supersonic flight make possible large tail volumes with canard controls, a factor which aids in reducing the deflection necessary for trim and the associated trim drag. Further, in contrast to trailing-edge flaps, when a

canard surface is deflected for trim the net lift is not reduced below that of the wing-body combination. In addition to the aforementioned advantages of the canard in providing attitude control, the possibility also exists that the canard can be used for controlling the aerodynamic center movement.

Previous studies have shown that the canard arrangement has some deficiencies, particularly at low speeds. As pointed out in reference 1, these include the inability of the canard to provide trim at the maximum lift required for take-off and the adverse effect of the canard on the directional stability characteristics at high lift coefficients. However, considering the possible gains to be realized from the canard arrangement at supersonic speeds, further studies of these arrangements are warranted. Therefore, an extensive research program aimed at determining the static longitudinal and directional characteristics of several canard configurations has been undertaken by the NACA. To expedite publication, results from each of various parts of the Ames Laboratory program are being reported separately without analysis. This report presents the stability and control data for one complete configuration and its component parts. The configuration consisted of a triangular wing and triangular canard, both of aspect ratio 2.0, a Sears-Haack body of fineness ratio 12.5, and a low-aspect-ratio vertical tail.

NOTATION

$\bar{c}$ mean aerodynamic chord of wing, ft

$\bar{c}_c$ mean aerodynamic chord of canard, ft

c_c canard root chord, ft

C_D drag coefficient, $\frac{\text{drag}}{qS}$

C_{D_o} drag coefficient at zero lift

C_L lift coefficient, $\frac{\text{lift}}{qS}$

C_{L_α} lift-curve slope, taken through zero angle of attack, per deg

C_m pitching-moment coefficient, $\frac{\text{pitching moment}}{qS\bar{c}}$, referred to projection of the $0.21\bar{c}$ point on the fuselage reference line

C_{h_c} canard hinge-moment coefficient, $\frac{\text{canard hinge moment}}{qS_c(c_c/2)}$, referred to projection of $0.35\bar{c}_c$ point on the fuselage reference line

C_{z_c} force coefficient normal to canard, $\frac{\text{canard normal force}}{qS}$

$\left(\frac{L}{D}\right)_{max}$ maximum lift-drag ratio

M free-stream Mach number

q free-stream dynamic pressure, lb/sq ft

S wing area formed by extending the leading and trailing edges to the plane of symmetry, sq ft

S_c exposed canard area, sq ft

α angle of attack of wing root chord, deg

δ angle of deflection of the canard with respect to the extended wing chord plane, positive when trailing edge is down, deg

Configurations are denoted by the following letters used in combination:

B body

C canard

V vertical tail

W wing

APPARATUS AND MODEL

Test Facility

The experimental data were obtained in the Ames 6- by 6-foot supersonic wind tunnel which is a closed-circuit variable-pressure type with a Mach number range continuous from 0.70 to 2.22. A recent modification involved perforating the test section floor and ceiling and adding a boundary-layer removal system to enable uniform flow to be maintained at transonic and low supersonic speeds. At the same time injector flaps were installed downstream of the test section to extend the upper Mach number limit by reducing the required compression ratio across the nozzle and by better matching the weight flow characteristics of the nozzle with those of the compressor.

Analysis of the results of an extensive survey of the modified wind-tunnel characteristics, although incomplete, is sufficiently complete to establish the validity of the results of the present investigation.

Description of Model and Balances

The sting-mounted model (fig. 1(a)) consisted of an aspect ratio 2.0 triangular wing, an aspect ratio 2.0 all-movable triangular canard, and a low-aspect-ratio vertical tail all mounted on a fineness ratio 12.5 Sears-Haack body. A dimensional sketch of the configuration is shown in figure 1(b). The wing and vertical tail had NACA 0003-63 sections streamwise and the constant thickness canard, detailed in figure 1(c), had beveled leading and trailing edges. The canard which was pivoted about the 0.35 canard mean aerodynamic chord was mounted in the extended wing chord plane 1.21 wing mean aerodynamic chords ahead of the reference center of moments ($0.21\bar{c}$). The ratio of the area of the exposed canard panels to the total area of the wing was 6.9 percent and the ratio of the total areas was 12.9 percent. The wing, canard, and vertical tail were of solid steel construction to minimize aeroelastic effects. The surfaces were polished to give a smooth surface and further treated to prevent corrosion.

The fuselage was cut off as shown in figure 1(b) to accommodate the sting and the six-component strain-gage balance which measured forces and moments on the entire configuration. Canard normal forces and hinge moments were obtained from a two-component strain-gage balance mounted in the nose of the fuselage. The canard, wing, and vertical tail were removable, enabling data to be taken which would permit an evaluation of the contributions of each of the component parts of the model and the interference between parts.

TEST AND PROCEDURES

Range of Test Variables

Mach numbers of 0.70, 0.90, 0.95, 1.00, 1.05, 1.10, 1.30, 1.50, 1.70, 1.90, and 2.22 and angles of attack ranging from -6° to $+18^{\circ}$ were covered in the investigation. Data were obtained with the canard set at angles from -5° to $+30^{\circ}$ with the wing on and with the wing off. The exact canard deflection angles are noted in tables I and II. Data were also obtained with the canard off for the wing on and off. The test Reynolds number based on the wing mean aerodynamic chord was 1.84 million at Mach numbers of 0.95, 1.00, 1.05, and 1.10 and 3.68 million at all other Mach numbers. The smaller Reynolds number at transonic speeds was necessary because of model structural limitations.

For the relatively low Reynolds numbers at which most wind tunnels operate, extensive regions of laminar flow exist on models at zero lift. At lifting conditions the transition points on the wing, canard, and vertical tail usually move forward, thus causing a change in the friction

drag with changing lift coefficient which is difficult to evaluate and moreover not necessarily representative of full scale. In order to induce transition at fixed locations on the component parts, a 0.010-inch-diameter wire was placed on the wing and 0.005-inch-diameter wires were affixed to the canard and vertical tail in the locations shown in figure 1(b). When the model was tested with the canard off a 0.010-inch-diameter wire was located on the body 4 inches from the nose. The wire sizes were selected on the basis of the results of reference 2. Although there is no conclusive evidence as to the magnitude of the form drag increment contributed by the transition wires, previous studies have indicated this increment to be not more than 0.0010. All of the data presented herein are with transition fixed.

Reduction of Data

The data presented herein have been reduced to standard NACA coefficient form. The pitching-moment coefficients were referred to the 0.21 point of the wing mean aerodynamic chord. This location was chosen to give a minimum static margin of $0.03\bar{c}$ in the range of trim lift coefficients between 0 and 0.6 throughout the Mach number range investigated. The canard hinge moments were computed about a hinge line located at the 0.35 point of the canard mean aerodynamic chord. Factors which affect the accuracy of the results are discussed in the following paragraphs.

Stream variations.- Surveys of the stream characteristics of the Ames 6- by 6-foot supersonic wind tunnel showed that in the region of the test section, essentially no stream curvature existed in the pitch plane of the model and that the axial static-pressure variations were usually less than ±1 percent of the dynamic pressure. This static-pressure variation resulted in negligible longitudinal-buoyancy corrections to the drag of this model; therefore, no corrections for stream curvature or static-pressure variation were made in the present investigation.

From a test of the model in the normal and inverted attitudes, a stream angle, which was less than 0.3° throughout the Mach number range, was found to exist in the pitch plane. The data presented herein have been corrected for these stream angles which correlated closely with those obtained from a cone survey.

Support interference.- The effects of model support interference on the aerodynamic characteristics were considered to consist primarily of a change in the pressure at the base of the model. However, the drag data presented herein contain no base drag component since the base pressure was measured and the drag was adjusted to correspond to a base pressure equal to the free-stream static pressure; therefore, no corrections were made to account for support interference.

Tunnel-wall interference.- The effectiveness of the perforations in the wind-tunnel test section in preventing choking and absorbing reflected disturbances at transonic and low supersonic speeds has been established experimentally. Unpublished data from the wind-tunnel calibration indicate that reliable data can be obtained throughout the Mach number range if certain restrictions are imposed on the model size and attitude. The configurations and methods of testing used in the present investigation conform to these restrictions so that the data at transonic and low supersonic speeds are reasonably free of interference effects. Thus, no corrections for wall interference have been made.

RESULTS

The results are presented in this report without analysis in order to expedite publication. Figures 2 through 4 present representative data for only the configuration with the wing on, whereas all of the data taken with the wing on and off are tabulated in table I and table II, respectively. Lift, drag, and pitching-moment characteristics with the canard on and deflected and with the canard off are presented for several test Mach numbers in figure 2. Figure 3 shows the variations of canard normal forces and hinge moments as a function of angle of attack at constant canard deflection angles. Presented in figure 4 are the lift-curve slopes, maximum lift-drag ratios, minimum drag coefficients, and the aerodynamic centers as a function of Mach number for the canard on at zero deflection and for the canard off.

Ames Aeronautical Laboratory
National Advisory Committee for Aeronautics
Moffett Field, Calif., Oct. 15, 1957

REFERENCES

1. Driver, Cornelius: Longitudinal and Lateral Stability and Control Characteristics of Two Canard Airplane Configurations at Mach Numbers of 1.41 and 2.01. NACA RM L56L19, 1957.

2. Winter, K. G., Scott-Wilson, J. B., and Davies, F. V.: Methods of Determining and of Fixing Boundary Layer Transition on Wind Tunnel Models at Supersonic Speeds. R.A.E. TN Aero. 2341, British, Sept. 1954.

TABLE I.- AERODYNAMIC CHARACTERISTICS WITH THE WING ON

(a) BVW

M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m
0.70	-6.4	-0.311	0.0404	0.0602	1.00	-5.8	-0.347	0.0483	0.1020	1.30	-6.0	-0.291	0.0418	0.0873	1.90	-5.8	-0.212	0.0332	0.0594
	-4.2	-.196	.0214	.0386		-3.8	-.222	.0295	.0670		-4.0	-.189	.0254	.0569		-3.8	-.139	.0218	.0398
	-2.2	-.101	.0130	.0204		-1.8	-.109	.0174	.0342		-2.0	-.093	.0169	.0280		-2.0	-.079	.0159	.0230
	-0.7	-.039	.0107	.0106		-0.3	-.031	.0149	.0134		-0.5	-.026	.0145	.0087		-0.4	-.026	.0136	.0092
	-0.2	-.018	.0104	.0070		.2	-.007	.0154	.0054		-0.0	-.005	.0139	.0036		.1	-.007	.0132	.0040
	.4	.004	.0103	.0037		.7	.024	.0155	-.0022		.6	.019	.0145	-.0038		.6	.011	.0132	-.0009
	1.9	.066	.0113	-.0078		2.2	.104	.0178	-.0242		2.1	.087	.0167	-.0233		2.1	.062	.0150	-.0150
	3.9	.164	.0183	-.0260		4.2	.222	.0288	-.0583		4.0	.181	.0246	-.0507		4.2	.137	.0216	-.0347
	5.8	.260	.0317	-.0439		6.3	.345	.0490	-.0935		6.0	.278	.0399	-.0793		6.1	.202	.0323	-.0524
	7.8	.368	.0538	-.0637		8.2	.459	.0768	-.1268		8.0	.374	.0620	-.1067		8.1	.269	.0481	-.0707
	9.8	.478	.0844	-.0824		10.3	.580	.1153	-.1610		10.0	.470	.0910	-.1347		10.1	.331	.0682	-.0871
	11.7	.588	.1210	-.1019		12.2	.686	.1585	-.1908		12.0	.562	.1264	-.1613		12.0	.393	.0923	-.1031
	13.8	.702	.1681	-.1229		14.2	.792	.2089	-.2211		14.1	.650	.1677	-.1869		14.1	.452	.1204	-.1174
	15.8	.808	.2225	-.1396		16.3	.897	.2704	-.2517		16.1	.735	.2146	-.2112		16.2	.514	.1552	-.1310
	17.8	.919	.2862	-.1572		18.2	.990	.3326	-.2781		18.1	.809	.2660	-.2280		18.1	.569	.1918	-.1408
0.90	-6.0	-0.324	0.0411	0.0729	1.05	-5.9	-0.334	0.0488	0.0975	1.50	-6.2	-0.264	0.0395	0.0784	2.22	-5.9	-0.185	0.0308	0.0495
	-3.9	-.202	.0221	.0447		-3.9	-.220	.0296	.0692		-4.1	-.174	.0242	.0515		-3.6	-.114	.0191	.0313
	-1.9	-.098	.0125	.0225		-2.0	-.106	.0191	.0330		-2.1	-.088	.0163	.0258		-1.7	-.057	.0139	.0165
	-0.6	-.037	.0110	.0113		-0.4	-.028	.0159	.0120		-0.6	-.029	.0141	.0088		-0.3	-.013	.0124	.0047
	0.0	-.012	.0107	.0070		.1	.000	.0167	.0041		-0.1	-.008	.0139	.0031		.2	.003	.0123	.0003
	.6	.010	.0107	.0023		.6	.024	.0167	-.0025		.5	.018	.0139	-.0044		.8	.022	.0126	-.0040
	2.0	.077	.0120	-.0114		2.2	.107	.0193	-.0256		2.0	.079	.0155	-.0219		2.2	.068	.0145	-.0167
	4.0	.180	.0200	-.0339		4.3	.224	.0293	-.0617		3.9	.158	.0224	-.0455		4.2	.129	.0207	-.0329
	6.0	.291	.0370	-.0584		6.1	.334	.0477	-.0916		5.8	.242	.0353	-.0696		6.2	.187	.0309	-.0480
	7.9	.410	.0620	-.0864		8.1	.439	.0738	-.1175		7.9	.330	.0551	-.0948		8.3	.244	.0453	-.0625
	10.0	.540	.0992	-.1187		10.2	.550	.1090	-.1491		9.9	.412	.0808	-.1183		10.2	.300	.0629	-.0761
	12.0	.661	.1434	-.1490		12.2	.661	.1542	-.1871		12.0	.492	.1118	-.1407		12.3	.357	.0862	-.0899
	14.0	.789	.1983	-.1867		14.2	.765	.2032	-.2166		14.0	.571	.1478	-.1631		14.2	.409	.1115	-.1009
	16.0	.913	.2627	-.2243		16.2	.860	.2587	-.2439		16.0	.645	.1887	-.1829		16.2	.465	.1426	-.1116
											18.0	.716	.2353	-.2008		18.3	.519	.1777	-.1223
0.95	-5.8	-0.343	0.0446	0.0944	1.10	-6.0	-0.334	0.0484	0.1030	1.70	-6.3	-0.239	0.0376	0.0695					
	-3.8	-.220	.0250	.0585		-4.0	-.215	.0294	.0694		-4.1	-.160	.0238	.0470					
	-2.0	-.115	.0147	.0314		-2.0	-.106	.0194	.0363		-2.2	-.084	.0163	.0251					
	-0.4	-.031	.0111	.0128		-0.4	-.027	.0162	.0145		-0.7	-.031	.0140	.0098					
	.1	-.009	.0108	.0077		.1	-.004	.0160	.0078		-0.1	-.010	.0136	.0044					
	.6	.014	.0111	.0020		.6	.024	.0163	-.0011		.4	.012	.0137	-.0019					
	2.2	.097	.0136	-.0187		2.1	.102	.0186	-.0236		1.8	.065	.0152	-.0169					
	4.1	.204	.0238	-.0473		4.1	.214	.0279	-.0588		3.8	.143	.0215	-.0386					
	6.1	.325	.0428	-.0792		6.1	.330	.0469	-.0932		5.8	.216	.0327	-.0595					
	8.2	.472	.0760	-.1236		8.1	.446	.0723	-.1259		7.8	.290	.0493	-.0796					
	10.1	.578	.1103	-.1537		10.1	.544	.1043	-.1484		9.8	.362	.0721	-.1000					
	12.1	.698	.1582	-.1861		12.1	.636	.1449	-.1774		11.8	.430	.0988	-.1188					
	14.1	.812	.2106	-.2193		14.1	.739	.1934	-.2111		13.9	.499	.1299	-.1372					
	16.2	.934	.2780	-.2573		16.1	.838	.2506	-.2401		15.9	.565	.1666	-.1542					
	18.2	1.039	.3474	-.2867		18.1	.924	.3105	-.2641		17.9	.627	.2063	-.1678					

TABLE I.- AERODYNAMIC CHARACTERISTICS WITH THE WING ON - Continued

(b) BVWC, $\delta = -5.7^{\circ}$

M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}	M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}
0.70	-6.3	-0.316	0.0466	0.0055	-0.0431	0.1110	1.30	-6.0	-0.288	0.0476	0.0337	-0.0375	0.1426
	-2.2	-.106	.0155	-.0045	-.0231	.0626		-2.0	-.089	.0200	.0008	-.0218	.0842
	-0.2	-.022	.0118	-.0081	-.0133	.0382		.1	-.011	.0168	-.0115	-.0139	.0550
	1.8	.062	.0117	-.0133	-.0055	.0185		2.0	.083	.0172	-.0307	-.0061	.0249
	5.8	.263	.0324	-.0333	.0078	-.0239		6.0	.277	.0406	-.0701	.0067	-.0249
	9.7	.480	.0829	-.0498	.0248	-.0677		10.0	.470	.0909	-.1019	.0221	-.0866
	13.8	.718	.1710	-.0643	.0446	-.1173		14.0	.654	.1670	-.1282	.0378	-.1442
	17.8	.948	.2924	-.0715	.0650	-.1634		18.1	.833	.2714	-.1515	.0529	-.2004
0.90	-6.0	-0.337	0.0485	0.0221	-0.0441	0.1432	1.70	-6.2	-0.237	0.0420	0.0209	-0.0313	0.1191
	-2.0	-.107	.0160	-.0015	-.0240	.0780		-2.2	-.082	.0191	-.0016	-.0187	.0728
	0.0	-.023	.0124	-.0076	-.0146	.0473		-0.2	-.008	.0156	-.0131	-.0119	.0470
	2.1	.075	.0120	-.0177	-.0053	.0178		1.9	.066	.0165	-.0250	-.0052	.0203
	6.0	.299	.0362	-.0497	.0087	-.0308		5.9	.218	.0340	-.0505	.0059	-.0233
	10.0	.549	.0977	-.0861	.0265	-.0860		9.9	.365	.0725	-.0700	.0185	-.0733
	14.1	.816	.2009	-.1336	.0459	-.1471		13.8	.505	.1308	-.0866	.0308	-.1212
	18.0	1.046	.3317	-.1654	.0652	-.2131		17.9	.646	.2116	-.1036	.0421	-.1643
1.00	-5.8	-0.354	0.0555	0.0489	-0.0422	0.1472	2.22	-5.6	-0.189	0.0339	0.0107	-0.0255	0.0923
	-1.8	-.115	.0224	.0096	-.0233	.0810		-1.9	-.061	.0163	-.0059	-.0156	.0556
	.2	-.005	.0180	-.0116	-.0144	.0508		0.3	.004	.0138	-.0150	-.0244	.0859
	2.3	.104	.0200	-.0328	-.0059	.0235		2.3	.066	.0155	-.0240	-.0048	.0167
	6.2	.342	.0506	-.0827	.0083	-.0291		6.3	.189	.0314	-.0399	.0049	-.0199
	10.1	.568	.1108	-.1231	.0252	-.0855		10.3	.307	.0646	-.0526	.0152	-.0600
	14.2	.792	.2069	-.1564	.0433	-.1498		14.3	.422	.1148	-.0640	.0244	-.0962
	18.2	1.001	.3323	-.1811	.0627	-.2269		18.3	.535	.1825	-.0738	.0326	-.1200
1.10	-2.0	-0.113	0.0238	0.0148	-0.0231	0.0837							
	-0.0	-.004	.0190	-.0092	-.0142	.0521							
	2.0	.100	.0204	-.0294	-.0054	.0223							
	6.0	.318	.0454	-.0775	.0081	-.0308							
	10.0	.547	.1040	-.1171	.0248	-.0914							
	14.1	.740	.1913	-.1444	.0425	-.1533							
	18.1	.935	.3102	-.1753	.0578	-.2080							

[redacted]

[redacted]

TABLE I.- AERODYNAMIC CHARACTERISTICS WITH THE WING ON - Continued

(c) BVWC, $\delta = 0^{\circ}$

M	α, deg	C_L	C_D	C_m	C_{Z_α}	C_{h_α}
0.70	-6.3	-0.314	0.0420	0.0275	-0.0269	0.0705
	-4.2	-.199	.0233	.0185	-.0166	.0435
	-2.2	-.101	.0139	.0111	-.0081	.0224
	-.8	-.039	.0112	.0076	-.0027	.0069
	-.2	-.013	.0108	.0053	-.0006	-.0003
	.3	.008	.0108	.0024	.0007	-.0018
	1.8	.074	.0119	-.0030	.0059	-.0180
	3.7	.166	.0191	-.0102	.0136	-.0373
	5.8	.279	.0348	-.0185	.0234	-.0625
	7.7	.383	.0569	-.0248	.0327	-.0865
	9.8	.501	.0893	-.0310	.0426	-.1095
	11.7	.616	.1292	-.0370	.0526	-.1327
	13.8	.734	.1794	-.0417	.0628	-.1537
	15.8	.863	.2411	-.0461	.0750	-.1824
	17.8	.976	.3082	-.0482	.0851	-.1987
0.90	-6.0	-0.331	0.0433	0.0422	-0.0269	0.0885
	-3.9	-.206	.0238	.0262	-.0169	.0541
	-2.0	-.099	.0139	.0140	-.0079	.0262
	-0.5	-.035	.0115	.0068	-.0022	.0063
	0.0	-.010	.0110	.0058	-.0004	-.0000
	0.5	.012	.0106	.0021	.0008	-.0043
	2.0	.084	.0128	-.0058	.0066	-.0245
	4.0	.192	.0217	-.0184	.0153	-.0513
	6.0	.313	.0398	-.0332	.0250	-.0813
	8.0	.431	.0665	-.0473	.0343	-.1101
	9.9	.565	.1041	-.0666	.0444	-.1445
	12.0	.691	.1513	-.0854	.0539	-.1729
	13.9	.812	.2052	-.1025	.0638	-.2042
	16.1	.947	.2762	-.1257	.0743	-.2389
	18.1	1.060	.3482	-.1380	.0825	-.2543
1.00	-5.9	-0.359	0.0527	0.0696	-0.0262	0.0885
	-3.8	-.231	.0314	.0469	-.0164	.0557
	-1.8	-.113	.0210	.0250	-.0079	.0262
	-0.3	-.034	.0170	.0105	-.0017	.0035
	.2	-.006	.0166	.0055	-.0001	-.0023
	.7	.020	.0168		.0012	-.0071
	2.2	.099	.0188	-.0149	.0066	-.0287
	4.3	.220	.0303	-.0388	.0160	-.0614
	6.2	.342	.0509	-.0615	.0242	-.0858
	8.2	.464	.0793	-.0820	.0335	-.1184
	10.2	.577	.1151	-.0987	.0431	-.1532
	12.2	.694	.1616	-.1153	.0525	-.1914
	14.2	.808	.2150	-.1298	.0623	-.2270
	16.3	.917	.2763	-.1421	.0714	-.2586
	18.3	1.017	.3438	-.1533	.0800	-.2886

M	α, deg	C_L	C_D	C_m	C_{Z_α}	C_{h_α}
1.10	-6.0	-0.342	0.0518	0.0715	-0.0249	0.0870
	-4.0	-.220	.0317	.0495	-.0162	.0580
	-2.0	-.109	.0211	.0272	-.0073	.0255
	-0.5	-.035	.0179	.0128	-.0024	.0072
	.1	-.010	.0179	.0080	.0001	-.0029
	.5	.013	.0177	.0027	.0010	-.0062
	2.1	.094	.0204	-.0133	.0062	-.0257
	4.1	.204	.0295	-.0361	.0148	-.0580
	6.1	.321	.0479	-.0607	.0231	-.0818
	8.0	.443	.0743	-.0829	.0315	-.1111
	10.0	.552	.1089	-.0930	.0403	-.1433
	12.2	.658	.1518	-.1040	.0496	-.1773
	14.1	.747	.1963	-.1134	.0582	-.2120
	16.2	.848	.2566	-.1354	.0656	-.2367
	18.1	.944	.3193	-.1474	.0742	-.2693
1.30	-6.1	-0.292	0.0448	0.0528	-0.0244	0.0936
	-4.0	-.189	.0277	.0354	-.0157	.0611
	-2.0	-.091	.0184	.0178	-.0076	.0294
	-0.4	-.022	.0158	.0049	-.0022	.0073
	.1	-.001	.0154	.0008	-.0004	.0004
	2.0	.085	.0177	-.0159	.0056	-.0224
	4.0	.182	.0261	-.0340	.0133	-.0521
	6.0	.277	.0410	-.0509	.0208	-.0801
	7.9	.374	.0632	-.0659	.0288	-.1107
	10.0	.472	.0934	-.0808	.0365	-.1387
	12.0	.569	.1303	-.0940	.0443	-.1670
	14.1	.661	.1729	-.1070	.0517	-.1933
	16.0	.752	.2219	-.1202	.0588	-.2176
	18.1	.843	.2803	-.1305	.0657	-.2418
1.50	-6.1	-0.261	0.0412	0.0461	-0.0211	0.0812
	-4.1	-.174	.0262	.0318	-.0141	.0551
	-2.1	-.087	.0176	.0164	-.0067	.0260
	-0.6	-.023	.0151	.0049	-.0016	.0052
	-0.2	-.006	.0145	.0017	-.0003	-.0000
	.4	.013	.0146	-.0023	.0007	-.0030
	2.0	.078	.0166	-.0143	.0056	-.0231
	3.9	.160	.0239	-.0292	.0122	-.0486
	6.0	.250	.0382	-.0434	.0197	-.0758
	9.9	.419	.0837	-.0694	.0327	-.1243
	12.0	.504	.1166	-.0810	.0395	-.1509
	14.1	.590	.1567	-.0924	.0465	-.1778
	16.1	.669	.2007	-.1030	.0527	-.1995
	18.0	.743	.2470	-.1117	.0582	-.2186

M	α, deg	C_L	C_D	C_m	C_{Z_α}	C_{h_α}
1.70	-6.3	-0.241	0.0399	0.0388	-0.0205	0.0798
	-4.2	-.159	.0253	.0273	-.0135	.0537
	-2.2	-.082	.0175	.0149	-.0068	.0282
	-0.6	-.023	.0147	.0051	-.0016	.0069
	-0.3	-.010	.0146	.0028	-.0005	.0025
	.3	.009	.0145	-.0006	.0007	-.0020
	1.7	.063	.0159	-.0099	.0050	-.0192
	3.8	.142	.0225	-.0219	.0119	-.0463
	5.8	.218	.0343	-.0330	.0183	-.0704
	7.8	.293	.0514	-.0427	.0245	-.0941
	9.8	.368	.0741	-.0530	.0307	-.1175
	11.9	.445	.1039	-.0625	.0365	-.1390
	13.9	.513	.1360	-.0716	.0423	-.1594
	15.9	.585	.1745	-.0811	.0472	-.1766
	17.8	.651	.2163	-.0892	.0516	-.1941
1.90	-5.7	-0.207	0.0339	0.0314	-0.0174	0.0658
	-3.9	-.139	.0230	.0223	-.0118	.0452
	-1.9	-.072	.0163	.0130	-.0058	.0225
	-0.4	-.019	.0140	.0048	-.0015	.0049
	.1	.000	.0138	.0015	-.0000	-.0009
	.5	.012	.0138	-.0003	.0012	-.0056
	2.0	.065	.0155	-.0087	.0053	-.0204
	4.2	.142	.0227	-.0192	.0116	-.0450
	6.1	.208	.0340	-.0282	.0171	-.0658
	8.1	.278	.0504	-.0363	.0229	-.0870
	10.0	.343	.0715	-.0443	.0282	-.1068
	12.1	.410	.0976	-.0524	.0334	-.1253
	14.1	.475	.1285	-.0604	.0383	-.1436
	16.1	.537	.1639	-.0675	.0426	-.1602
	18.0	.597	.2024	-.0734	.0470	-.1787
2.22	-5.7	-0.182	0.0309	0.0238	-0.0159	0.0603
	-3.8	-.117	.0206	.0158	-.0105	.0396
	-1.7	-.050	.0141	.0071	-.0047	.0178
	-0.2	-.005	.0128	.0009	-.0010	.0034
	.7	.026	.0129	-.0042	.0009	-.0037
	2.3	.075	.0152	-.0113	.0049	-.0184
	4.3	.137	.0218	-.0188	.0100	-.0372
	6.2	.196	.0328	-.0254	.0152	-.0565
	8.3	.257	.0481	-.0324	.0202	-.0741
	10.3	.318	.0685	-.0389	.0249	-.0917
	12.2	.372	.0907	-.0446	.0293	-.1073
	14.2	.429	.1186	-.0505	.0336	-.1231
	16.3	.489	.1518	-.0566	.0376	-.1388
	18.3	.544	.1880	-.0607	.0413	-.1529

TABLE I.- AERODYNAMIC CHARACTERISTICS WITH THE WING ON - Continued

(d) BVWC, $\delta = 2.5^{\circ}$

M	α, deg	C_L	C_D	C_m
0.70	-6.2	-0.324	0.0421	0.0420
	-2.3	-.113	.0140	.0223
	-0.2	-.027	.0114	.0164
	1.9	.063	.0129	.0122
	5.7	.268	.0354	-.0032
	9.8	.494	.0926	-.0163
	13.8	.729	.1823	-.0272
	17.8	.959	.3077	-.0327
0.90	-6.0	-0.345	0.0440	0.0569
	-1.9	-.109	.0141	.0254
	.1	-.016	.0116	.0165
	2.1	.085	.0140	.0046
	6.0	.308	.0420	-.0187
	10.1	.560	.1085	-.0521
	14.1	.818	.2140	-.0920
	18.1	1.108	.3515	-.1274

(e) BVWC, $\delta = 4.7^{\circ}$

M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}	M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}
0.90	-6.0	-0.333	0.0426	0.0616	-0.0118	0.0386	1.30	-6.1	-0.291	0.0429	0.0707	-0.0111	0.0457
	-2.0	-.104	.0141	.0280	.0034	-.0132		-2.0	-.095	.0183	.0331	.0026	-.0102
	0.0	-.012	.0120	.0199	.0115	-.0374		0.0	-.006	.0160	.0172	.0103	-.0410
	2.0	.082	.0145	.0096	.0208	-.0669		2.0	.081	.0188	.0003	.0183	-.0712
	6.0	.306	.0433	-.0128	.0399	-.1260		6.0	.277	.0439	-.0333	.0337	-.1272
	10.0	.552	.1087	-.0424	.0593	-.1857		10.0	.472	.0982	-.0641	.0485	-.1822
	14.0	.814	.2152	-.0848	.0776	-.2454		14.1	.658	.1780	-.0902	.0624	-.2312
	18.1	1.048	.3529	-.1262	.0860	-.2445		16.1	.754	.2290	-.1051	.0693	-.2565
								18.0	.836	.2827	-.1180	.0747	-.2760
1.00	-5.9	-0.352	0.0506	0.0885	-0.0113	0.0369	1.70	-6.3	-0.244	0.0387	0.0551	-0.0096	0.0400
	-1.9	-.110	.0191	.0386	.0035	-.0162		-2.2	-.084	.0173	.0286	.0027	-.0080
	0.1	-.007	.0185	.0193	.0116	-.0444		-0.2	-.012	.0151	.0170	.0091	-.0324
	2.2	.106	.0214	-.0059	.0208	-.0739		1.8	.062	.0172	.0051	.0157	-.0577
	6.1	.341	.0546	-.0451	.0389	-.1371		5.8	.218	.0371	-.0178	.0285	-.1063
	10.2	.577	.1206	-.0807	.0573	-.2051		9.8	.368	.0783	-.0388	.0399	-.1500
	14.2	.793	.2190	-.1099	.0748	-.2699		13.8	.512	.0401	-.0577	.0504	-.1893
	16.3	.904	.2821	-.1225	.0840	-.3032		15.9	.582	.1789	-.0675	.0552	-.2066
	18.3	1.001	.3475	-.1336	.0915	-.3310		17.9	.650	.2222	-.0774	.0595	-.2225
1.10	-6.0	-0.337	0.0496	0.0917	-0.0110	0.0381	2.22	-5.8	-0.180	0.0298	0.0373	-0.0064	0.0272
	-2.1	-.110	.0213	.0435	.0031	-.0172		-1.7	-.050	.0144	.0193	.0036	-.0115
	-0.1	-.014	.0189	.0239	.0112	-.0450		.3	.009	.0134	.0113	.0086	-.0301
	2.1	.094	.0213	.0017	.0205	-.0774		2.3	.071	.0159	.0022	.0138	-.0483
	6.0	.319	.0509	-.0379	.0386	-.1421		6.2	.194	.0346	-.0125	.0234	-.0816
	9.9	.552	.1124	-.0793	.0540	-.1957		10.2	.312	.0698	-.0259	.0328	-.1166
	14.1	.751	.2046	-.0938	.0710	-.2555		14.4	.426	.1225	-.0383	.0409	-.1480
	16.1	.829	.2570	-.1084	.0777	-.2770		16.3	.480	.1528	-.0439	.0446	-.1627
	18.1	.929	.3224	-.1266	.0847	-.3074		18.3	.533	.1889	-.0476	.0486	-.1794

TABLE I.- AERODYNAMIC CHARACTERISTICS WITH THE WING ON - Continued
(f) BVWC, $\delta = 9.7^{\circ}$

M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}
0.70	-6.3	-0.316	0.0417	0.0626	0.0015	-0.0088
	-4.2	-.199	.0236	.0508	.0094	-.0307
	-2.2	-.098	.0160	.0423	.0179	-.0523
	-0.8	-.037	.0148	.0395	.0238	-.0676
	-0.3	-.016	.0143	.0382	.0265	-.0736
	.2	.007	.0153	.0363	.0289	-.0801
	1.8	.070	.0175	.0316	.0355	-.0963
	3.7	.160	.0253	.0240	.0451	-.1193
	5.7	.273	.0442	.0199	.0554	-.1433
	7.8	.387	.0714	.0171	.0645	-.1592
	9.8	.499	.1046	.0095	.0740	-.1782
	11.7	.610	.1455	.0047	.0839	-.2029
	15.8	.842	.2538	-.0100	.0979	-.2239
	17.8	.961	.3221	-.0279	.0956	-.2092
0.90	-4.0	-0.204	0.0254	0.0597	0.0109	-0.0380
	-2.1	-.104	.0165	.0471	.0186	-.0610
	-0.5	-.032	.0152	.0414	.0259	-.0852
	0.0	-.008	.0152	.0395	.0290	-.0978
	.5	.014	.0159	.0365	.0305	-.1008
	2.1	.085	.0189	.0283	.0382	-.1247
	4.0	.188	.0281	.0130	.0475	-.1541
	6.0	.311	.0502	.0033	.0574	-.1846
	7.9	.427	.0793	-.0062	.0653	-.2054
	10.0	.556	.1186	-.0253	.0746	-.2361
	12.1	.680	.1665	-.0418	.0833	-.2605
	14.1	.810	.2227	-.0813	.0796	-.2058
	16.0	.924	.2834	-.1064	.0811	-.2148
	18.1	1.044	.3582	-.1391	.0782	-.2158
1.00	-5.9	-0.349	0.0518	0.1045	0.0028	-0.0127
	-3.8	-.219	.0325	.0783	.0098	-.0344
	-1.8	-.101	.0232	.0530	.0182	-.0609
	-0.4	-.027	.0212	.0397	.0248	-.0838
	.2	-.001	.0216	.0350	.0274	-.0929
	.7	.026	.0215	.0284	.0294	-.1000
	2.2	.105	.0260	.0115	.0359	-.1226
	4.1	.209	.0353	-.0119	.0453	-.1553
	6.1	.330	.0582	-.0257	.0545	-.1900
	8.2	.451	.0898	-.0422	.0638	-.2251
	10.2	.562	.1264	-.0595	.0713	-.2513
	12.2	.680	.1736	-.0777	.0796	-.2803
	14.2	.785	.2261	-.0924	.0867	-.3049
	16.2	.886	.2853	-.1048	.0932	-.3275
	18.2	.981	.3493	-.1235	.0948	-.3033
1.10	-6.1	-0.343	0.0514	0.1087	0.0022	-0.0131
	-4.0	-.219	.0323	.0851	.0091	-.0328
	-2.1	-.111	.0238	.0623	.0179	-.0641
	-0.6	-.039	.0221	.0475	.0245	-.0897
	-0.1	-.002	.0217	.0390	.0272	-.0992
	.5	.011	.0226	.0379	.0284	-.0967
	2.0	.081	.0255	.0234	.0349	-.1217
	4.0	.188	.0355	-.0009	.0429	-.1495
	6.0	.305	.0558	-.0197	.0517	-.1854
	8.0	.415	.0832	-.0353	.0589	-.2055
	10.0	.548	.1205	-.0642	.0679	-.2444
	12.0	.659	.1656	-.0763	.0750	-.2693
	14.1	.755	.2138	-.0844	.0820	-.2936
	16.0	.831	.2640	-.0887	.0868	-.3051
	18.0	.908	.3222	-.1060	.0927	-.3273
1.30	-6.0	-0.288	0.0430	0.0886	0.0023	-0.0093
	-4.0	-.187	.0279	.0695	.0095	-.0369
	-2.0	-.092	.0204	.0507	.0168	-.0634
	-0.5	-.028	.0191	.0386	.0225	-.0857
	0.0	-.007	.0193	.0352	.0249	-.0940
	.5	.013	.0197	.0311	.0263	-.1001
	2.0	.077	.0227	.0171	.0319	-.1208
	4.0	.170	.0313	-.0035	.0394	-.1480
	6.0	.275	.0497	-.0185	.0463	-.1732
	8.0	.377	.0753	-.0331	.0539	-.2018
	10.0	.473	.1057	-.0482	.0605	-.2248
	12.0	.564	.1417	-.0623	.0664	-.2445
	14.0	.652	.1835	-.0770	.0723	-.2625
	16.1	.748	.2358	-.0926	.0783	-.2871
	18.1	.834	.2917	-.1044	.0836	-.3064
1.70	-6.3	-0.238	0.0387	0.0724	0.0024	-0.0063
	-4.2	-.154	.0256	.0588	.0088	-.0297
	-2.2	-.078	.0193	.0452	.0149	-.0521
	-0.8	-.031	.0180	.0368	.0195	-.0692
	-0.2	-.009	.0178	.0334	.0212	-.0752
	.3	.008	.0183	.0300	.0227	-.0814
	1.8	.061	.0207	.0200	.0273	-.0984
	3.8	.136	.0278	.0059	.0334	-.1208
	5.8	.220	.0420	-.0051	.0386	-.1410
	7.8	.294	.0604	-.0154	.0440	-.1622
	9.8	.371	.0844	-.0266	.0493	-.1824
	11.9	.444	.1139	-.0371	.0542	-.2007
	13.8	.513	.1470	-.0481	.0590	-.2187
	15.8	.581	.1854	-.0571	.0633	-.2346
	17.7	.640	.2250	-.0657	.0674	-.2524
2.22	-5.8	-0.173	0.0303	0.0523	0.0042	-0.0114
	-3.7	-.113	.0213	.0442	.0086	-.0264
	-1.8	-.049	.0168	.0348	.0137	-.0457
	-0.3	-.004	.0158	.0277	.0176	-.0602
	.3	.007	.0164	.0258	.0188	-.0643
	.7	.025	.0166	.0232	.0199	-.0683
	4.2	.132	.0264	.0052	.0280	-.0964
	6.2	.198	.0389	-.0017	.0324	-.1120
	8.2	.255	.0548	-.0088	.0369	-.1286
	10.2	.313	.0748	-.0154	.0408	-.1435
	12.2	.372	.0993	-.0224	.0446	-.1592
	14.2	.421	.1249	-.0280	.0482	-.1728
	16.3	.477	.1578	-.0343	.0520	-.1871
	18.3	.532	.1947	-.0386	.0562	-.2040

TABLE I.- AERODYNAMIC CHARACTERISTICS WITH THE WING ON - Continued

(g) BVWC, $\delta = 19.5^{\circ}$

M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}	M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}
1.00	-5.8	-0.343	0.0600	0.1413	0.0302	-0.1214	1.70	-6.3	-0.232	0.0458	0.1020	0.0096	-0.0388
	-1.9	-.101	.0351	.0899	.0468	-.1822		-2.2	-.080	.0285	.0719	.0337	-.1266
	.2	.003	.0354	.0678	.0550	-.2106		-0.2	-.009	.0283	.0569	.0393	-.1482
	2.3	.104	.0408	.0434	.0636	-.2422		1.8	.056	.0316	.0411	.0445	-.1701
	6.2	.325	.0732	-.0069	.0786	-.2958		5.8	.217	.0544	.0136	.0545	-.2109
	10.2	.566	.1456	-.0387	.0909	-.3332		9.8	.368	.0982	-.0127	.0636	-.2470
	14.3	.783	.2440	-.0888	.0936	-.3039		13.9	.512	.1629	-.0375	.0728	-.2855
	18.5	.997	.3762	-.1295	.0944	-.3211		17.8	.644	.2439	-.0578	.0810	-.3177
1.10	-6.1	-0.331	0.0600	0.1374	0.0293	-0.1169	2.22	-5.8	-0.161	0.0357	0.0765	0.0215	-0.0728
	-2.0	-.111	.0356	.0930	.0448	-.1768		-1.8	-.043	.0250	.0566	.0297	-.1065
	-0.0	-.008	.0360	.0697	.0523	-.2021		.3	.016	.0254	.0454	.0340	-.1228
	2.0	.084	.0408	.0465	.0595	-.2263		2.3	.069	.0288	.0335	.0383	-.1393
	6.0	.293	.0701	.0000	.0735	-.2750		6.3	.197	.0499	.0144	.0462	-.1696
	10.1	.539	.1386	-.0412	.0846	-.3111		10.5	.319	.0896	-.0035	.0543	-.2039
	14.2	.774	.2367	-.0883	.0915	-.3177		14.2	.422	.1397	-.0160	.0624	-.2413
	18.0	.915	.3385	-.1051	.0944	-.3314		18.4	.532	.2120	-.0255	.0717	-.2880
1.30	-6.0	-0.286	0.0515	0.1229	0.0269	-0.1098							
	-1.9	-.087	.0311	.0800	.0407	-.1632							
	-0.1	-.011	.0313	.0631	.0470	-.1863							
	2.1	.073	.0360	.0423	.0541	-.2133							
	6.0	.263	.0625	.0017	.0662	-.2582							
	10.1	.469	.1218	-.0314	.0771	-.2944							
	14.1	.651	.2015	-.0658	.0866	-.3326							

(h) BVWC, $\delta = 29.6^{\circ}$

M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}	M	α, deg	C_L	C_D	C_m	C_{Z_c}	C_{h_c}
1.00	-5.9	-0.322	0.0774	0.1729	0.0566	-0.2492	1.70	-6.3	-0.215	0.0581	0.1208	0.0400	-0.1674
	-1.8	-.088	.0553	.1160	.0704	-.3000		-2.2	-.070	.0439	.0899	.0496	-.2114
	.2	.012	.0561	.0860	.0755	-.3200		-0.1	.002	.0443	.0711	.0540	-.2296
	2.2	.104	.0617	.0622	.0813	-.3351		1.9	.067	.0490	.0537	.0583	-.2490
	6.2	.317	.0905	.0041	.0847	-.3131		5.8	.218	.0721	.0226	.0669	-.2882
	10.2	.564	.1624	-.0437	.0914	-.3420		9.9	.370	.1178	-.0064	.0742	-.3193
	14.3	.785	.2608	-.0935	.0927	-.3476		13.9	.507	.1815	-.0300	.0827	-.3569
	18.2	.977	.3832	-.1364	.0929	-.3634		17.9	.641	.2663	-.0515	.0895	-.3896
1.10	-6.0	-0.316	0.0779	0.1721	0.0542	-0.2400	2.22	-5.8	-0.148	0.0470	0.0902	0.0356	-0.1358
	-2.1	-.102	.0575	.1218	.0656	-.2825		-1.8	-.031	.0382	.0700	.0433	-.1725
	-0.1	-.011	.0575	.0981	.0707	-.2974		.3	.025	.0395	.0582	.0475	-.1930
	2.1	.085	.0630	.0680	.0762	-.3159		2.3	.077	.0441	.0451	.0512	-.2098
	6.0	.301	.0910	.0093	.0813	-.3090		6.2	.198	.0657	.0247	.0585	-.2430
	10.0	.536	.1560	-.0429	.0852	-.3211		10.2	.308	.1043	.0097	.0673	-.2926
	14.0	.768	.2511	-.1025	.0871	-.3251		14.2	.417	.1601	-.0016	.0773	-.3480
	18.1	.936	.3662	-.1171	.0920	-.3640		18.2	.521	.2294	-.0134	.0841	-.3783
1.30	-6.0	-0.269	0.0670	0.1496	0.0489	-0.2220							
	-2.0	-.082	.0497	.1031	.0601	-.2654							
	.1	.000	.0508	.0815	.0654	-.2858							
	2.1	.070	.0554	.0604	.0699	-.3015							
	6.0	.267	.0820	.0114	.0779	-.3321							
	10.0	.467	.1381	-.0305	.0833	-.3430							
	13.9	.658	.2173	-.0734	.0881	-.3556							

TABLE I.- AERODYNAMIC CHARACTERISTICS WITH THE WING ON - Concluded

(i) BW

M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m
0.70	-6.3	-0.307	0.0378	0.0591	1.00	-5.9	-0.338	0.0483	0.0980	1.30	-6.1	-0.286	0.0400	0.0840	1.90	-6.0	-0.207	0.0315	0.0573
	-4.3	-.200	.0206	.0389		-3.8	-.212	.0253	.0615		-4.0	-.185	.0236	.0541		-4.0	-.138	.0204	.0385
	-2.3	-.099	.0117	.0195		-1.8	-.094	.0191	.0266		-2.0	-.086	.0150	.0250		-1.9	-.068	.0136	.0196
	-0.8	-.040	.0095	.0108		-0.3	-.021	.0145	.0075		-0.5	-.024	.0131	.0073		-0.5	-.019	.0118	.0065
	-0.3	-.018	.0087	.0073		.2	.010	.0172	-.0008		-0.1	.000	.0130	.0009		.1	-.002	.0117	.0021
	.2	.004	.0091	.0041		.7	.031	.0147	-.0061		.5	.018	.0131	-.0042		.5	.015	.0118	-.0025
	1.7	.065	.0101	-.0065		2.1	.110	.0179	-.0286		2.0	.089	.0154	-.0240		2.0	.069	.0137	-.0169
	3.7	.162	.0165	-.0249		4.1	.233	.0346	-.0625		3.9	.183	.0229	-.0517		4.0	.138	.0202	-.0356
	5.7	.264	.0305	-.0435		6.2	.348	.0489	-.0967		6.0	.282	.0389	-.0810		6.0	.204	.0312	-.0534
	7.8	.376	.0534	-.0641		8.2	.471	.0799	-.1321		8.0	.379	.0612	-.1086		8.0	.266	.0464	-.0719
	9.8	.489	.0845	-.0832		10.2	.584	.1150	-.1623		10.0	.475	.0906	-.1361		10.1	.334	.0673	-.0878
	11.7	.602	.1229	-.1034		12.1	.694	.1589	-.1925		12.0	.564	.1253	-.1617		12.0	.394	.0911	-.1033
	13.7	.715	.1700	-.1239		14.2	.799	.2107	-.2224		13.9	.653	.1659	-.1873		14.0	.456	.1199	-.1187
	15.7	.829	.2259	-.1420		16.2	.906	.2707	-.2530		16.0	.738	.2131	-.2113		16.0	.514	.1527	-.1313
	17.7	.934	.2861	-.1577		18.2	.997	.3351	-.2796		18.0	.820	.2662	-.2340		18.0	.573	.1912	-.1427
0.90	-6.0	-0.326	0.0399	0.0739	1.05	-6.0	-0.328	0.0470	0.0936	1.50	-6.2	-0.260	0.0374	0.0759	2.22	-5.8	-0.173	0.0274	0.0452
	-4.0	-.206	.0211	.0454		-3.9	-.209	.0281	.0598		-4.2	-.174	.0230	.0505		-3.8	-.114	.0177	.0297
	-2.0	-.097	.0119	.0220		-1.9	-.099	.0188	.0284		-2.1	-.085	.0148	.0239		-1.7	-.050	.0122	.0129
	-0.5	-.031	.0096	.0106		-0.4	-.021	.0158	.0101		-0.6	-.024	.0125	.0069		-0.2	-.006	.0109	.0019
	0.0	-.010	.0094	.0065		.1	-.003	.0156	.0045		-0.2	-.005	.0123	.0020		.3	.009	.0109	-.0020
	.2	.025	.0165	.0016		.5	.021	.0158	-.0028		.4	.015	.0123	-.0037		.7	.024	.0111	-.0055
	2.0	.084	.0108	-.0118		2.0	.109	.0190	-.0269		1.8	.078	.0143	-.0217		2.2	.070	.0131	-.0177
	4.0	.190	.0202	-.0352		4.1	.227	.0294	-.0626		3.8	.163	.0213	-.0467		4.2	.130	.0195	-.0333
	6.0	.305	.0371	-.0618		6.1	.350	.0494	-.0997		5.9	.248	.0345	-.0711		6.2	.187	.0298	-.0483
	8.0	.436	.0657	-.0942		8.1	.465	.0764	-.1295		7.9	.335	.0547	-.0960		8.3	.244	.0443	-.0629
	10.0	.556	.1008	-.1242		10.1	.563	.1106	-.1557		9.9	.415	.0799	-.1191		10.2	.297	.0615	-.0753
	12.0	.683	.1476	-.1601		12.0	.664	.1524	-.1870		11.9	.494	.1101	-.1411		12.2	.351	.0834	-.0881
	14.0	.804	.2018	-.1939		14.1	.775	.2045	-.2188		13.8	.571	.1454	-.1631		14.2	.406	.1091	-.0995
	16.0	.936	.2699	-.2343		16.1	.870	.2599	-.2468		15.9	.649	.1877	-.1842		16.2	.463	.1399	-.1106
	18.0	.933	.3039	-.2045							17.9	.719	.2333	-.2017		18.2	.514	.1747	-.1207
0.95	-5.9	-0.344	0.0444	0.0943	1.10	-6.0	-0.322	0.0459	0.0966	1.70	-6.3	-0.236	0.0357	0.0674					
	-4.0	-.224	.0246	.0600		-4.0	-.203	.0277	.0642		-4.3	-.162	.0229	.0465					
	-1.9	-.106	.0133	.0287		-2.0	-.088	.0177	.0285		-2.2	-.078	.0147	.0225					
	-0.4	-.031	.0113	.0106		-0.5	-.018	.0153	.0088		-0.8	-.027	.0126	.0061					
	.1	-.002	.0098	.0040		-0.0	.007	.0156	.0022		-0.2	-.007	.0123	.0028					
	.5	.022	.0106	-.0006		.5	.028	.0157	-.0031		.3	.012	.0125	-.0024					
	2.1	.104	.0136	-.0220		2.0	.106	.0179	-.0252		1.8	.068	.0141	-.0180					
	4.1	.221	.0250	-.0537		4.0	.216	.0282	-.0585		3.8	.144	.0205	-.0396					
	6.1	.345	.0456	-.0882		6.0	.329	.0453	-.0932		5.8	.219	.0319	-.0604					
	8.1	.476	.0752	-.1251		8.0	.452	.0725	-.1297		7.8	.294	.0494	-.0809					
	10.1	.592	.1139	-.1565		10.0	.555	.1052	-.1525		9.8	.365	.0711	-.1007					
	12.1	.706	.1591	-.1885		11.9	.638	.1427	-.1721		11.8	.432	.0974	-.1190					
	14.1	.825	.2163	-.2248		14.0	.751	.1956	-.2129		13.7	.498	.1277	-.1369					
	16.1	.936	.2790	-.2578		16.0	.843	.2499	-.2405		15.8	.567	.1646	-.1544					
	18.1	1.044	.3479	-.2887		18.0	.933	.3114	-.2665		17.8	.632	.2054	-.1685					

TABLE II.- AERODYNAMIC CHARACTERISTICS WITH THE WING OFF

(a) BV

M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m
0.70	-6.3	-0.007	0.0068	-0.0127	1.00	-5.8	-0.008	0.0095	-0.0134	1.30	-6.0	-0.010	0.0099	-0.0125	1.90	-6.0	-0.016	0.0103	-0.0106
	-4.3	-.003	.0064	-.0092		-3.8	-.007	.0089	-.0089		-4.0	-.005	.0088	-.0090		-3.8	-.011	.0089	-.0062
	-2.2	-.002	.0060	-.0051		-1.8	-.007	.0086	-.0044		-1.9	-.001	.0084	-.0048		-1.8	-.006	.0081	-.0024
	-0.7	.000	.0057	-.0018		-0.3	-.003	.0073	-.0015		-0.5	.000	.0082	-.0017		-0.5	-.003	.0079	-.0000
	-0.2	.001	.0057	-.0008		.2	-.001	.0075	-.0008		0.0	.001	.0082	-.0005		.2	-.003	.0079	.0016
	.3	.002	.0055	.0002		.8	-.001	.0069	.0012		.6	.001	.0081	.0004		.6	-.004	.0077	.0026
	1.7	.003	.0055	.0039		2.2	-.000	.0070	.0033		2.0	.004	.0073	.0037		2.0	-.001	.0076	.0058
	3.8	.004	.0057	.0082		4.3	.003	.0073	.0095		4.1	.007	.0081	.0082		4.1	.004	.0079	.0102
	5.7	.007	.0056	.0122		6.2	.005	.0074	.0137		6.0	.008	.0084	.0120		6.0	.008	.0083	.0139
	7.8	.011	.0072	.0158		8.2	.010	.0089	.0176		8.0	.013	.0093	.0157		8.1	.015	.0095	.0178
	9.8	.015	.0076	.0192		10.2	.015	.0097	.0213		10.1	.019	.0107	.0197		10.1	.024	.0114	.0216
	11.8	.021	.0083	.0231		12.3	.021	.0092	.0255		12.0	.027	.0130	.0239		12.1	.035	.0145	.0257
	13.8	.029	.0102	.0269		14.2	.028	.0120	.0298		14.1	.035	.0162	.0285		14.1	.048	.0192	.0298
	15.8	.036	.0126	.0310		16.3	.036	.0154	.0354		16.1	.047	.0199	.0333		16.2	.066	.0268	.0354
	17.9	.043	.0159	.0363		18.3	.047	.0191	.0400		18.1	.059	.0247	.0385		18.2	.087	.0353	.0415
0.90	-6.0	-0.008	0.0069	-0.0129	1.05	-6.0	-0.012	0.0144	-0.0120	1.50	-6.1	-0.011	0.0099	-0.0124	2.22	-5.7	-0.016	0.0092	-0.0100
	-3.9	-.004	.0062	-.0089		-3.9	-.008	.0119	-.0082		-4.1	-.006	.0083	-.0089		-3.6	-.010	.0081	-.0061
	-1.9	-.000	.0060	-.0050		-1.9	-.006	.0120	-.0038		-2.0	-.002	.0080	-.0049		-1.7	-.007	.0073	-.0021
	-0.5	.001	.0057	-.0019		-0.4	-.005	.0102	.0002		-0.6	-.001	.0080	-.0017		-0.2	-.002	.0070	.0004
	.1	.001	.0053	-.0003		.1	-.005	.0119	.0008		-0.1	.000	.0079	-.0005		.3	-.003	.0070	.0018
	.5	.002	.0054	.0005		.7	-.001	.0115	.0011		.5	.001	.0077	.0004		.8	-.001	.0070	.0031
	2.0	.003	.0053	.0039		2.0	-.002	.0112	.0050		1.8	.003	.0077	.0034		2.2	.001	.0069	.0057
	4.1	.005	.0054	.0086		4.2	.002	.0098	.0098		4.0	.005	.0078	.0084		4.3	.005	.0069	.0102
	6.0	.009	.0058	.0120		6.1	.004	.0106	.0140		5.9	.010	.0084	.0121		6.3	.011	.0080	.0140
	8.0	.012	.0065	.0160		8.1	.009	.0114	.0172		7.9	.014	.0090	.0159		8.3	.017	.0093	.0176
	10.1	.019	.0078	.0194		10.2	.014	.0108	.0217		9.9	.020	.0107	.0198		10.3	.028	.0119	.0214
	12.1	.024	.0091	.0235		12.1	.021	.0145	.0245		11.9	.028	.0126	.0238		12.3	.041	.0157	.0247
	14.1	.031	.0117	.0276		14.1	.029	.0157	.0294		13.9	.038	.0163	.0283		14.3	.058	.0213	.0294
	16.1	.038	.0140	.0321		16.2	.039	.0190	.0340		16.0	.050	.0210	.0338		16.4	.075	.0289	.0347
	18.1	.048	.0176	.0373		18.2	.048	.0226	.0398		18.0	.065	.0276	.0391		18.4	.093	.0372	.0395
0.95	-5.9	-0.006	0.0074	-0.0136	1.10	-6.1	-0.013	0.0132	-0.0116	1.70	-6.2	-0.012	0.0106	-0.0119					
	-3.9	-.002	.0057	-.0102		-3.9	-.010	.0122	-.0077		-4.1	-.009	.0092	-.0077					
	-1.8	.000	.0063	-.0055		-1.9	-.006	.0109	-.0036		-2.1	-.005	.0087	-.0036					
	-0.3	.001	.0053	-.0026		-0.5	-.007	.0111	.0001		-0.7	-.003	.0084	-.0008					
	.2	-.000	.0055	-.0007		.1	-.004	.0106	.0003		-0.2	-.001	.0084	.0002					
	.6	.001	.0060	.0001		.5	-.004	.0103	.0015		.4	-.002	.0082	.0019					
	2.2	.004	.0053	.0045		2.0	-.000	.0101	.0038		1.8	.001	.0081	.0048					
	4.2	.007	.0061	.0089		4.1	.000	.0100	.0096		3.9	.005	.0083	.0091					
	6.1	.007	.0053	.0132		6.0	.003	.0101	.0137		5.8	.009	.0088	.0132					
	8.2	.014	.0068	.0162		8.1	.008	.0107	.0169		7.8	.010	.0084	.0167					
	10.1	.015	.0075	.0212		10.1	.012	.0117	.0206		9.8	.022	.0110	.0210					
	12.1	.023	.0102	.0250		12.0	.021	.0130	.0241		11.8	.032	.0140	.0246					
	14.1	.029	.0106	.0299		14.0	.029	.0147	.0283		13.9	.042	.0177	.0292					
	16.2	.036	.0129	.0358		16.2	.037	.0183	.0334		15.9	.058	.0236	.0342					
	18.3	.045	.0162	.0411		18.1	.047	.0219	.0379		17.9	.076	.0314	.0405					

TABLE II.- AERODYNAMIC CHARACTERISTICS WITH THE WING OFF - Continued

(b) BVC, $\delta = 0^{\circ}$

M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m
0.70	-6.2	-0.038	0.0105	-0.0487	1.00	-5.8	-0.040	0.0137	-0.0494	1.30	-6.0	-0.038	0.0138	-0.0473	1.90	-5.9	-0.037	0.0128	-0.0366
	-4.3	-.024	.0084	-.0333		-3.8	-.025	.0108	-.0323		-4.0	-.025	.0114	-.0319		-3.9	-.025	.0107	-.0238
	-2.2	-.013	.0069	-.0167		-1.8	-.008	.0079	-.0169		-1.9	-.011	.0099	-.0158		-1.9	-.013	.0092	-.0112
	-0.7	-.002	.0065	-.0055		-0.3	.000	.0076	-.0059		-0.5	-.002	.0094	-.0053		-0.5	-.006	.0087	-.0021
	-0.2	.001	.0059	-.0019		.2	.003	.0080	-.0017		0.0	-.000	.0094	-.0024		.2	-.004	.0086	.0013
	.4	.002	.0059	.0006		.7	-.000	.0093	.0006		.5	.001	.0093	.0009		.5	-.002	.0086	.0035
	1.7	.010	.0063	.0102		2.2	.006	.0091	.0123		2.0	.010	.0095	.0104		2.1	.006	.0087	.0126
	3.9	.022	.0076	.0264		4.2	.020	.0110	.0286		4.1	.022	.0105	.0255		4.1	.018	.0097	.0254
	5.8	.035	.0102	.0423		6.3	.032	.0121	.0464		6.0	.035	.0125	.0405		6.1	.029	.0117	.0383
	7.8	.048	.0121	.0591		8.2	.046	.0159	.0629		8.1	.049	.0157	.0568		8.1	.040	.0144	.0508
	9.8	.064	.0164	.0776		10.2	.062	.0177	.0825		10.1	.063	.0200	.0730		10.0	.052	.0181	.0628
	11.8	.078	.0221	.0963		12.3	.076	.0233	.1006		12.1	.076	.0257	.0881		12.1	.066	.0238	.0740
	13.8	.093	.0278	.1142		14.2	.090	.0303	.1163		14.1	.089	.0320	.1025		14.1	.083	.0310	.0838
	15.8	.107	.0359	.1327		16.3	.104	.0383	.1362		16.1	.103	.0395	.1157		16.2	.102	.0402	.0935
	17.8	.125	.0446	.1531		18.3	.118	.0455	.1537		18.1	.122	.0497	.1313		18.1	.124	.0516	.1043
0.90	-6.0	-0.039	0.0107	-0.0501	1.05	-5.9	-0.041	0.0150	-0.0470	1.50	-6.1	-0.036	0.0134	-0.0440	2.22	-5.8	-0.035	0.0120	-0.0340
	-4.0	-.025	.0082	-.0326		-3.9	-.026	.0139	-.0311		-4.1	-.023	.0109	-.0297		-3.7	-.023	.0099	-.0217
	-1.9	-.010	.0068	-.0158		-1.9	-.009	.0105	-.0158		-2.1	-.012	.0097	-.0156		-1.7	-.012	.0083	-.0100
	-0.5	-.002	.0063	-.0045		-0.4	-.001	.0120	-.0053		-0.6	-.003	.0091	-.0052		-0.2	-.004	.0080	-.0021
	.2	.001	.0062	-.0006		.2	.001	.0098	-.0012		-0.0	.001	.0090	-.0015		.3	-.003	.0078	.0012
	.5	.002	.0063	.0012		.7	-.004	.0126	.0029		.5	.000	.0090	.0019		.7	-.002	.0078	.0033
	2.0	.011	.0066	.0117		2.1	.003	.0077	.0122		1.8	.008	.0090	.0105		2.2	.005	.0082	.0120
	4.1	.024	.0074	.0283		4.1	.018	.0122	.0286		4.0	.021	.0100	.0251		4.3	.017	.0092	.0247
	6.0	.038	.0102	.0457		6.1	.032	.0141	.0444		5.9	.033	.0118	.0384		6.3	.028	.0111	.0361
	8.0	.053	.0132	.0633		8.1	.045	.0170	.0608		8.0	.046	.0151	.0537		8.3	.040	.0137	.0471
	10.1	.071	.0180	.0830		10.2	.059	.0215	.0799		9.9	.058	.0189	.0671		10.2	.051	.0180	.0581
	12.1	.086	.0240	.1017		12.2	.073	.0253	.0972		12.0	.071	.0245	.0814		12.2	.068	.0239	.0668
	14.1	.100	.0308	.1191		14.2	.086	.0334	.1141		13.9	.084	.0306	.0950		14.3	.085	.0315	.0762
	16.1	.116	.0386	.1383		16.2	.102	.0383	.1321		16.0	.100	.0392	.1077		16.3	.106	.0413	.0862
	18.1	.132	.0480	.1554		18.2	.115	.0493	.1498		18.0	.118	.0490	.1207		18.3	.127	.0533	.0962
0.95	-5.9	-0.037	0.0103	-0.0501	1.10	-6.0	-0.041	0.0158	-0.0466	1.70	-6.2	-0.037	0.0140	-0.0412					
	-3.8	-.020	.0073	-.0337		-3.9	-.025	.0142	-.0310		-4.1	-.025	.0114	-.0275					
	-1.8	-.005	.0063	-.0169		-2.0	-.014	.0125	-.0143		-2.1	-.013	.0098	-.0141					
	-0.4	.004	.0062	-.0068		-0.5	-.004	.0118	-.0035		-0.7	-.005	.0094	-.0040					
	.2	.007	.0065	-.0027		.1	-.001	.0120	-.0001		-0.2	-.002	.0093	-.0012					
	.6	.004	.0066	-.0003		.5	-.003	.0117	.0017		.4	-.001	.0093	.0016					
	2.1	.010	.0056	.0115		2.0	.004	.0118	.0130		1.7	.007	.0093	.0104					
	4.2	.022	.0087	.0278		4.1	.016	.0123	.0284		3.8	.019	.0103	.0241					
	6.1	.034	.0097	.0458		6.1	.032	.0142	.0443		5.8	.030	.0121	.0383					
	8.2	.050	.0134	.0641		8.1	.046	.0174	.0602		7.9	.043	.0150	.0524					
	10.2	.066	.0176	.0840		10.1	.059	.0227	.0772		9.9	.056	.0191	.0661					
	12.2	.080	.0233	.1023		12.2	.074	.0282	.0949		11.8	.067	.0240	.0783					
	14.2	.093	.0286	.1217		14.0	.085	.0333	.1104		13.8	.083	.0306	.0901					
	16.2	.109	.0386	.1392		16.1	.099	.0417	.1279		15.9	.100	.0391	.1006					
	18.2	.124	.0459	.1594		18.1	.110	.0506	.1462		17.9	.120	.0495	.1098					

TABLE II.- AERODYNAMIC CHARACTERISTICS WITH THE WING OFF - Continued

(c) BVC, $\delta = 4.7^{\circ}$

M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m
0.70	-6.2	-0.018	0.0077	-0.0260	1.30	-6.0	-0.018	0.0110	-0.0251
	-2.1	.005	.0069	.0012		-1.9	.004	.0098	.0019
	-0.1	.017	.0076	.0160		.1	.017	.0103	.0170
	1.7	.029	.0088	.0312		1.9	.028	.0120	.0301
	5.8	.059	.0157	.0656		6.1	.055	.0180	.0612
	9.7	.089	.0260	.1012		10.0	.080	.0283	.0904
	13.8	.125	.0433	.1402		14.1	.108	.0428	.1202
	17.8	.152	.0617	.1734		18.1	.138	.0624	.1458
0.90	-6.0	-0.017	0.0076	-0.0266	1.70	-6.2	-0.022	0.0115	-0.0235
	-2.0	.004	.0067	.0017		-2.1	.001	.0099	.0021
	.1	.018	.0076	.0178		-0.2	.012	.0104	.0152
	2.0	.032	.0094	.0342		1.8	.023	.0115	.0283
	6.0	.063	.0166	.0691		5.9	.047	.0168	.0551
	10.1	.093	.0278	.1054		9.8	.069	.0258	.0796
	14.0	.125	.0439	.1420		13.9	.097	.0393	.1032
	18.1	.158	.0656	.1769		17.9	.131	.0593	.1226
1.00	-5.8	-0.017	0.0087	-0.0262	2.22	-5.8	-0.020	0.0102	-0.0184
	-1.8	.006	.0086	.0024		-1.7	.001	.0086	.0045
	.2	.018	.0093	.0181		.3	.010	.0088	.0162
	2.2	.031	.0102	.0341		2.2	.021	.0100	.0271
	6.2	.063	.0180	.0687		6.3	.042	.0153	.0497
	10.2	.093	.0297	.1043		10.3	.065	.0239	.0702
	14.3	.123	.0444	.1403		14.3	.097	.0387	.0875
	18.3	.156	.0658	.1718		18.3	.140	.0620	.1073
1.10	-6.1	-0.018	0.0124	-0.0259					
	-1.9	.004	.0121	.0015					
	-0.1	.017	.0122	.0163					
	2.0	.031	.0138	.0318					
	6.0	.059	.0218	.0642					
	10.0	.087	.0327	.0966					
	14.1	.115	.0482	.1318					
	18.1	.145	.0691	.1616					

TABLE II.- AERODYNAMIC CHARACTERISTICS WITH THE WING OFF - Continued

(d) BVC, $\delta = 9.7^{\circ}$

M	α, deg	C_L	C_D	C_m	M	α, deg	C_L	C_D	C_m
0.70	-6.4	-0.005	0.0070	-0.0104	1.30	-6.1	-0.008	0.0110	-0.0085
	-2.1	.018	.0085	.0210		-1.9	.017	.0119	.0201
	-0.2	.031	.0108	.0367		0.0	.028	.0139	.0344
	1.9	.044	.0138	.0534		2.0	.041	.0166	.0480
	5.7	.074	.0230	.0847		6.0	.067	.0253	.0748
	9.8	.107	.0368	.1201		10.0	.091	.0367	.1044
	13.9	.135	.0548	.1563		14.1	.115	.0520	.1310
	17.9	.150	.0697	.1703		18.1	.145	.0731	.1554
0.90	-6.0	-0.005	0.0071	-0.0085	1.70	-6.2	-0.010	0.0111	-0.0072
	-1.9	.022	.0091	.0228		-2.1	.012	.0116	.0184
	0.0	.033	.0113	.0379		-0.2	.022	.0131	.0308
	2.1	.046	.0147	.0552		1.9	.033	.0156	.0430
	6.1	.078	.0247	.0885		5.9	.055	.0225	.0656
	10.1	.108	.0382	.1226		9.9	.078	.0329	.0906
	14.1	.128	.0528	.1477		13.8	.099	.0461	.1112
	18.1	.142	.0652	.1588		17.9	.134	.0674	.1303
1.00	-5.8	-0.005	0.0087	-0.0080	2.22	-5.7	-0.010	0.0102	-0.0032
	-1.8	.020	.0109	.0229		-1.7	.012	.0100	.0187
	.3	.035	.0123	.0392		.3	.021	.0117	.0298
	2.2	.045	.0156	.0544		2.2	.029	.0136	.0397
	6.3	.075	.0253	.0869		6.3	.049	.0200	.0594
	10.2	.106	.0403	.1214		10.3	.070	.0296	.0787
	14.3	.133	.0553	.1525		14.3	.100	.0438	.0945
	18.3	.165	.0771	.1816		18.2	.140	.0674	.1145
1.10	-6.0	-0.008	0.0135	-0.0065					
	-1.9	.018	.0138	.0220					
	.1	.031	.0164	.0385					
	2.0	.042	.0196	.0526					
	6.1	.072	.0293	.0818					
	10.0	.101	.0429	.1130					
	14.1	.123	.0585	.1449					
	18.1	.148	.0795	.1723					

TABLE II.- AERODYNAMIC CHARACTERISTICS WITH THE WING OFF - Concluded

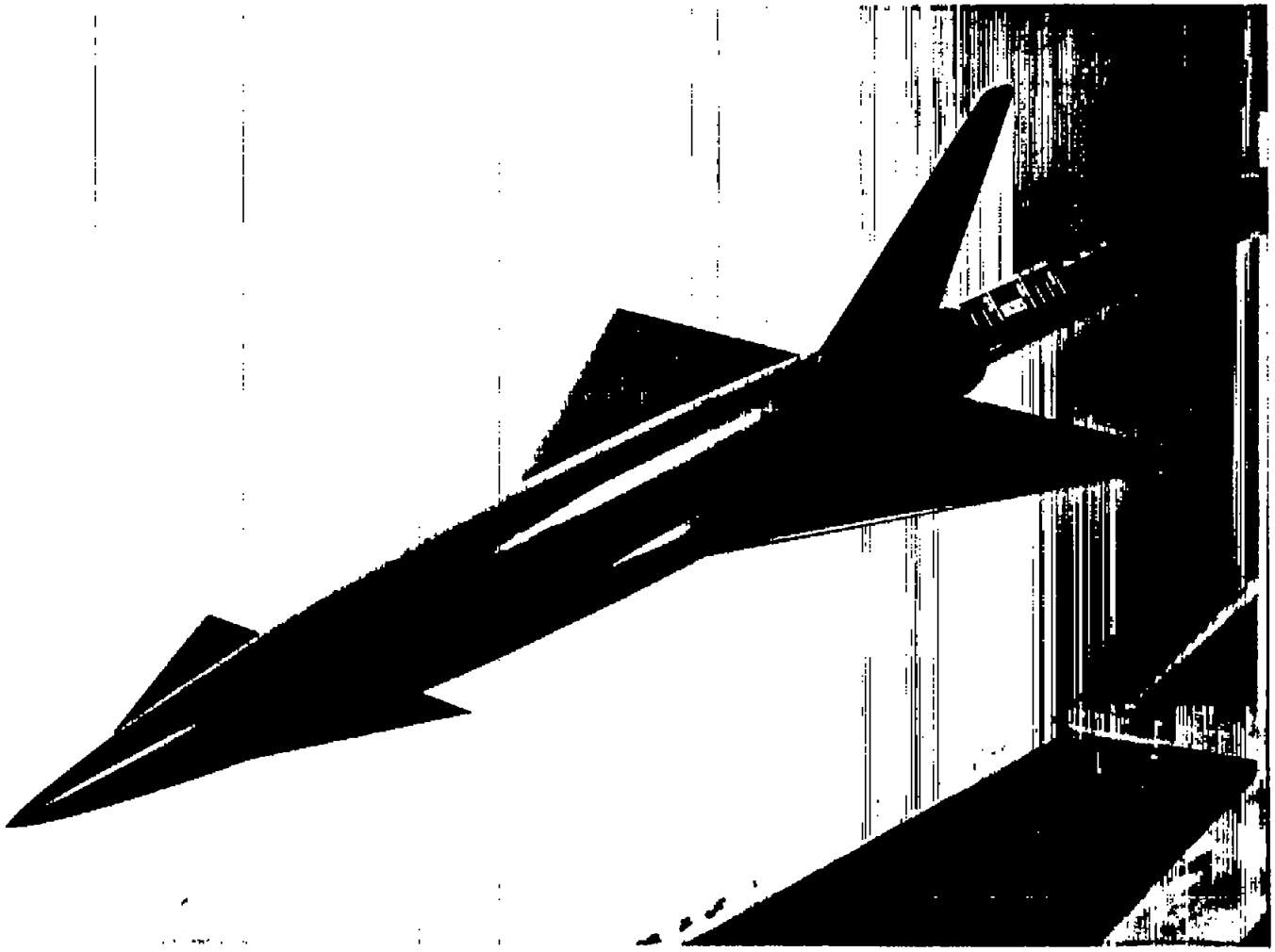
(e) BVC, $\delta = 19.5^{\circ}$

M	α, deg	C_L	C_D	C_m
1.00	-5.8	0.032	0.0146	0.0254
	-1.8	.058	.0221	.0541
	.3	.070	.0277	.0683
	2.1	.078	.0318	.0833
	6.2	.105	.0456	.1119
	10.2	.128	.0611	.1377
	14.4	.140	.0759	.1604
	18.3	.155	.0902	.1809
1.10	-6.0	0.029	0.0194	0.0252
	-1.9	.053	.0258	.0505
	-0.1	.063	.0314	.0642
	1.9	.077	.0367	.0774
	6.0	.099	.0501	.1045
	10.0	.115	.0636	.1303
	14.1	.132	.0799	.1536
	18.1	.142	.0937	.1703
1.30	-6.0	0.023	0.0166	0.0220
	-2.0	.045	.0222	.0465
	.1	.056	.0265	.0596
	2.0	.066	.0312	.0723
	6.0	.087	.0426	.0967
	9.9	.105	.0554	.1199
	14.0	.125	.0715	.1432
	18.2	.140	.0883	.1610
1.70	-6.2	0.015	0.0162	0.0182
	-2.2	.036	.0202	.0392
	-0.2	.045	.0235	.0496
	1.8	.055	.0276	.0619
	5.8	.074	.0368	.0819
	9.8	.088	.0484	.1017
	13.8	.108	.0630	.1214
	17.9	.134	.0842	.1434
2.22	-5.7	0.011	0.0150	0.0177
	-1.7	.031	.0177	.0356
	.3	.040	.0208	.0454
	2.2	.045	.0240	.0539
	6.3	.061	.0322	.0721
	10.3	.079	.0433	.0895
	14.3	.103	.0589	.1084
	18.4	.142	.0840	.1299

(f) BVC, $\delta = 29.6^{\circ}$

M	α, deg	C_L	C_D	C_m
1.00	-5.8	0.057	0.0346	0.0590
	-3.1	.078	.0407	.0838
	.2	.084	.0519	.0948
	2.3	.090	.0571	.1042
	6.2	.097	.0642	.1173
	10.1	.109	.0743	.1329
	14.3	.124	.0862	.1495
	18.3	.135	.1016	.1696
1.10	-6.0	0.051	0.0395	0.0568
	-3.2	.069	.0438	.0794
	.1	.076	.0548	.0890
	2.0	.082	.0597	.0984
	6.0	.090	.0687	.1131
	10.0	.100	.0788	.1274
	14.1	.112	.0905	.1445
	18.2	.127	.1037	.1597
1.30	-6.1	0.043	0.0330	0.0479
	-1.8	.062	.0420	.0710
	.1	.070	.0469	.0810
	2.0	.079	.0521	.0889
	6.1	.090	.0632	.1076
	9.9	.099	.0730	.1228
	14.0	.110	.0854	.1417
	18.1	.129	.1028	.1625
1.70	-6.2	0.030	0.0298	0.0375
	-2.2	.047	.0365	.0570
	-0.2	.054	.0402	.0653
	1.8	.060	.0450	.0758
	5.8	.075	.0555	.0931
	9.8	.089	.0678	.1103
	13.8	.105	.0832	.1301
	17.9	.131	.1049	.1496
2.22	-5.8	0.021	0.0272	0.0322
	-1.7	.041	.0322	.0501
	.3	.048	.0359	.0587
	2.3	.053	.0399	.0675
	6.3	.066	.0492	.0819
	10.3	.083	.0625	.1008
	14.3	.106	.0809	.1223
	18.5	.138	.1063	.1402

[redacted]



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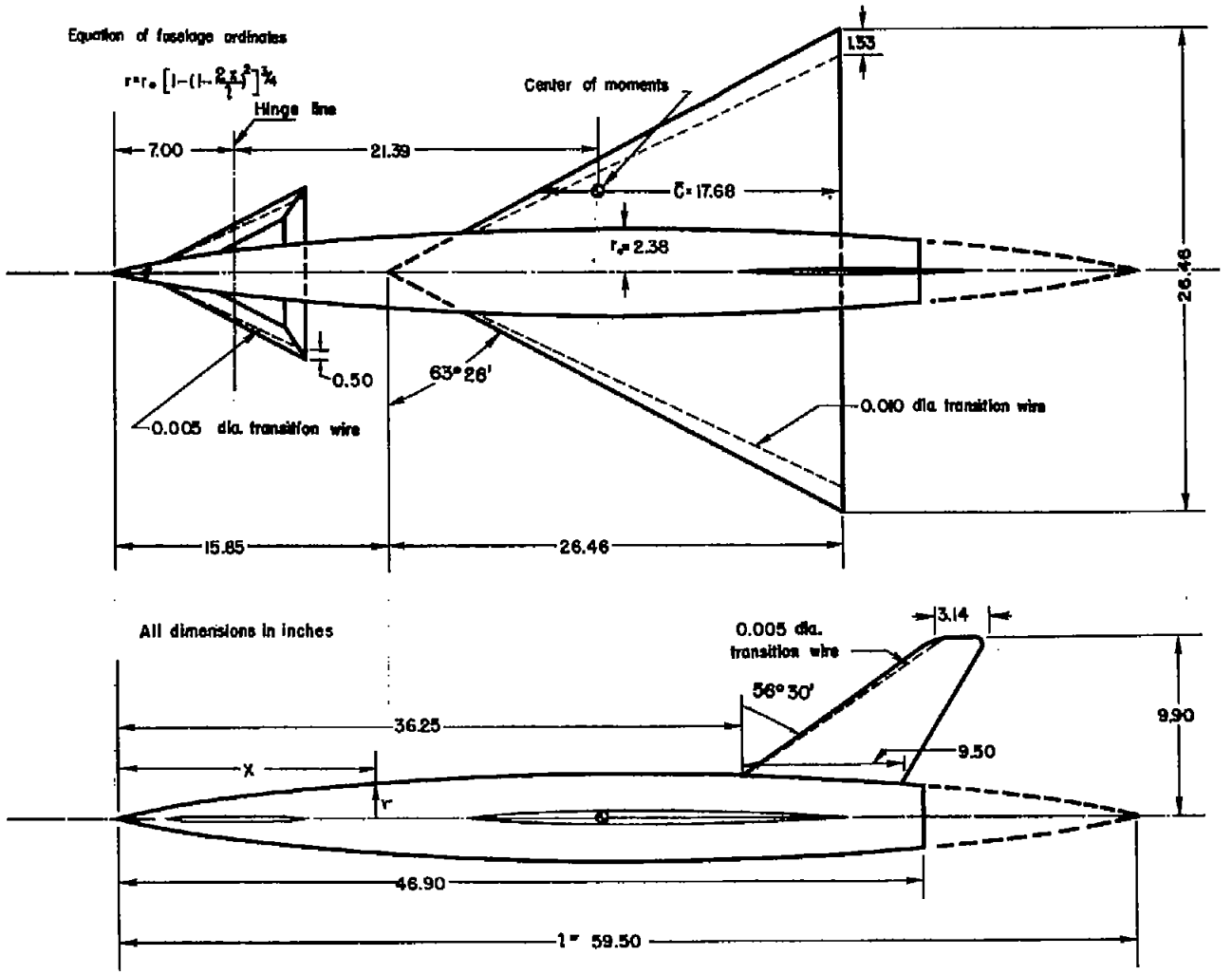
(a) Photograph of model.

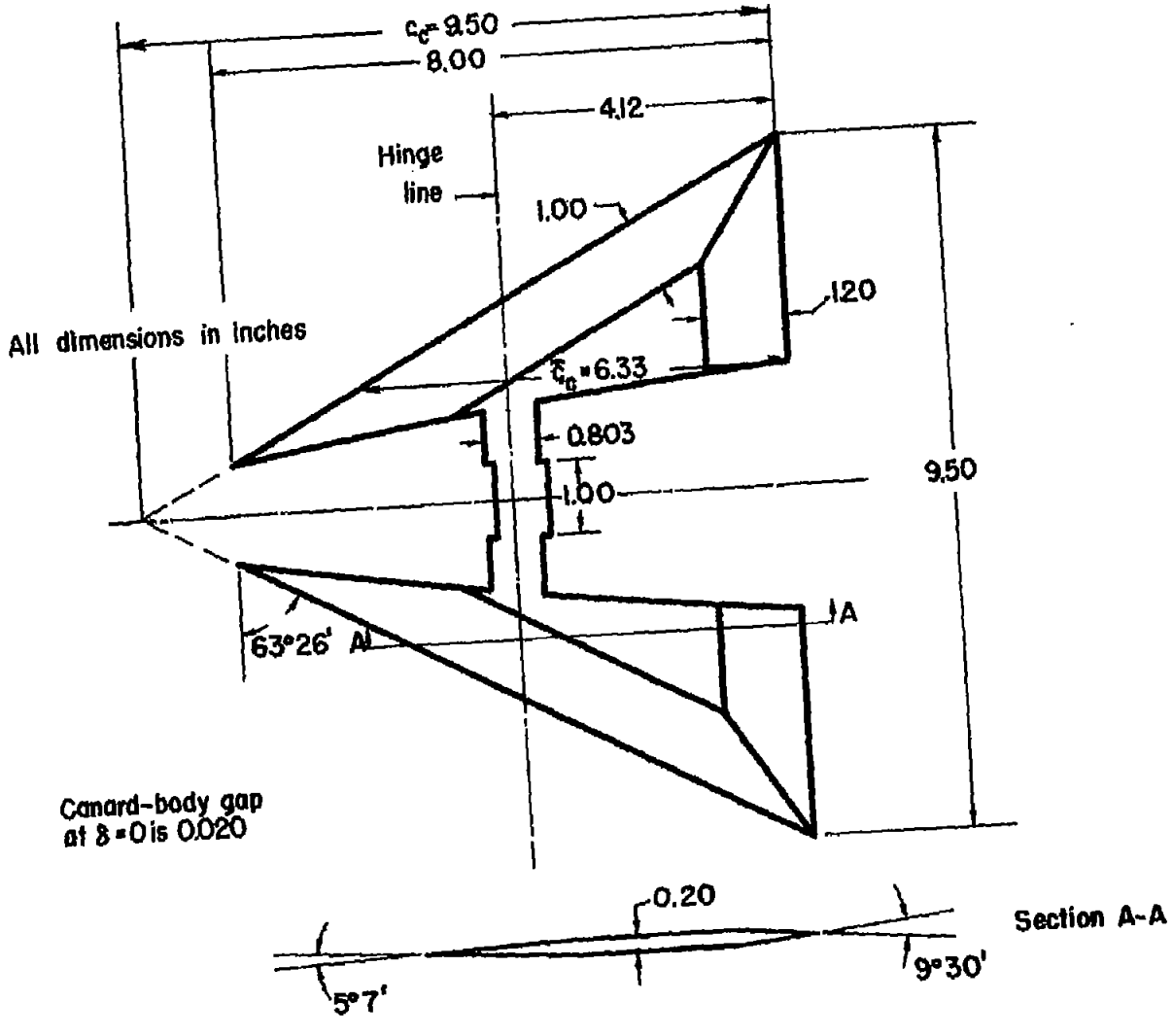
Figure 1.- Model details and dimensions.

[redacted]



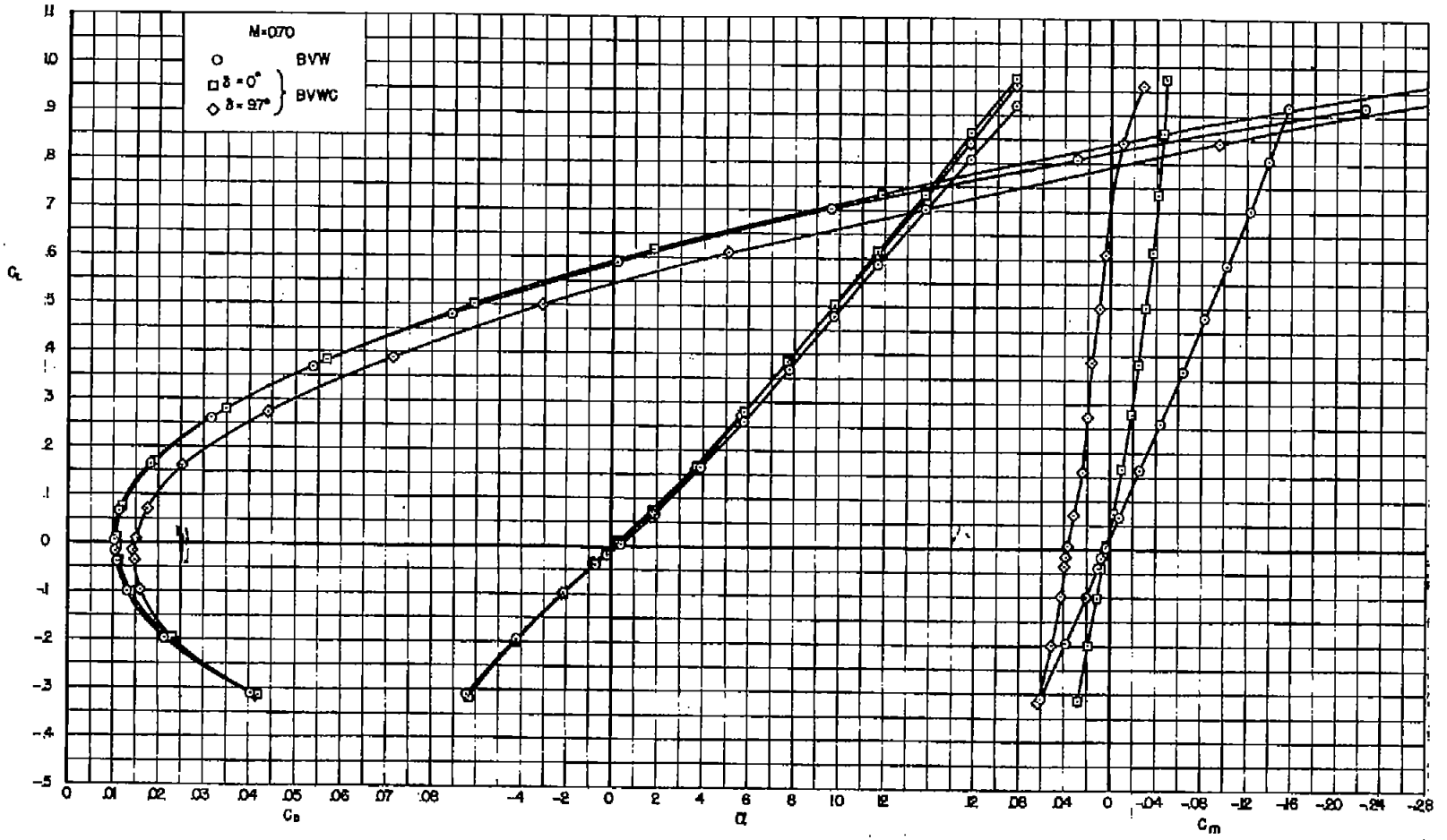
(b) Dimensional sketch of complete model.

Figure 1.- Continued.



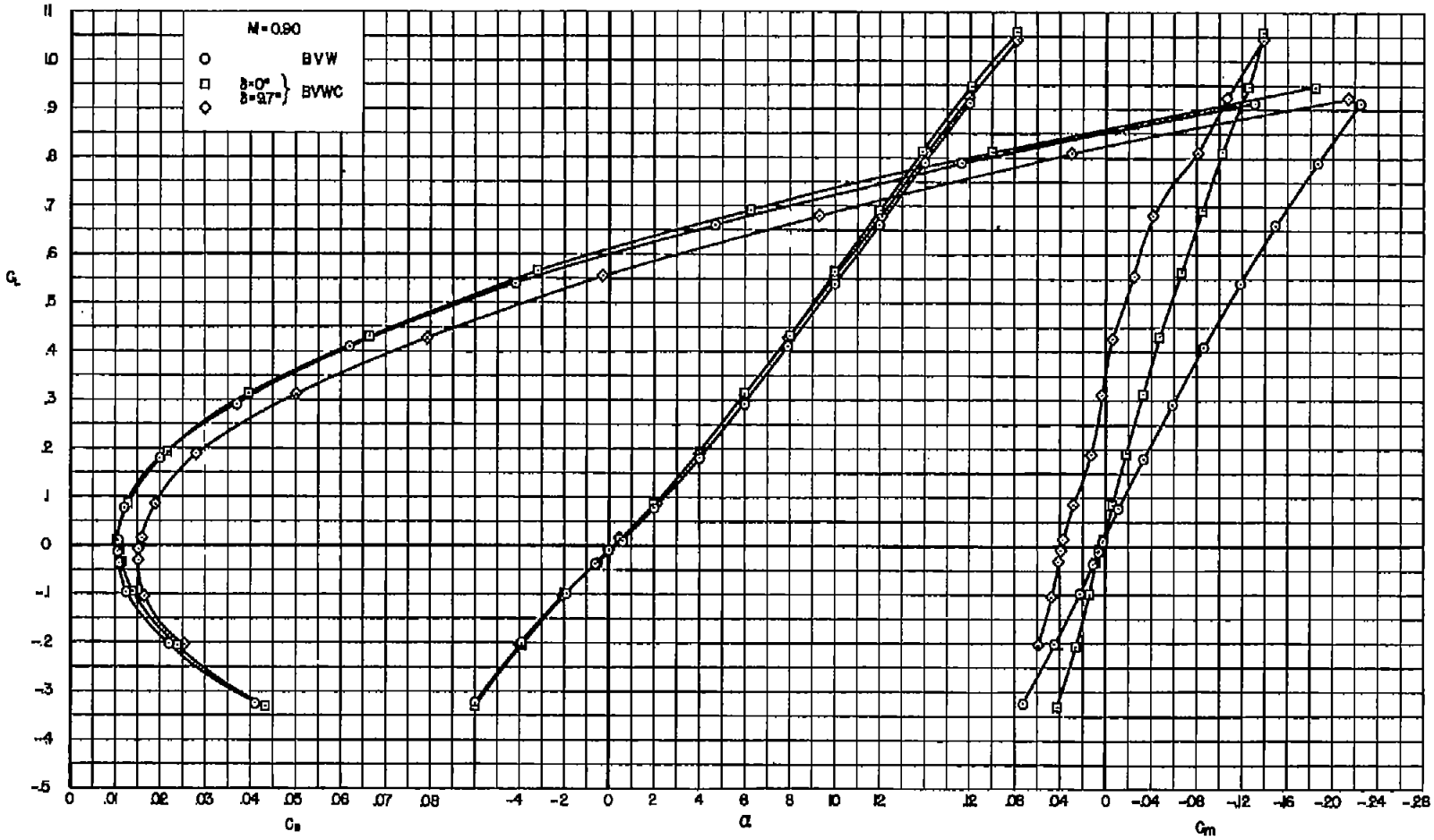
(c) Details of canard surface.

Figure 1.- Concluded.



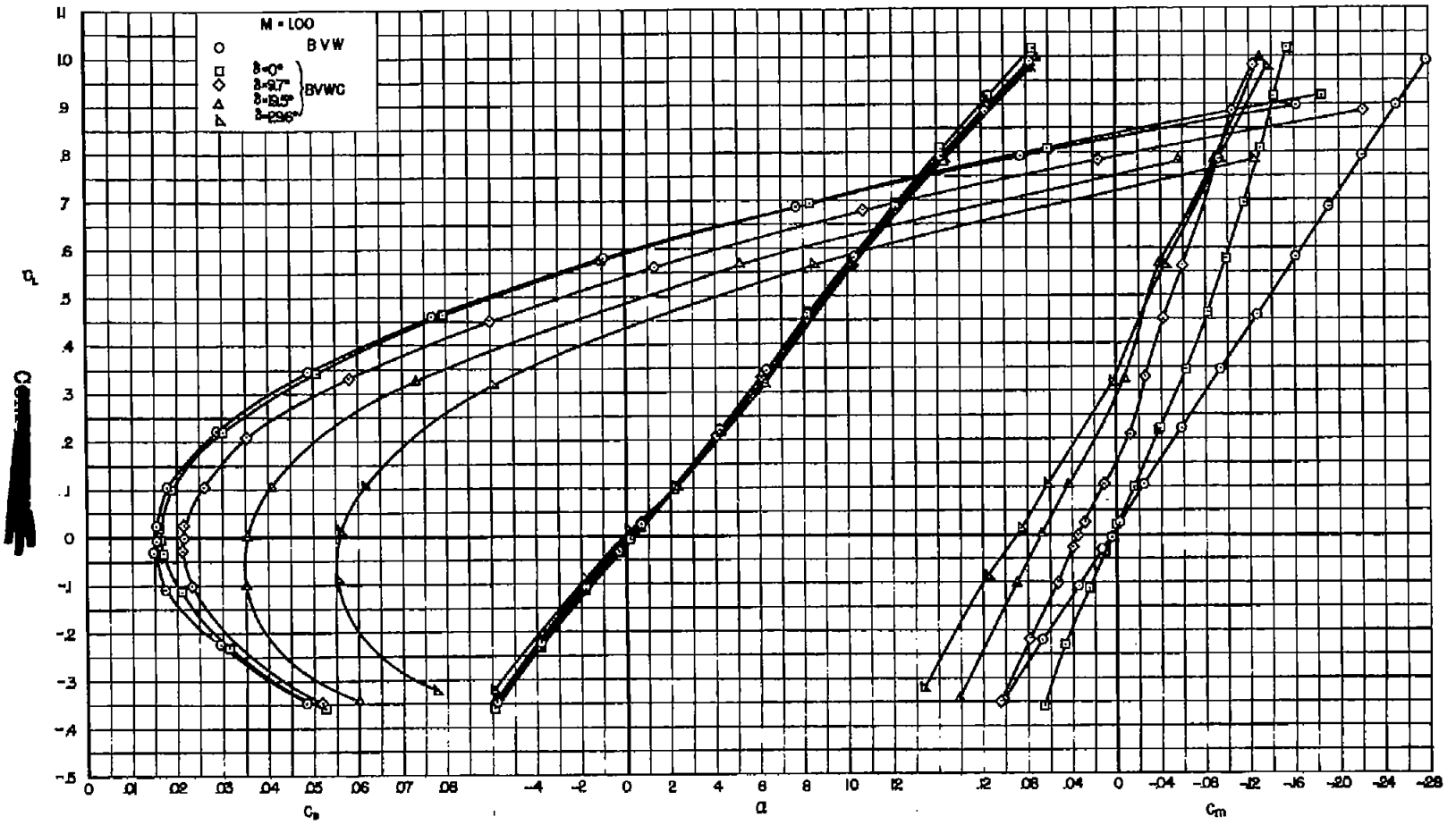
(a) M = 0.70

Figure 2.- Lift, drag, and pitching-moment characteristics with the canard on and off.



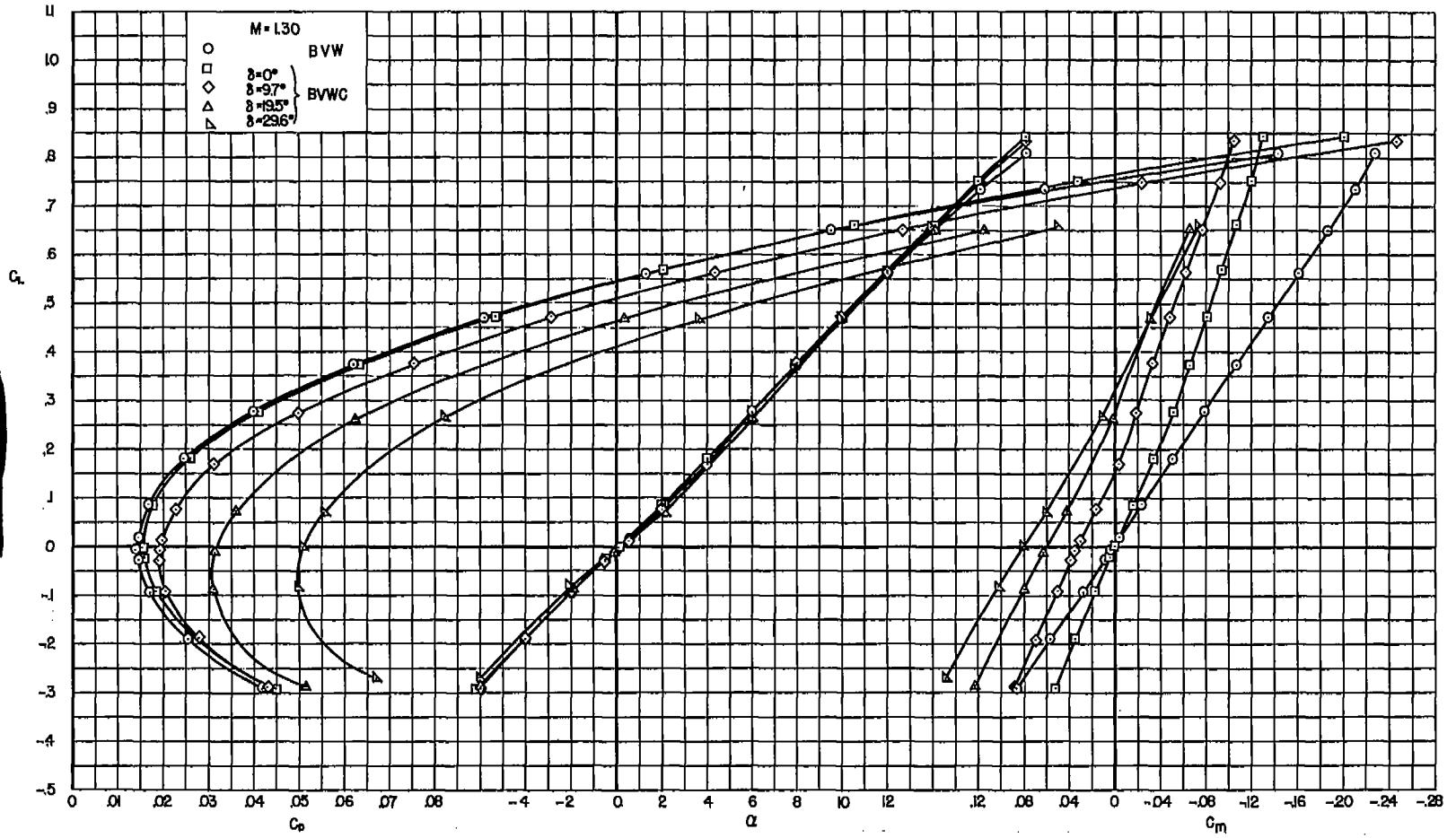
(b) M = 0.90

Figure 2.- Continued.



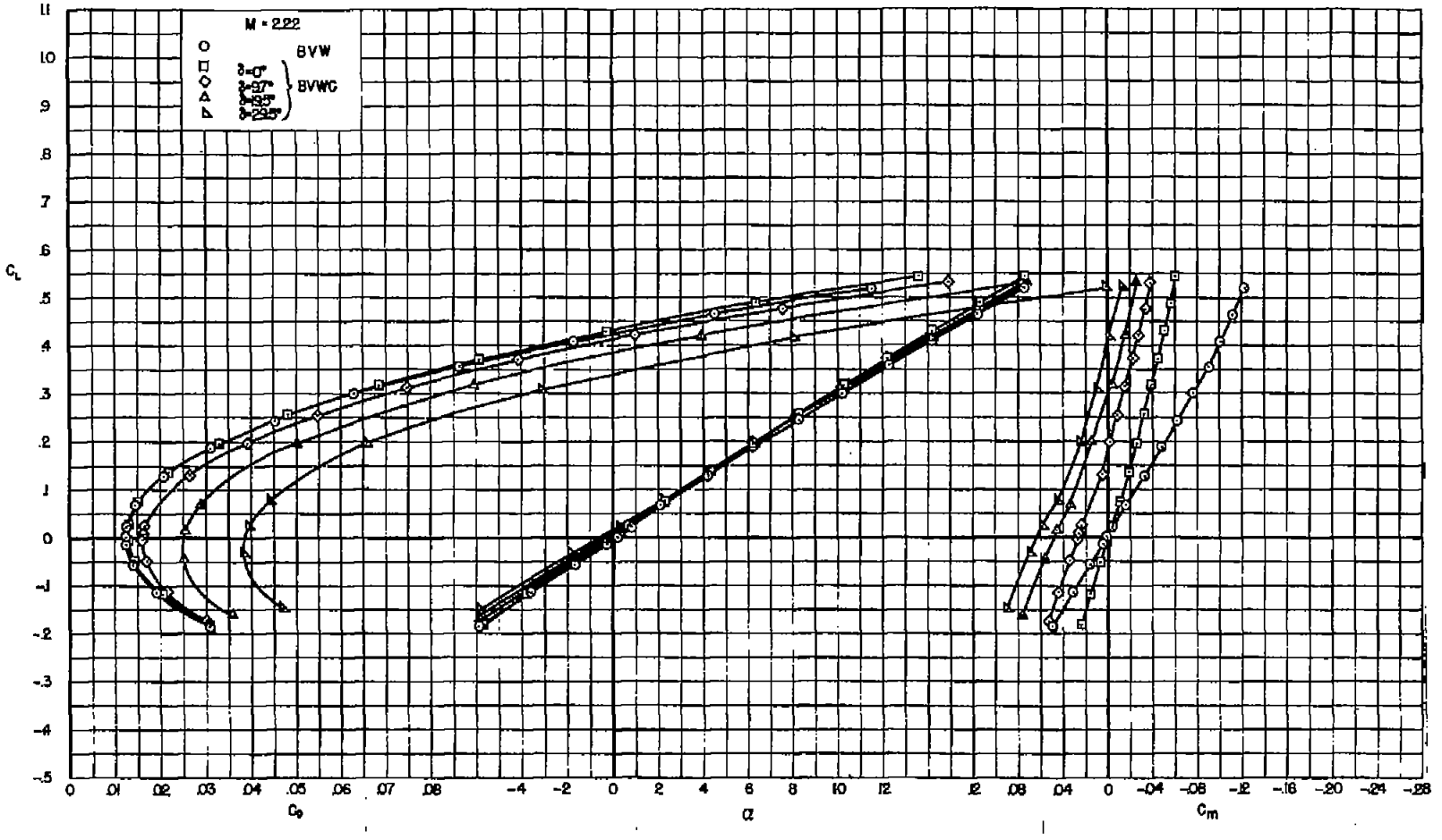
(c) M = 1.00

Figure 2.- Continued.



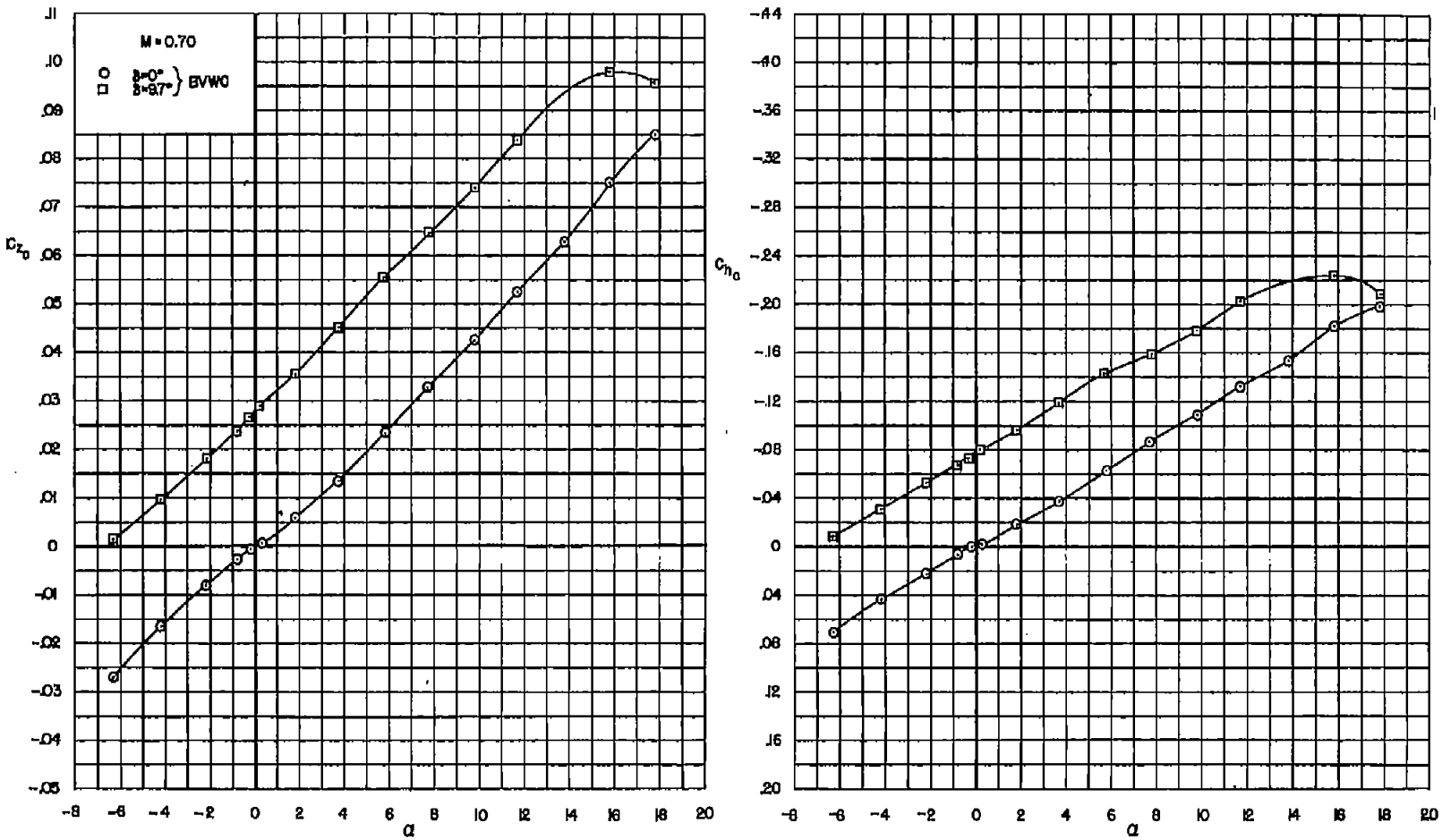
(d) M = 1.30

Figure 2.- Continued.



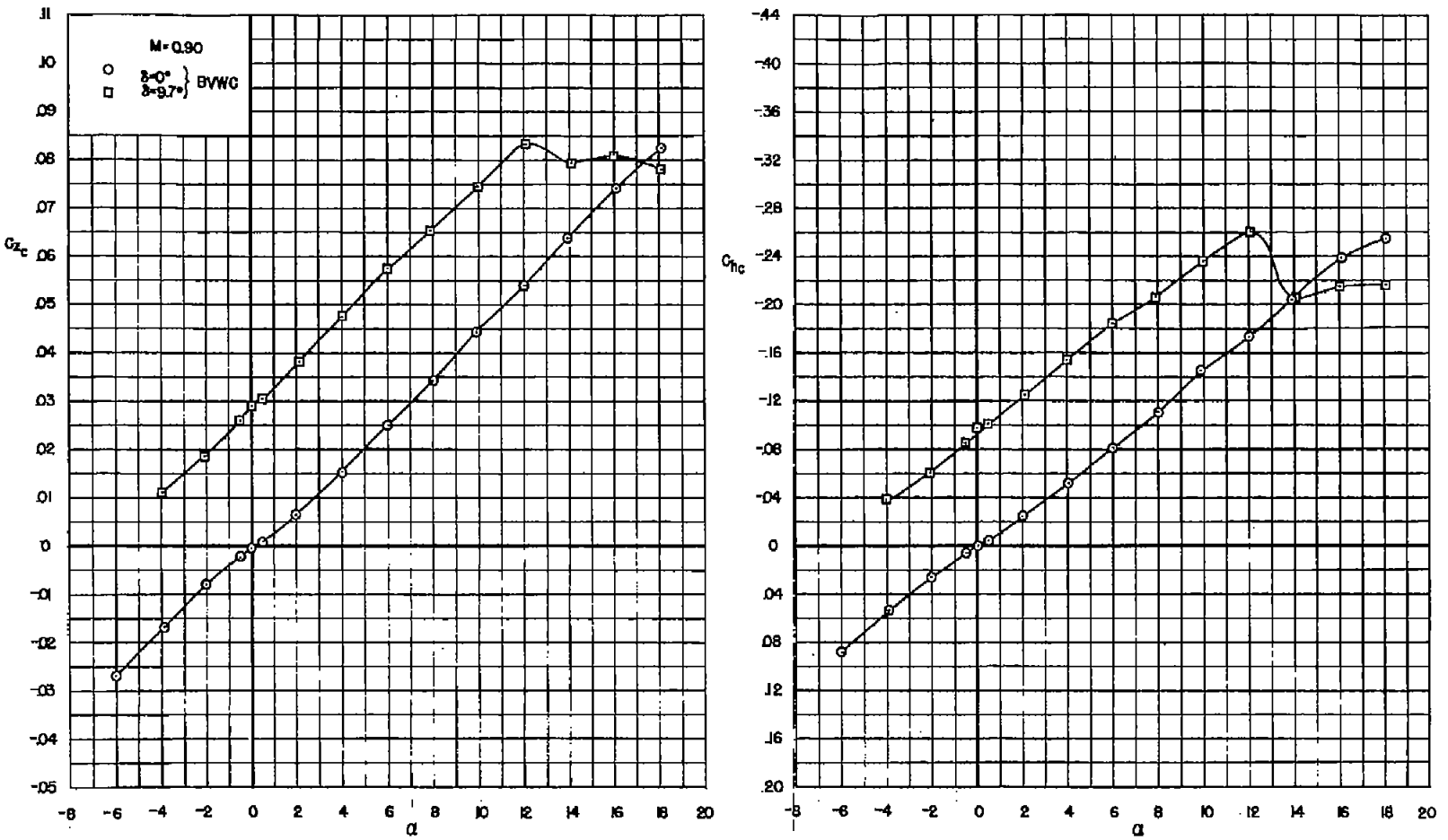
(e) M = 2.22

Figure 2.- Concluded.



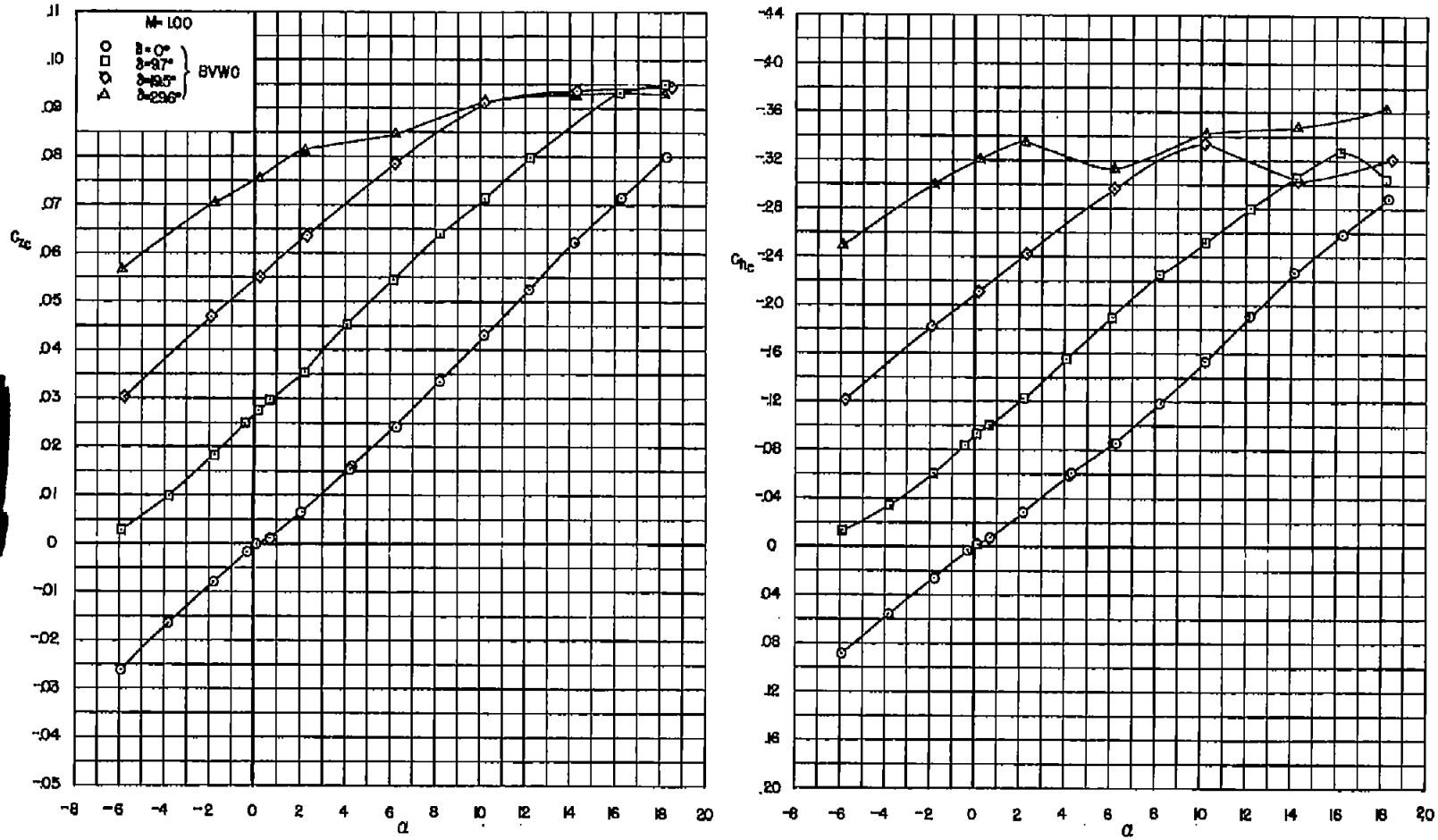
(a) M = 0.70

Figure 3.- Variation of canard normal forces and hinge moments as a function of angle of attack at constant canard deflection angles.



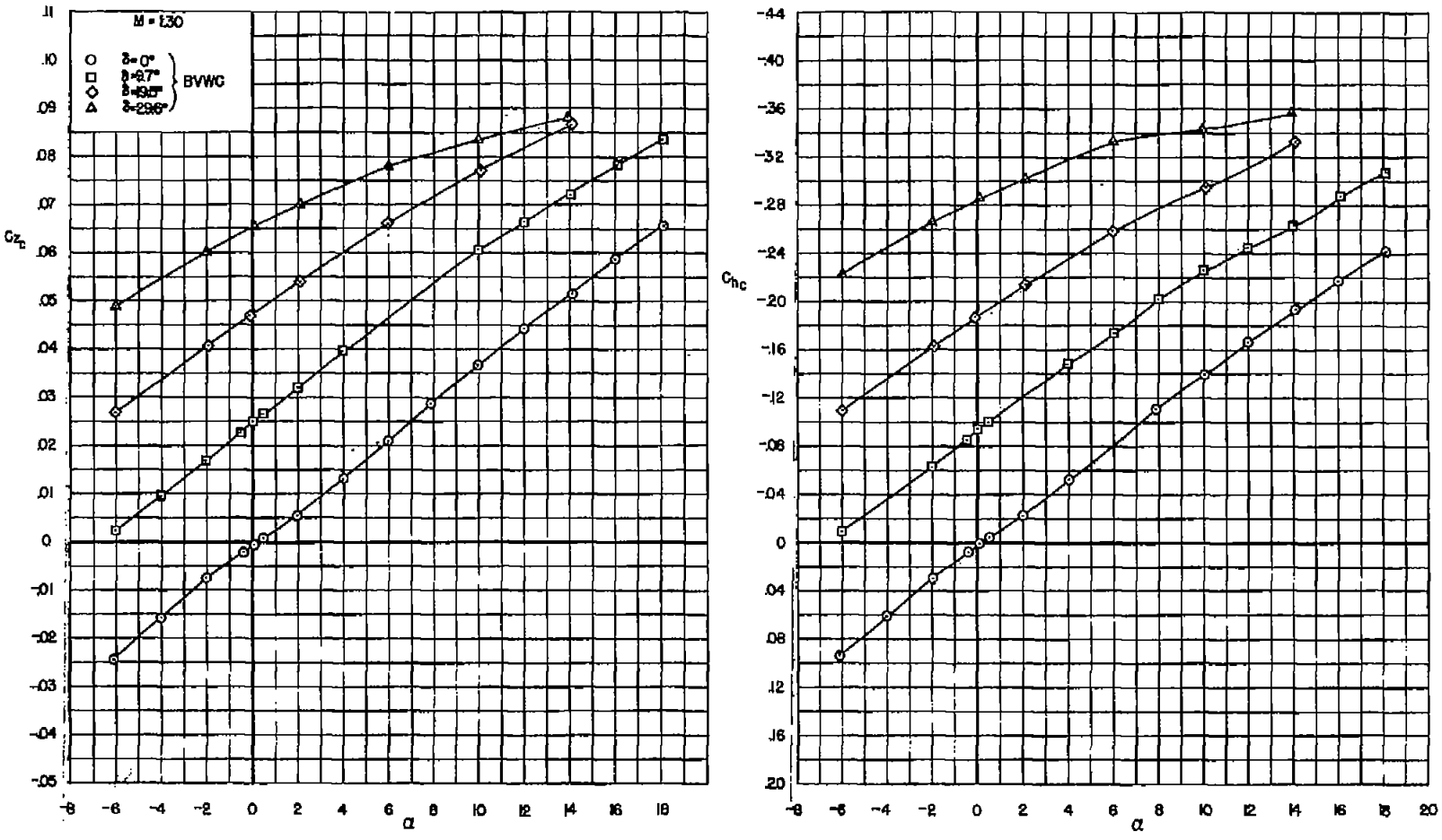
(b) M = 0.90

Figure 3.- Continued.



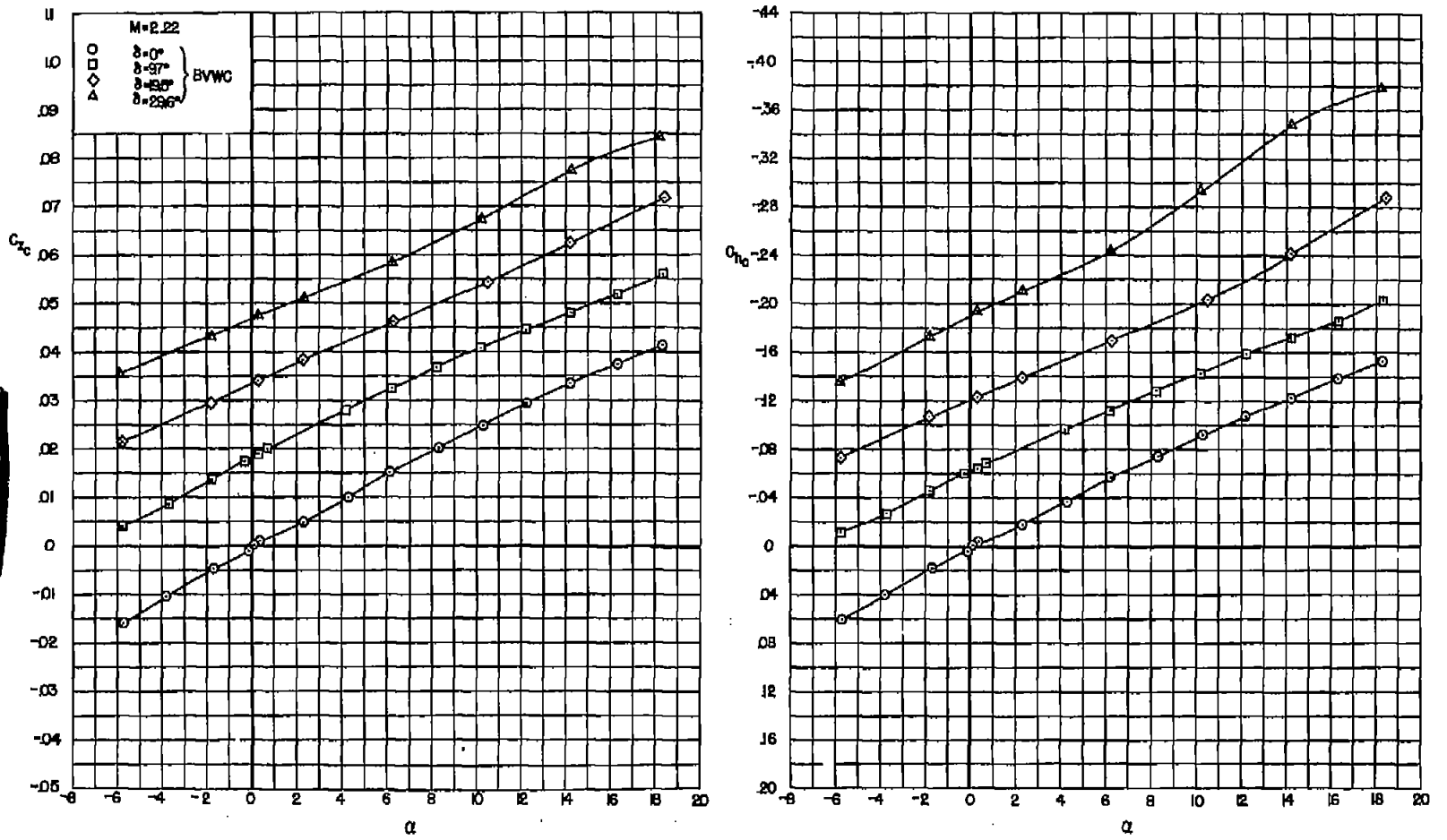
(c) M = 1.00

Figure 3.- Continued.



(d) M = 1.30

Figure 3.- Continued.



(e) M = 2.22

Figure 3.- Concluded.

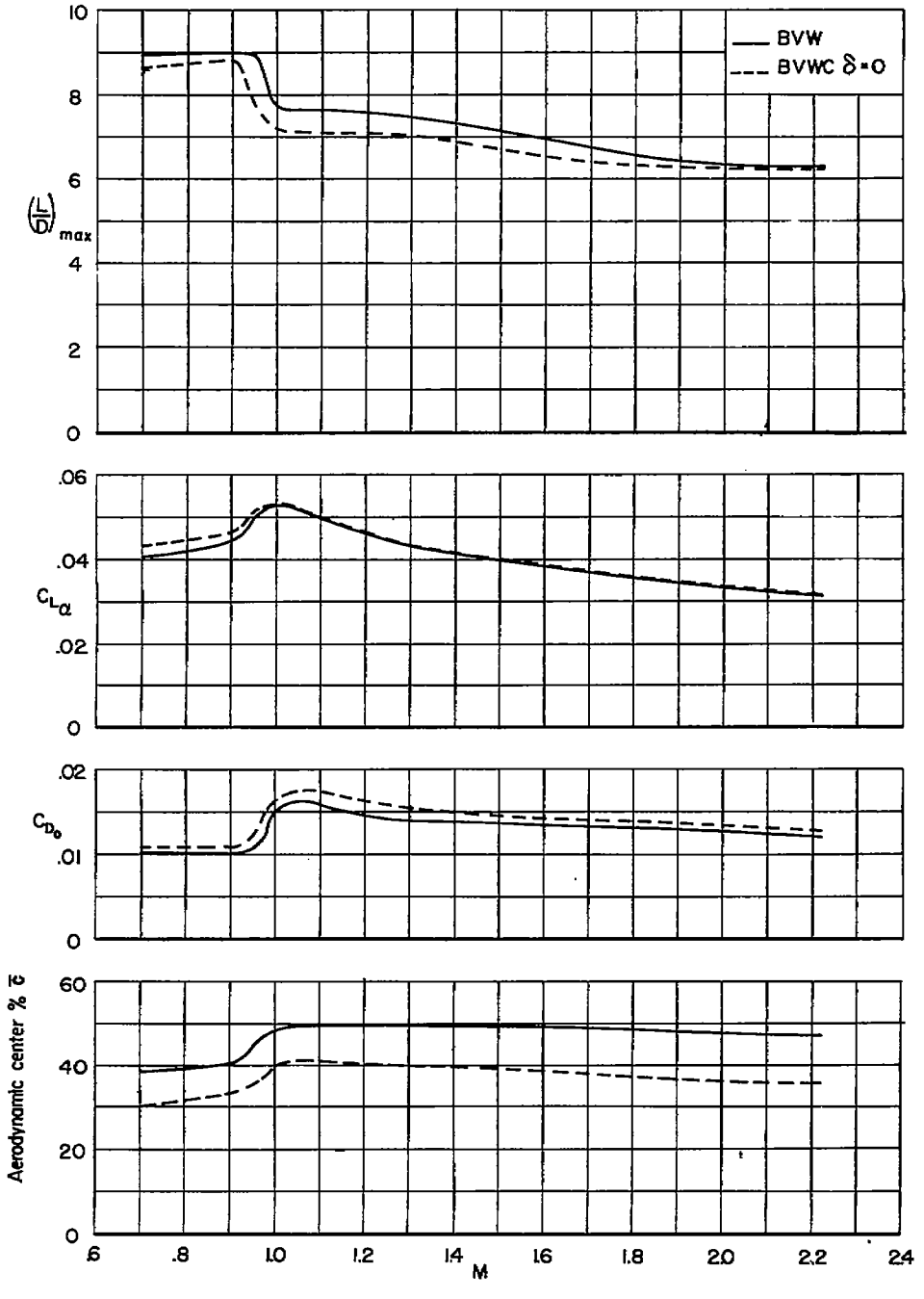


Figure 4.- Variation with Mach number of maximum lift-drag ratios, lift-curve slopes, minimum drag coefficients, and aerodynamic center locations for canard on and off.

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